MIXED WASTE DISPOSAL UNIT

RCRA Part A Permit Application for Waste Management Activities at the Nevada Test Site

September 2009

SEND COMPLETED FORM TO: The Appropriate State or EPA Regional Office.	United States Environmental Protection Agency **RCRA SUBTITLE C SITE IDENTIFICATION FORM**	

1. Reason for Submittal (See instructions on page 14.) MARK ALL BOX(ES) THAT APPLY	**Reason for Submittal:** ☐ To provide Initial Notification of Regulated Waste Activity (to obtain an EPA ID Number for hazardous waste, universal waste, or used oil activities) ☐ To provide Subsequent Notification of Regulated Waste Activity (to update site identification information) ☑ As a component of a First RCRA Hazardous Waste Part A Permit Application ☐ As a component of a Revised RCRA Hazardous Waste Part A Permit Application (Amendment #______) ☐ As a component of the Hazardous Waste Report
2. Site EPA ID Number (page 15)	**EPA ID Number** N V 3 8 9 0 0 9 0 0 0 1
3. Site Name (page 15)	**Name:** U.S. DEPARTMENT OF ENERGY - NEVADA TEST SITE
4. Site Location Information (page 15)	**Street Address:** MERCURY HIGHWAY AND HARDTACK AVE. BUILDING 111 **City, Town, or Village:** MERCURY — **State:** NEVADA **County Name:** NYE — **Zip Code:** 89023
5. Site Land Type (page 15)	**Site Land Type:** ☐ Private ☐ County ☐ District ☑ Federal ☐ Indian ☐ Municipal ☐ State ☐ Other
6. North American Industry Classification System (NAICS) Code(s) for the Site (page 15)	**A.** 9 2 8 1 1 — **B.** 5 4 1 3 3 **C.** 5 4 1 7 1 — **D.** 5 6 2 9 9
7. Site Mailing Address (page 16)	**Street or P. O. Box:** P.O. BOX 98518 **City, Town, or Village:** LAS VEGAS **State:** NEVADA **Country:** USA — **Zip Code:** 89193-8518
8. Site Contact Person (page 16)	**First Name:** KENNETH — **MI:** M — **Last Name:** SMALL **Phone Number:** (702) 295-1933 **Extension:** — **Email address:** SMALL@NV.DOE.GOV
9. Operator and Legal Owner of the Site (pages 16 and 17)	**A. Name of Site's Operator:** NATIONAL SECURITY TECHNOLOGIES, LLC (NSTec) — **Date Became Operator (mm/dd/yyyy):** 07/01/2006 **Operator Type:** ☑ Private ☐ County ☐ District ☐ Federal ☐ Indian ☐ Municipal ☐ State ☐ Other **B. Name of Site's Legal Owner:** U.S DOE NATIONAL NUCLEAR SECURITY ADMINISTRATION — **Date Became Owner (mm/dd/yyyy):** 02/12/1952 **Owner Type:** ☐ Private ☐ County ☐ District ☑ Federal ☐ Indian ☐ Municipal ☐ State ☐ Other

9. Legal Owner (Continued) Address	
	Street or P. O. Box: P.O. BOX 98518
	City, Town, or Village: LAS VEGAS
	State: NEVADA
	Country: USA — Zip Code: 89193-8518

10. Type of Regulated Waste Activity
Mark "Yes" or "No" for all activities; complete any additional boxes as instructed. (See instructions on pages 18 to 21.)

A. Hazardous Waste Activities
Complete all parts for 1 through 6.

Y ☑ N ☐ 1. **Generator of Hazardous Waste**
If "Yes", choose only one of the following - a, b, or c.

☑ a. LQG: Greater than 1,000 kg/mo (2,200 lbs./mo.) of non-acute hazardous waste; or

☐ b. SQG: 100 to 1,000 kg/mo (220 - 2,200 lbs./mo.) of non-acute hazardous waste; or

☐ c. CESQG: Less than 100 kg/mo (220 lbs./mo.) of non-acute hazardous waste

In addition, indicate other generator activities.

Y ☐ N ☑ d. United States Importer of Hazardous Waste

Y ☑ N ☐ e. Mixed Waste (hazardous and radioactive) Generator

Y ☐ N ☑ 2. **Transporter of Hazardous Waste**

Y ☑ N ☐ 3. **Treater, Storer, or Disposer of Hazardous Waste (at your site)** Note: A hazardous waste permit is required for this activity.

Y ☐ N ☑ 4. **Recycler of Hazardous Waste (at your site)**

Y ☐ N ☑ 5. **Exempt Boiler and/or Industrial Furnace**
If "Yes", mark each that applies.
☐ a. Small Quantity On-site Burner Exemption
☐ b. Smelting, Melting, and Refining Furnace Exemption

Y ☐ N ☑ 6. **Underground Injection Control**

B. Universal Waste Activities

Y ☑ N ☐ 1. **Large Quantity Handler of Universal Waste (accumulate 5,000 kg or more) [refer to your State regulations to determine what is regulated]. Indicate types of universal waste generated and/or accumulated at your site. If "Yes", mark all boxes that apply:**

	Generate	Accumulate
a. Batteries	☑	☑
b. Pesticides	☐	☐
c. Thermostats	☑	☑
d. Lamps	☑	☑
e. Other (specify) ________	☐	☐
f. Other (specify) ________	☐	☐
g. Other (specify) ________	☐	☐

Y ☐ N ☑ 2. **Destination Facility for Universal Waste**
Note: A hazardous waste permit may be required for this activity.

C. Used Oil Activities
Mark all boxes that apply.

Y ☐ N ☑ 1. **Used Oil Transporter**
If "Yes", mark each that applies.
☐ a. Transporter
☐ b. Transfer Facility

Y ☐ N ☑ 2. **Used Oil Processor and/or Re-refiner**
If "Yes", mark each that applies.
☐ a. Processor
☐ b. Re-refiner

Y ☐ N ☑ 3. **Off-Specification Used Oil Burner**

Y ☐ N ☑ 4. **Used Oil Fuel Marketer**
If "Yes", mark each that applies.
☐ a. Marketer Who Directs Shipment of Off-Specification Used Oil to Off-Specification Used Oil Burner
☐ b. Marketer Who First Claims the Used Oil Meets the Specifications

11. Description of Hazardous Wastes (See instructions on page 22.)

A. Waste Codes for Federally Regulated Hazardous Wastes. Please list the waste codes of the Federal hazardous wastes handled at your site. List them in the order they are presented in the regulations (e.g., D001, D003, F007, U112). Use an additional page if more spaces are needed.

See Attachment A						

B. Waste Codes for State-Regulated (i.e., non-Federal) Hazardous Wastes. Please list the waste codes of the State-regulated hazardous wastes handled at your site. List them in the order they are presented in the regulations. Use an additional page if more spaces are needed for waste codes.

See Attachment B						

12. Comments (See instructions on page 22.)

Section 4: the NTS is located at longitude 116 degrees, 11 minutes and 00 seconds West, latitude 37 degrees, 02 minutes and 00 seconds North.

13. Certification. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.
For the RCRA Hazardous Waste Part A Permit Application, all operator(s) and owner(s) must sign (see 40 CFR 270.10 (b) and 270.11).
(See instructions on page 22.)

Signature of operator, owner, or an authorized representative	Name and Official Title (type or print)	Date Signed (mm/dd/yyyy)
	Stephen A. Mellington, Manager, NNSA/NSO - Owner	
	Stephen M. Younger, President, NSTec, LLC - Operator	

Waste Codes

Section 11.A – Waste Codes
EPA ID NO: NV3 890 090 001

D001	D002	D003	D004	D005	D006	D007	D008	D009	D010	D011	D012	D013	D014	D015	D016	D017	D018	D019	D020
D021	D022	D023	D024	D025	D026	D027	D028	D029	D030	D031	D032	D033	D034	D035	D036	D037	D038	D039	D040
D041	D042	D043	F001	F002	F003	F004	F005	F006	F007	F008	F009	F039	P001	P002	P003	P004	P005	P006	P007
P008	P009	P010	P011	P012	P013	P014	P015	P016	P017	P018	P020	P021	P022	P023	P024	P026	P027	P028	P029
P030	P031	P033	P034	P036	P037	P038	P039	P040	P041	P042	P043	P044	P045	P046	P047	P048	P049	P050	P051
P054	P056	P057	P058	P059	P060	P062	P063	P064	P065	P066	P067	P068	P069	P070	P071	P072	P073	P074	P075
P076	P077	P078	P081	P082	P084	P085	P087	P088	P089	P092	P093	P094	P095	P096	P097	P098	P099	P101	P102
P103	P104	P105	P106	P108	P109	P110	P111	P112	P113	P114	P115	P116	P118	P119	P120	P121	P122	P123	P127
P128	P185	P188	P189	P190	P191	P192	P194	P196	P197	P198	P199	P201	P202	P203	P204	P205	U001	U002	U003
U004	U005	U006	U007	U008	U009	U010	U011	U012	U014	U015	U016	U017	U018	U019	U020	U021	U022	U023	U024
U025	U026	U027	U028	U029	U030	U031	U032	U033	U034	U035	U036	U037	U038	U039	U041	U042	U043	U044	U045
U046	U047	U048	U049	U050	U051	U052	U053	U055	U056	U057	U058	U059	U060	U061	U062	U063	U064	U066	U067
U068	U069	U070	U071	U072	U073	U074	U075	U076	U077	U078	U079	U080	U081	U082	U083	U084	U085	U086	U087
U088	U089	U090	U091	U092	U093	U094	U095	U096	U097	U098	U099	U101	U102	U103	U105	U106	U107	U108	U109
U110	U111	U112	U113	U114	U115	U116	U117	U118	U119	U120	U121	U122	U123	U124	U125	U126	U127	U128	U129
U130	U131	U132	U133	U134	U135	U136	U137	U138	U140	U141	U142	U143	U144	U145	U146	U147	U148	U149	U150
U151	U152	U153	U154	U155	U156	U157	U158	U159	U160	U161	U162	U163	U164	U165	U166	U167	U168	U169	U170
U171	U172	U173	U174	U176	U177	U178	U179	U180	U181	U182	U183	U184	U185	U186	U187	U188	U189	U190	U191
U192	U193	U194	U196	U197	U200	U201	U202	U203	U204	U205	U206	U207	U208	U209	U210	U211	U213	U214	U215
U216	U217	U218	U219	U220	U221	U222	U223	U225	U226	U227	U228	U234	U235	U236	U237	U238	U239	U240	U243
U244	U246	U247	U248	U249	U271	U278	U279	U280	U328	U353	U359	U364	U367	U372	U373	U387	U389	U394	U395
U404	U409	U410	U411																

EPA ID NO: NV3 890 090 001

RCRA Subtitle C Identification Form
Section 11.B: Waste Codes for Regulated Hazardous Wastes

1. **California Waste Codes**

Code	Description	Code	Description
141	Off-specification, aged, or surplus inorganics	**351**	Organic solids with halogens
151	Asbestos-containing waste	**352**	Other organic solids
161	Fluid-cracking catalyst waste	**411**	Alum and gypsum sludge
162	Other spent catalyst	**421**	Lime sludge
171	Metal sludge	**431**	Phosphate sludge
172	Metal dust and machining waste	**441**	Sulfur sludge
181	Other inorganic solids	**451**	Degreasing sludge
211	Halogenated solvents	**431**	Paint sludge
212	Oxygenated solvents	**471**	Paper sludge/pulp
213	Hydrocarbon solvents	**481**	Tetraethyl lead sludge
214	Unspecified solvent mixture	**491**	Unspecified sludge waste
221	Waste oil and mixed oil	**511**	Empty pesticide containers ≥ 30 gallons
222	Oil/water separation sludge	**512**	Other empty containers ≥ 30 gallons
223	Unspecified oil-containing waste	**513**	Empty containers ≤ 30 gallons
232	Pesticides and other waste associated with pesticide production	**521**	Drilling mud
241	Tank bottom waste	**531**	Chemical toilet waste
251	Still bottoms with halogenated solvents	**541**	Photo chemicals/photo processing waste
252	Other still bottom wastes	**551**	Laboratory waste chemicals
261	Polychlorinated biphenyls and material containing PCBs	**561**	Detergent and soap
271	Organic monomer waste (includes unreacted resins)	**571**	Fly ash, bottom ash, and retort ash
272	Polymeric resin waste	**581**	Gas scrubber waste
281	Adhesives	**591**	Bag house waste
291	Latex wastes	**611**	Contaminated soil from site clean ups
311	Pharmaceutical waste	**612**	Household waste
321	Sewage sludge	**613**	Autoshredder waste
322	Biological waste other than sewage sludge	**751**	Solids or sludges with halogenated organic compounds ≥ 100 mg/Kg
331	Off-specification, aged, or surplus organics		

2. **Wastes meeting “hazardous waste” definition in Nevada Administrative Code 444.843, which includes: Waste containing polychlorinated biphenyl; and waste brought into this State that is designated as hazardous waste in the state of its origin.**
3. **Wastes containing friable and nonfriable asbestos will also be accepted for disposal.**

EPA ID NO: N V 3 8 9 0 0 9 0 0 0 0 1   OMB #: 2050-0034 Expires 11/30/2005

United States Environmental Protection Agency

HAZARDOUS WASTE PERMIT INFORMATION FORM

1. Facility Permit Contact (See instructions on page 23)	First Name: SAME AS SITE CONTACT	MI:	Last Name:
	Phone Number:		Phone Number Extension:
2. Facility Permit Contact Mailing Address (See instructions on page 23)	Street or P.O. Box: SAME AS SITE CONTACT		
	City, Town, or Village:		
	State:		
	Country:		Zip Code:
3. Operator Mailing Address and Telephone Number (See instructions on page 23)	Street or P.O. Box: P.O. BOX 98521		
	City, Town, or Village: LAS VEGAS		
	State: NEVADA		
	Country: USA	Zip Code: 89193-8521	Phone Number (702) 295-6272
4. Legal Owner Mailing Address and Telephone Number (See instructions on page 23)	Street or P.O. Box: P.O. BOX 98518		
	City, Town, or Village: LAS VEGAS		
	State: NEVADA		
	Country: USA	Zip Code: 89193-8518	Phone Number (702) 295-1933
5. Facility Existence Date (See instructions on page 24)	Facility Existence Date (mm/dd/yyyy): 02/12/1952		

6. Other Environmental Permits (See instructions on page 24)

A. Permit Type (Enter code)	B. Permit Number	C. Description
SEE ATTACHMENT C		

7. Nature of Business (Provide a brief description; see instructions on page 24)

The U.S. Department of Energy National Nuclear Security Administration Nevada Site office maintains the capability at the Nevada Test Site to implement NNSA initiatives in stockpile stewardship, emergency management, waste management, environmental management and remediation, research and development, and work for others, as well as supporting other DOE and NNSA programs.

8. Process Codes and Design Capacities (See instructions on page 24) - Enter information in the Sections on Form Page 3.

A. **PROCESS CODE** - *Enter the code from the list of process codes in the table below that best describes each process to be used at the facility. Fifteen lines are provided for entering codes. If more lines are needed, attach a separate sheet of paper with the additional information. For "other" processes (i.e., D99, S99, T04 and X99), enter the process information in Item 9 (including a description).*

B. **PROCESS DESIGN CAPACITY**- *For each code entered in Section A, enter the capacity of the process.*

1. **AMOUNT** - *Enter the amount. In a case where design capacity is not applicable (such as in a closure/post-closure or enforcement action) enter the total amount of waste for that process.*

2. **UNIT OF MEASURE** - *For each amount entered in Section B(1), enter the code in Section B(2) from the list of unit of measure codes below that describes the unit of measure used. Select only from the units of measure in this list.*

C. **PROCESS TOTAL NUMBER OF UNITS** - *Enter the total number of units for each corresponding process code.*

PROCESS CODE	PROCESS	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
	Disposal:	
D79	Underground Injection Well Disposal	Gallons; Liters; Gallons Per Day; or Liters Per Day
D80	Landfill	Acre-feet; Hectare-meter; Acres; Cubic Meters; Hectares; Cubic Yards
D81	Land Treatment	Acres or Hectares
D82	Ocean Disposal	Gallons Per Day or Liters Per Day
D83	Surface Impoundment Disposal	Gallons; Liters; Cubic Meters; or Cubic Yards
D99	Other Disposal	Any Unit of Measure in Code Table Below
	Storage:	
S01	Container	Gallons; Liters; Cubic Meters; or Cubic Yards
S02	Tank Storage	Gallons; Liters; Cubic Meters; or Cubic Yards
S03	Waste Pile	Cubic Yards or Cubic Meters
S04	Surface Impoundment Storage	Gallons; Liters; Cubic Meters; or Cubic Yards
S05	Drip Pad	Gallons; Liters; Acres; Cubic Meters; Hectares; or Cubic Yards
S06	Containment Building Storage	Cubic Yards or Cubic Meters
S99	Other Storage	Any Unit of Measure in Code Table Below
	Treatment:	
T01	Tank Treatment	Gallons Per Day; Liters Per Day
T02	Surface Impoundment Treatment	Gallons Per Day; Liters Per Day
T03	Incinerator	Short Tons Per Hour; Metric Tons Per Hour; Gallons Per Hour; Liters Per Hour; Btu Per Hour; Pounds Per Hour; Short Tons Per Day; Kilograms Per Hour; Gallons Per Day; Liters Per Day; Metric Tons Per Hour; or Million Btu Per Hour
T04	Other Treatment	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; Btu Per Hour; Gallons Per Day; Liters Per Hour; or Million Btu Per Hour
T80	Boiler	Gallons; Liters; Gallons Per Hour; Liters Per Hour; Btu Per Hour; or Million Btu Per Hour

PROCESS CODE	PROCESS	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
	Treatment (continued):	
T81	Cement Kiln	For T81-T93:
T82	Lime Kiln	
T83	Aggregate Kiln	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; Btu Per Hour; Liters Per Hour; Kilograms Per Hour; or Million Btu Per Hour
T84	Phosphate Kiln	
T85	Coke Oven	
T86	Blast Furnace	
T87	Smelting, Melting, or Refining Furnace	
T88	Titanium Dioxide Chloride Oxidation Reactor	
T89	Methane Reforming Furnace	
T90	Pulping Liquor Recovery Furnace	
T91	Combustion Device Used In The Recovery Of Sulfur Values From Spent Sulfuric Acid	
T92	Halogen Acid Furnaces	
T93	Other Industrial Furnaces Listed In 40 CFR §260.10	
T94	Containment Building - Treatment	Cubic Yards; Cubic Meters; Short Tons Per Hour; Gallons Per Hour; Liters Per Hour; Btu Per Hour; Pounds Per Hour; Short Tons Per Day; Kilograms Per Hour; Metric Tons Per Day; Gallons Per Day; Liters Per Day; Metric Tons Per Hour; or Million Btu Per Hour
	Miscellaneous (Subpart X):	
X01	Open Burning/Open Detonation	Any Unit of Measure in Code Table Below
X02	Mechanical Processing	Short Tons Per Hour; Metric Tons Per Hour; Short Tons Per Day; Metric Tons Per Day; Pounds Per Hour; Kilograms Per Hour; Gallons Per Hour; Liters Per Hour; or Gallons Per Day
X03	Thermal Unit	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; Btu Per Hour; or Million Btu Per Hour
X04	Geologic Repository	Cubic Yards; Cubic Meters; Acre-feet; Hectare-meter; Gallons; or Liters
X99	Other Subpart X	Any Unit of Measure Listed Below

UNIT OF MEASURE	UNIT OF MEASURE CODE
Gallons	G
Gallons Per Hour	E
Gallons Per Day	U
Liters	L
Liters Per Hour	H
Liters Per Day	V

UNIT OF MEASURE	UNIT OF MEASURE CODE
Short Tons Per Hour	D
Metric Tons Per Hour	W
Short Tons Per Day	N
Metric Tons Per Day	S
Pounds Per Hour	J
Kilograms Per Hour	R
Million Btu Per Hour	X

UNIT OF MEASURE	UNIT OF MEASURE CODE
Cubic Yards	Y
Cubic Meters	C
Acres	B
Acre-feet	A
Hectares	Q
Hectare-meter	F
Btu Per Hour	I

8. Process Codes and Design Capacities (Continued)

EXAMPLE FOR COMPLETING Item 8 (shown in line number X-1 below): A facility has a storage tank, which can hold 533.788 gallons.

Line Number		A. Process Code (From list above)			B. PROCESS DESIGN CAPACITY (1) Amount (Specify)	(2) Unit of Measure (Enter code)	C. Process Total Number of Units	For Official Use Only
X	1	S	0	2	5 3 3 . 7 8 8	G	0 0 1	
	1	D	8	0	25485 . 0	C	001	
	2				.			
	3				.			
	4				.			
	5				.			
	6				.			
	7				.			
	8				.			
	9				.			
1	0				.			
1	1				.			
1	2				.			
1	3				.			
1	4				.			
1	5				.			

NOTE: If you need to list more than 15 process codes, attach an additional sheet(s) with the information in the same format as above. Number the lines sequentially, taking into account any lines that will be used for "other" processes (i.e., D99, S99, T04 and X99) in Item 9.

9. Other Processes (*See instructions on page 25 and follow instructions from Item 8 for D99, S99, T04 and X99 process codes*)

Line Number (Enter #s in sequence with Item 8)		A. Process Code (From list above)			B. PROCESS DESIGN CAPACITY (1) Amount (Specify)	(2) Unit of Measure (Enter code)	C. Process Total Number of Units	D. Description of Process
X	2	T	0	4	1 0 0 . 0 0 0	U	0 0 1	In-situ Vitrification
					.			
					.			
					.			
					.			
					.			

10. Description of Hazardous Wastes (See instructions on page 25) - Enter information in the Sections on Form Page 5.

A. EPA HAZARDOUS WASTE NUMBER - *Enter the four-digit number from 40 CFR, Part 261 Subpart D of each listed hazardous waste you will handle. For hazardous wastes which are not listed in 40 CFR, Part 261 Subpart D, enter the four-digit number(s) from 40 CFR Part 261, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.*

B. ESTIMATED ANNUAL QUANTITY - *For each listed waste entered in Section A, estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in Section A, estimate the total annual quantity of all the non-listed waste(s) that will be handled which possess that characteristic or contaminant.*

C. UNIT OF MEASURE - *For each quantity entered in Section B, enter the unit of measure code. Units of measure which must be used and the appropriate codes are:*

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure, taking into account the appropriate density or specific gravity of the waste.

D. PROCESSES

1. PROCESS CODES:

For listed hazardous waste: For each listed hazardous waste entered in Section A, select the code(s) from the list of process codes contained in Items 8A and 9A on page 3 to indicate all the processes that will be used to store, treat, and/or dispose of all the listed hazardous wastes.

For non-listed hazardous waste: For each characteristic or toxic contaminant entered in Section A, select the code(s) from the list of process codes contained in Items 8A and 9A on page 3 to indicate all the processes that will be used to store, treat, and/or dispose of all the non-listed hazardous wastes that possess that characteristic or toxic contaminant.

NOTE: THREE SPACES ARE PROVIDED FOR ENTERING PROCESS CODES. IF MORE ARE NEEDED:

1. *Enter the first two as described above.*
2. *Enter "000" in the extreme right box of Item 10.D(1).*
3. *Use additional sheet, enter line number from previous sheet, and enter additional code(s) in Item 10.E.*

2. PROCESS DESCRIPTION: *If a code is not listed for a process that will be used, describe the process in Item 10.D(2) or in Item 10.E(2).*

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER - Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

1. *Select one of the EPA Hazardous Waste Numbers and enter it in Section A. On the same line complete Sections B, C and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.*
2. *In Section A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In Section D(2) on that line enter "included with above" and make no other entries on that line.*
3. *Repeat step 2 for each EPA Hazardous Waste Number that can be used to describe the hazardous waste.*

EXAMPLE FOR COMPLETING Item 10 (shown in line numbers X-1, X-2, X-3, and X-4 below) - A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operations. In addition, the facility will treat and dispose of three non-listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Quantity of Waste	C. Unit of Measure (Enter code)	D. PROCESSES (1) PROCESS CODES (Enter code)									D. PROCESSES (2) PROCESS DESCRIPTION- (If a code is not entered in D(1))
X	1	K	0	5	4	900	P	T	0	3	D	8	0				
X	2	D	0	0	2	400	P	T	0	3	D	8	0				
X	3	D	0	0	1	100	P	T	0	3	D	8	0				
X	4	D	0	0	2												Included With Above

EPA ID NO: N V 3 8 9 0 0 9 0 0 0 1 OMB #: 2050-0034 Expires 11/30/2005

10. Description of Hazardous Wastes (Continued. Use the Additional Sheet(s) as necessary; number pages as 5 a, etc.)

Line Number	A. EPA Hazardous Waste No. (Enter code)	B. Estimated Annual Quantity of Waste	C. Unit of Measure (Enter code)	D. PROCESSES (1) PROCESS CODES (Enter code)	D. PROCESSES (2) PROCESS DESCRIPTION (If a code is not entered in D(1))
1	D004	22,270	M	D080	MWDU
2	D005				INCLUDED IN ABOVE
3	D006				INCLUDED IN ABOVE
4	D007				INCLUDED IN ABOVE
5	D008				INCLUDED IN ABOVE
6	D009				INCLUDED IN ABOVE
7	D010				INCLUDED IN ABOVE
8	D011				INCLUDED IN ABOVE
9	D012				INCLUDED IN ABOVE
10	D013				INCLUDED IN ABOVE
11	D014				INCLUDED IN ABOVE
12	D015				INCLUDED IN ABOVE
13	D016				INCLUDED IN ABOVE
14	D017				INCLUDED IN ABOVE
15	D018				INCLUDED IN ABOVE
16	D019				INCLUDED IN ABOVE
17	D020				INCLUDED IN ABOVE
18	D021				INCLUDED IN ABOVE
19	D022				INCLUDED IN ABOVE
20	D023				INCLUDED IN ABOVE
21	D024				INCLUDED IN ABOVE
22	D025				INCLUDED IN ABOVE
23	D026				INCLUDED IN ABOVE
24	D027				INCLUDED IN ABOVE
25	D028				INCLUDED IN ABOVE
26	D029				INCLUDED IN ABOVE
27	D030				INCLUDED IN ABOVE
28	D031				INCLUDED IN ABOVE
29	D032				INCLUDED IN ABOVE
30	D033				INCLUDED IN ABOVE
31	D034				INCLUDED IN ABOVE
32	D035				INCLUDED IN ABOVE
33	D036				INCLUDED IN ABOVE
34	D037				INCLUDED IN ABOVE
35	D038				INCLUDED IN ABOVE
36	D039				INCLUDED IN ABOVE
37	D040				INCLUDED IN ABOVE
38	D041				INCLUDED IN ABOVE
39	D042				INCLUDED IN ABOVE

EPA ID NO: N V 3 8 9 0 0 9 0 0 0 1 OMB #: 2050-0034 Expires 11/30/2005

10. Description of Hazardous Wastes (Continued. Use this Additional Sheet(s) as necessary; number as 5 a, etc.)

Line Number	A. EPA Hazardous Waste No. (Enter code)	B. Estimated Annual Quantity of Waste	C. Unit of Measure (Enter code)	E. PROCESSES (1) PROCESS CODES (Enter code)	E. PROCESSES (2) PROCESS DESCRIPTION (If a code is not entered in E(1))
40	D043				INCLUDED IN THE ABOVE
41	F001				INCLUDED IN THE ABOVE
42	F002				INCLUDED IN THE ABOVE
43	F003				INCLUDED IN THE ABOVE
44	F004				INCLUDED IN THE ABOVE
45	F005				INCLUDED IN THE ABOVE
46	F006				INCLUDED IN THE ABOVE
47	F007				INCLUDED IN THE ABOVE
48	F008				INCLUDED IN THE ABOVE
49	F009				INCLUDED IN THE ABOVE
50	F039				INCLUDED IN THE ABOVE
51	P001				INCLUDED IN THE ABOVE
52	P002				INCLUDED IN THE ABOVE
53	P003				INCLUDED IN THE ABOVE
54	P004				INCLUDED IN THE ABOVE
55	P005				INCLUDED IN THE ABOVE
56	P006				INCLUDED IN THE ABOVE
57	P007				INCLUDED IN THE ABOVE
58	P008				INCLUDED IN THE ABOVE
59	P009				INCLUDED IN THE ABOVE
60	P010				INCLUDED IN THE ABOVE
61	P011				INCLUDED IN THE ABOVE
62	P012				INCLUDED IN THE ABOVE
63	P013				INCLUDED IN THE ABOVE
64	P014				INCLUDED IN THE ABOVE
65	P015				INCLUDED IN THE ABOVE
66	P016				INCLUDED IN THE ABOVE
67	P017				INCLUDED IN THE ABOVE
68	P018				INCLUDED IN THE ABOVE
69	P020				INCLUDED IN THE ABOVE
70	P021				INCLUDED IN THE ABOVE
71	P022				INCLUDED IN THE ABOVE
72	P023				INCLUDED IN THE ABOVE
73	P024				INCLUDED IN THE ABOVE
74	P026				INCLUDED IN THE ABOVE
75	P027				INCLUDED IN THE ABOVE
76	P028				INCLUDED IN THE ABOVE
77	P029				INCLUDED IN THE ABOVE
78	P030				INCLUDED IN THE ABOVE

10. Description of Hazardous Wastes (Continued. Use this Additional Sheet(s) as necessary; number as 5 a, etc.)

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Quantity of Waste	C. Unit of Measure (Enter code)	E. PROCESSES (1) PROCESS CODES (Enter code)	E. PROCESSES (2) PROCESS DESCRIPTION (If a code is not entered in E(1))
7	9	P	0	3	1				INCLUDED IN THE ABOVE
8	0	P	0	3	3				INCLUDED IN THE ABOVE
8	1	P	0	3	4				INCLUDED IN THE ABOVE
8	2	P	0	3	6				INCLUDED IN THE ABOVE
8	3	P	0	3	7				INCLUDED IN THE ABOVE
8	4	P	0	3	8				INCLUDED IN THE ABOVE
8	5	P	0	3	9				INCLUDED IN THE ABOVE
8	6	P	0	4	0				INCLUDED IN THE ABOVE
8	7	P	0	4	1				INCLUDED IN THE ABOVE
8	8	P	0	4	2				INCLUDED IN THE ABOVE
8	9	P	0	4	3				INCLUDED IN THE ABOVE
9	0	P	0	4	4				INCLUDED IN THE ABOVE
9	1	P	0	4	5				INCLUDED IN THE ABOVE
9	2	P	0	4	6				INCLUDED IN THE ABOVE
9	3	P	0	4	7				INCLUDED IN THE ABOVE
9	4	P	0	4	8				INCLUDED IN THE ABOVE
9	5	P	0	4	9				INCLUDED IN THE ABOVE
9	6	P	0	5	0				INCLUDED IN THE ABOVE
9	7	P	0	5	1				INCLUDED IN THE ABOVE
9	8	P	0	5	4				INCLUDED IN THE ABOVE
9	9	P	0	5	6				INCLUDED IN THE ABOVE
10	0	P	0	5	7				INCLUDED IN THE ABOVE
10	1	P	0	5	8				INCLUDED IN THE ABOVE
10	2	P	0	5	9				INCLUDED IN THE ABOVE
10	3	P	0	6	0				INCLUDED IN THE ABOVE
10	4	P	0	6	2				INCLUDED IN THE ABOVE
10	5	P	0	6	3				INCLUDED IN THE ABOVE
10	6	P	0	6	4				INCLUDED IN THE ABOVE
10	7	P	0	6	5				INCLUDED IN THE ABOVE
10	8	P	0	6	6				INCLUDED IN THE ABOVE
10	9	P	0	6	7				INCLUDED IN THE ABOVE
11	0	P	0	6	8				INCLUDED IN THE ABOVE
11	1	P	0	6	9				INCLUDED IN THE ABOVE
11	2	P	0	7	0				INCLUDED IN THE ABOVE
11	3	P	0	7	1				INCLUDED IN THE ABOVE
11	4	P	0	7	2				INCLUDED IN THE ABOVE
11	5	P	0	7	3				INCLUDED IN THE ABOVE
11	6	P	0	7	4				INCLUDED IN THE ABOVE
11	7	P	0	7	5				INCLUDED IN THE ABOVE

10. Description of Hazardous Wastes (Continued. Use this Additional Sheet(s) as necessary; number as 5 a, etc.)									
Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Quantity of Waste	C. Unit of Measure (Enter code)	E. PROCESSES (1) PROCESS CODES (Enter code)	E. PROCESSES (2) PROCESS DESCRIPTION (If a code is not entered in E(1))
11	8	P	0	7	6				INCLUDED IN THE ABOVE
11	9	P	0	7	7				INCLUDED IN THE ABOVE
12	0	P	0	7	8				INCLUDED IN THE ABOVE
12	1	P	0	8	1				INCLUDED IN THE ABOVE
12	2	P	0	8	2				INCLUDED IN THE ABOVE
12	3	P	0	8	4				INCLUDED IN THE ABOVE
12	4	P	0	8	5				INCLUDED IN THE ABOVE
12	5	P	0	8	7				INCLUDED IN THE ABOVE
12	6	P	0	8	8				INCLUDED IN THE ABOVE
12	7	P	0	8	9				INCLUDED IN THE ABOVE
12	8	P	0	9	2				INCLUDED IN THE ABOVE
12	9	P	0	9	3				INCLUDED IN THE ABOVE
13	0	P	0	9	4				INCLUDED IN THE ABOVE
13	1	P	0	9	5				INCLUDED IN THE ABOVE
13	2	P	0	9	6				INCLUDED IN THE ABOVE
13	3	P	0	9	7				INCLUDED IN THE ABOVE
13	4	P	0	9	8				INCLUDED IN THE ABOVE
13	5	P	0	9	9				INCLUDED IN THE ABOVE
13	6	P	1	0	1				INCLUDED IN THE ABOVE
13	7	P	1	0	2				INCLUDED IN THE ABOVE
13	8	P	1	0	3				INCLUDED IN THE ABOVE
13	9	P	1	0	4				INCLUDED IN THE ABOVE
14	0	P	1	0	5				INCLUDED IN THE ABOVE
14	1	P	1	0	6				INCLUDED IN THE ABOVE
14	2	P	1	0	8				INCLUDED IN THE ABOVE
14	3	P	1	0	9				INCLUDED IN THE ABOVE
14	4	P	1	1	0				INCLUDED IN THE ABOVE
14	5	P	1	1	1				INCLUDED IN THE ABOVE
14	6	P	1	1	2				INCLUDED IN THE ABOVE
14	7	P	1	1	3				INCLUDED IN THE ABOVE
14	8	P	1	1	4				INCLUDED IN THE ABOVE
14	9	P	1	1	5				INCLUDED IN THE ABOVE
15	0	P	1	1	6				INCLUDED IN THE ABOVE
15	1	P	1	1	8				INCLUDED IN THE ABOVE
15	2	P	1	1	9				INCLUDED IN THE ABOVE
15	3	P	1	2	0				INCLUDED IN THE ABOVE
15	4	P	1	2	1				INCLUDED IN THE ABOVE
15	5	P	1	2	2				INCLUDED IN THE ABOVE
15	6	P	1	2	3				INCLUDED IN THE ABOVE

10. Description of Hazardous Wastes (Continued. Use this Additional Sheet(s) as necessary; number as 5 a, etc.)

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Quantity of Waste	C. Unit of Measure (Enter code)	E. PROCESSES (1) PROCESS CODES (Enter code)	E. PROCESSES (2) PROCESS DESCRIPTION (If a code is not entered in E(1))
15	7	P	1	2	7				INCLUDED IN THE ABOVE
15	8	P	1	2	8				INCLUDED IN THE ABOVE
15	9	P	1	8	5				INCLUDED IN THE ABOVE
16	0	P	1	8	8				INCLUDED IN THE ABOVE
16	1	P	1	8	9				INCLUDED IN THE ABOVE
16	2	P	1	9	0				INCLUDED IN THE ABOVE
16	3	P	1	9	1				INCLUDED IN THE ABOVE
16	4	P	1	9	2				INCLUDED IN THE ABOVE
16	5	P	1	9	4				INCLUDED IN THE ABOVE
16	6	P	1	9	6				INCLUDED IN THE ABOVE
16	7	P	1	9	7				INCLUDED IN THE ABOVE
16	8	P	1	9	8				INCLUDED IN THE ABOVE
16	9	P	1	9	9				INCLUDED IN THE ABOVE
17	0	P	2	0	1				INCLUDED IN THE ABOVE
17	1	P	2	0	2				INCLUDED IN THE ABOVE
17	2	P	2	0	3				INCLUDED IN THE ABOVE
17	3	P	2	0	4				INCLUDED IN THE ABOVE
17	4	P	2	0	5				INCLUDED IN THE ABOVE
17	5	U	0	0	1				INCLUDED IN THE ABOVE
17	6	U	0	0	2				INCLUDED IN THE ABOVE
17	7	U	0	0	3				INCLUDED IN THE ABOVE
17	8	U	0	0	4				INCLUDED IN THE ABOVE
17	9	U	0	0	5				INCLUDED IN THE ABOVE
18	0	U	0	0	6				INCLUDED IN THE ABOVE
18	1	U	0	0	7				INCLUDED IN THE ABOVE
18	2	U	0	0	8				INCLUDED IN THE ABOVE
18	3	U	0	0	9				INCLUDED IN THE ABOVE
18	4	U	0	1	0				INCLUDED IN THE ABOVE
18	5	U	0	1	1				INCLUDED IN THE ABOVE
18	6	U	0	1	2				INCLUDED IN THE ABOVE
18	7	U	0	1	4				INCLUDED IN THE ABOVE
18	8	U	0	1	5				INCLUDED IN THE ABOVE
18	9	U	0	1	6				INCLUDED IN THE ABOVE
19	0	U	0	1	7				INCLUDED IN THE ABOVE
19	1	U	0	1	8				INCLUDED IN THE ABOVE
19	2	U	0	1	9				INCLUDED IN THE ABOVE
19	3	U	0	2	0				INCLUDED IN THE ABOVE
19	4	U	0	2	1				INCLUDED IN THE ABOVE
19	5	U	0	2	2				INCLUDED IN THE ABOVE

10. Description of Hazardous Wastes (Continued. Use this Additional Sheet(s) as necessary; number as 5 a, etc.)

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Quantity of Waste	C. Unit of Measure (Enter code)	E. PROCESSES (1) PROCESS CODES (Enter code)	E. PROCESSES (2) PROCESS DESCRIPTION (If a code is not entered in E(1))
19	6	U	0	2	3				INCLUDED IN THE ABOVE
19	7	U	0	2	4				INCLUDED IN THE ABOVE
19	8	U	0	2	5				INCLUDED IN THE ABOVE
19	9	U	0	2	6				INCLUDED IN THE ABOVE
20	0	U	0	2	7				INCLUDED IN THE ABOVE
20	1	U	0	2	8				INCLUDED IN THE ABOVE
20	2	U	0	2	9				INCLUDED IN THE ABOVE
20	3	U	0	3	0				INCLUDED IN THE ABOVE
20	4	U	0	3	1				INCLUDED IN THE ABOVE
20	5	U	0	3	2				INCLUDED IN THE ABOVE
20	6	U	0	3	3				INCLUDED IN THE ABOVE
20	7	U	0	3	4				INCLUDED IN THE ABOVE
20	8	U	0	3	5				INCLUDED IN THE ABOVE
20	9	U	0	3	6				INCLUDED IN THE ABOVE
21	0	U	0	3	7				INCLUDED IN THE ABOVE
21	1	U	0	3	8				INCLUDED IN THE ABOVE
21	2	U	0	3	9				INCLUDED IN THE ABOVE
21	3	U	0	4	1				INCLUDED IN THE ABOVE
21	4	U	0	4	2				INCLUDED IN THE ABOVE
21	5	U	0	4	3				INCLUDED IN THE ABOVE
21	6	U	0	4	4				INCLUDED IN THE ABOVE
21	7	U	0	4	5				INCLUDED IN THE ABOVE
21	8	U	0	4	6				INCLUDED IN THE ABOVE
21	9	U	0	4	7				INCLUDED IN THE ABOVE
22	0	U	0	4	8				INCLUDED IN THE ABOVE
22	1	U	0	4	9				INCLUDED IN THE ABOVE
22	2	U	0	5	0				INCLUDED IN THE ABOVE
22	3	U	0	5	1				INCLUDED IN THE ABOVE
22	4	U	0	5	2				INCLUDED IN THE ABOVE
22	5	U	0	5	3				INCLUDED IN THE ABOVE
22	6	U	0	5	5				INCLUDED IN THE ABOVE
22	7	U	0	5	6				INCLUDED IN THE ABOVE
22	8	U	0	5	7				INCLUDED IN THE ABOVE
22	9	U	0	5	8				INCLUDED IN THE ABOVE
23	0	U	0	5	9				INCLUDED IN THE ABOVE
23	1	U	0	6	0				INCLUDED IN THE ABOVE
23	2	U	0	6	1				INCLUDED IN THE ABOVE
23	3	U	0	6	2				INCLUDED IN THE ABOVE
23	4	U	0	6	3				INCLUDED IN THE ABOVE

10. Description of Hazardous Wastes (Continued. Use this Additional Sheet(s) as necessary; number as 5 a, etc.)

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Quantity of Waste	C. Unit of Measure (Enter code)	E. PROCESSES (1) PROCESS CODES (Enter code)	E. PROCESSES (2) PROCESS DESCRIPTION (If a code is not entered in E(1))
23	5	U	0	6	4				INCLUDED IN THE ABOVE
23	6	U	0	6	6				INCLUDED IN THE ABOVE
23	7	U	0	6	7				INCLUDED IN THE ABOVE
23	8	U	0	6	8				INCLUDED IN THE ABOVE
23	9	U	0	6	9				INCLUDED IN THE ABOVE
24	0	U	0	7	0				INCLUDED IN THE ABOVE
24	1	U	0	7	1				INCLUDED IN THE ABOVE
24	2	U	0	7	2				INCLUDED IN THE ABOVE
24	3	U	0	7	3				INCLUDED IN THE ABOVE
24	4	U	0	7	4				INCLUDED IN THE ABOVE
24	5	U	0	7	5				INCLUDED IN THE ABOVE
24	6	U	0	7	6				INCLUDED IN THE ABOVE
24	7	U	0	7	7				INCLUDED IN THE ABOVE
24	8	U	0	7	8				INCLUDED IN THE ABOVE
24	9	U	0	7	9				INCLUDED IN THE ABOVE
25	0	U	0	8	0				INCLUDED IN THE ABOVE
25	1	U	0	8	1				INCLUDED IN THE ABOVE
25	2	U	0	8	2				INCLUDED IN THE ABOVE
25	3	U	0	8	3				INCLUDED IN THE ABOVE
25	4	U	0	8	4				INCLUDED IN THE ABOVE
25	5	U	0	8	5				INCLUDED IN THE ABOVE
25	6	U	0	8	6				INCLUDED IN THE ABOVE
25	7	U	0	8	7				INCLUDED IN THE ABOVE
25	8	U	0	8	8				INCLUDED IN THE ABOVE
25	9	U	0	8	9				INCLUDED IN THE ABOVE
26	0	U	0	9	0				INCLUDED IN THE ABOVE
26	1	U	0	9	1				INCLUDED IN THE ABOVE
26	2	U	0	9	2				INCLUDED IN THE ABOVE
26	3	U	0	9	3				INCLUDED IN THE ABOVE
26	4	U	0	9	4				INCLUDED IN THE ABOVE
26	5	U	0	9	5				INCLUDED IN THE ABOVE
26	6	U	0	9	6				INCLUDED IN THE ABOVE
26	7	U	0	9	7				INCLUDED IN THE ABOVE
26	8	U	0	9	8				INCLUDED IN THE ABOVE
26	9	U	0	9	9				INCLUDED IN THE ABOVE
27	0	U	1	0	1				INCLUDED IN THE ABOVE
27	1	U	1	0	2				INCLUDED IN THE ABOVE
27	2	U	1	0	3				INCLUDED IN THE ABOVE
27	3	U	1	0	5				INCLUDED IN THE ABOVE

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10. Description of Hazardous Wastes (Continued. Use this Additional Sheet(s) as necessary; number as 5 a, etc.)																		
Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Quantity of Waste	C. Unit of Measure (Enter code)	E. PROCESSES (1) PROCESS CODES (Enter code)										(2) PROCESS DESCRIPTION (If a code is not entered in E(1))
27	4	U	1	0	6													INCLUDED IN THE ABOVE
27	5	U	1	0	7													INCLUDED IN THE ABOVE
27	6	U	1	0	8													INCLUDED IN THE ABOVE
27	7	U	1	0	9													INCLUDED IN THE ABOVE
27	8	U	1	1	0													INCLUDED IN THE ABOVE
27	9	U	1	1	1													INCLUDED IN THE ABOVE
28	0	U	1	1	2													INCLUDED IN THE ABOVE
28	1	U	1	1	3													INCLUDED IN THE ABOVE
28	2	U	1	1	4													INCLUDED IN THE ABOVE
28	3	U	1	1	5													INCLUDED IN THE ABOVE
28	4	U	1	1	6													INCLUDED IN THE ABOVE
28	5	U	1	1	7													INCLUDED IN THE ABOVE
28	6	U	1	1	8													INCLUDED IN THE ABOVE
28	7	U	1	1	9													INCLUDED IN THE ABOVE
28	8	U	1	2	0													INCLUDED IN THE ABOVE
28	9	U	1	2	1													INCLUDED IN THE ABOVE
29	0	U	1	2	2													INCLUDED IN THE ABOVE
29	1	U	1	2	3													INCLUDED IN THE ABOVE
29	2	U	1	2	4													INCLUDED IN THE ABOVE
29	3	U	1	2	5													INCLUDED IN THE ABOVE
29	4	U	1	2	6													INCLUDED IN THE ABOVE
29	5	U	1	2	7													INCLUDED IN THE ABOVE
29	6	U	1	2	8													INCLUDED IN THE ABOVE
29	7	U	1	2	9													INCLUDED IN THE ABOVE
29	8	U	1	3	0													INCLUDED IN THE ABOVE
29	9	U	1	3	1													INCLUDED IN THE ABOVE
30	0	U	1	3	2													INCLUDED IN THE ABOVE
30	1	U	1	3	3													INCLUDED IN THE ABOVE
30	2	U	1	3	4													INCLUDED IN THE ABOVE
30	3	U	1	3	5													INCLUDED IN THE ABOVE
30	4	U	1	3	6													INCLUDED IN THE ABOVE
30	5	U	1	3	7													INCLUDED IN THE ABOVE
30	6	U	1	3	8													INCLUDED IN THE ABOVE
30	7	U	1	4	0													INCLUDED IN THE ABOVE
30	8	U	1	4	1													INCLUDED IN THE ABOVE
30	9	U	1	4	2													INCLUDED IN THE ABOVE
31	0	U	1	4	3													INCLUDED IN THE ABOVE
31	1	U	1	4	4													INCLUDED IN THE ABOVE
31	2	U	1	4	5													INCLUDED IN THE ABOVE

10. Description of Hazardous Wastes (Continued. Use this Additional Sheet(s) as necessary; number as 5 a, etc.)

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Quantity of Waste	C. Unit of Measure (Enter code)	E. PROCESSES (1) PROCESS CODES (Enter code)	E. PROCESSES (2) PROCESS DESCRIPTION (If a code is not entered in E(1))
31	3	U	1	4	6				INCLUDED IN THE ABOVE
31	4	U	1	4	7				INCLUDED IN THE ABOVE
31	5	U	1	4	8				INCLUDED IN THE ABOVE
31	6	U	1	4	9				INCLUDED IN THE ABOVE
31	7	U	1	5	0				INCLUDED IN THE ABOVE
31	8	U	1	5	1				INCLUDED IN THE ABOVE
31	9	U	1	5	2				INCLUDED IN THE ABOVE
32	0	U	1	5	3				INCLUDED IN THE ABOVE
32	1	U	1	5	4				INCLUDED IN THE ABOVE
32	2	U	1	5	5				INCLUDED IN THE ABOVE
32	3	U	1	5	6				INCLUDED IN THE ABOVE
32	4	U	1	5	7				INCLUDED IN THE ABOVE
32	5	U	1	5	8				INCLUDED IN THE ABOVE
32	6	U	1	5	9				INCLUDED IN THE ABOVE
32	7	U	1	6	0				INCLUDED IN THE ABOVE
32	8	U	1	6	1				INCLUDED IN THE ABOVE
32	9	U	1	6	2				INCLUDED IN THE ABOVE
33	0	U	1	6	3				INCLUDED IN THE ABOVE
33	1	U	1	6	4				INCLUDED IN THE ABOVE
33	2	U	1	6	5				INCLUDED IN THE ABOVE
33	3	U	1	6	6				INCLUDED IN THE ABOVE
33	4	U	1	6	7				INCLUDED IN THE ABOVE
33	5	U	1	6	8				INCLUDED IN THE ABOVE
33	6	U	1	6	9				INCLUDED IN THE ABOVE
33	7	U	1	7	0				INCLUDED IN THE ABOVE
33	8	U	1	7	1				INCLUDED IN THE ABOVE
33	9	U	1	7	2				INCLUDED IN THE ABOVE
34	0	U	1	7	3				INCLUDED IN THE ABOVE
34	1	U	1	7	4				INCLUDED IN THE ABOVE
34	2	U	1	7	6				INCLUDED IN THE ABOVE
34	3	U	1	7	7				INCLUDED IN THE ABOVE
34	4	U	1	7	8				INCLUDED IN THE ABOVE
34	5	U	1	7	9				INCLUDED IN THE ABOVE
34	6	U	1	8	0				INCLUDED IN THE ABOVE
34	7	U	1	8	1				INCLUDED IN THE ABOVE
34	8	U	1	8	2				INCLUDED IN THE ABOVE
34	9	U	1	8	3				INCLUDED IN THE ABOVE
35	0	U	1	8	4				INCLUDED IN THE ABOVE
35	1	U	1	8	5				INCLUDED IN THE ABOVE

10. Description of Hazardous Wastes (Continued. Use this Additional Sheet(s) as necessary; number as 5 a, etc.)

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Quantity of Waste	C. Unit of Measure (Enter code)	E. PROCESSES (1) PROCESS CODES (Enter code)	E. PROCESSES (2) PROCESS DESCRIPTION (If a code is not entered in E(1))
35	2	U	1	8	6				INCLUDED IN THE ABOVE
35	3	U	1	8	7				INCLUDED IN THE ABOVE
35	4	U	1	8	8				INCLUDED IN THE ABOVE
35	5	U	1	8	9				INCLUDED IN THE ABOVE
35	6	U	1	9	0				INCLUDED IN THE ABOVE
35	7	U	1	9	1				INCLUDED IN THE ABOVE
35	8	U	1	9	2				INCLUDED IN THE ABOVE
35	9	U	1	9	3				INCLUDED IN THE ABOVE
36	0	U	1	9	4				INCLUDED IN THE ABOVE
36	1	U	1	9	6				INCLUDED IN THE ABOVE
36	2	U	1	9	7				INCLUDED IN THE ABOVE
36	3	U	2	0	0				INCLUDED IN THE ABOVE
36	4	U	2	0	1				INCLUDED IN THE ABOVE
36	5	U	2	0	2				INCLUDED IN THE ABOVE
36	6	U	2	0	3				INCLUDED IN THE ABOVE
36	7	U	2	0	4				INCLUDED IN THE ABOVE
36	8	U	2	0	5				INCLUDED IN THE ABOVE
36	9	U	2	0	6				INCLUDED IN THE ABOVE
37	0	U	2	0	7				INCLUDED IN THE ABOVE
37	1	U	2	0	8				INCLUDED IN THE ABOVE
37	2	U	2	0	9				INCLUDED IN THE ABOVE
37	3	U	2	1	0				INCLUDED IN THE ABOVE
37	4	U	2	1	1				INCLUDED IN THE ABOVE
37	5	U	2	1	3				INCLUDED IN THE ABOVE
37	6	U	2	1	4				INCLUDED IN THE ABOVE
37	7	U	2	1	5				INCLUDED IN THE ABOVE
37	8	U	2	1	6				INCLUDED IN THE ABOVE
37	9	U	2	1	7				INCLUDED IN THE ABOVE
38	0	U	2	1	8				INCLUDED IN THE ABOVE
38	1	U	2	1	9				INCLUDED IN THE ABOVE
38	2	U	2	2	0				INCLUDED IN THE ABOVE
38	3	U	2	2	1				INCLUDED IN THE ABOVE
38	4	U	2	2	2				INCLUDED IN THE ABOVE
38	5	U	2	2	3				INCLUDED IN THE ABOVE
38	6	U	2	2	5				INCLUDED IN THE ABOVE
38	7	U	2	2	6				INCLUDED IN THE ABOVE
38	8	U	2	2	7				INCLUDED IN THE ABOVE
38	9	U	2	2	8				INCLUDED IN THE ABOVE
39	0	U	2	3	4				INCLUDED IN THE ABOVE

EPA ID NO: N V 3 8 9 0 0 9 0 0 0 1 OMB #: 2050-0034 Expires 11/30/2005

10. Description of Hazardous Wastes (Continued. Use this Additional Sheet(s) as necessary; number as 5 a, etc.)									
Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Quantity of Waste	C. Unit of Measure (Enter code)	E. PROCESSES (1) PROCESS CODES (Enter code)	E. PROCESSES (2) PROCESS DESCRIPTION (If a code is not entered in E(1))
39	1	U	2	3	5				INCLUDED IN THE ABOVE
39	2	U	2	3	6				INCLUDED IN THE ABOVE
39	3	U	2	3	7				INCLUDED IN THE ABOVE
39	4	U	2	3	8				INCLUDED IN THE ABOVE
39	5	U	2	3	9				INCLUDED IN THE ABOVE
39	6	U	2	4	0				INCLUDED IN THE ABOVE
39	7	U	2	4	3				INCLUDED IN THE ABOVE
39	8	U	2	4	4				INCLUDED IN THE ABOVE
39	9	U	2	4	6				INCLUDED IN THE ABOVE
40	0	U	2	4	7				INCLUDED IN THE ABOVE
40	1	U	2	4	8				INCLUDED IN THE ABOVE
40	2	U	2	4	9				INCLUDED IN THE ABOVE
40	3	U	2	7	1				INCLUDED IN THE ABOVE
40	4	U	2	7	8				INCLUDED IN THE ABOVE
40	5	U	2	7	9				INCLUDED IN THE ABOVE
40	6	U	2	8	0				INCLUDED IN THE ABOVE
40	7	U	3	2	8				INCLUDED IN THE ABOVE
40	8	U	3	5	3				INCLUDED IN THE ABOVE
40	9	U	3	5	9				INCLUDED IN THE ABOVE
41	0	U	3	6	4				INCLUDED IN THE ABOVE
41	1	U	3	6	7				INCLUDED IN THE ABOVE
41	2	U	3	7	2				INCLUDED IN THE ABOVE
41	3	U	3	7	3				INCLUDED IN THE ABOVE
41	4	U	3	8	7				INCLUDED IN THE ABOVE
41	5	U	3	8	9				INCLUDED IN THE ABOVE
41	6	U	3	9	4				INCLUDED IN THE ABOVE
41	7	U	3	9	5				INCLUDED IN THE ABOVE
41	8	U	4	0	4				INCLUDED IN THE ABOVE
41	9	U	4	0	9				INCLUDED IN THE ABOVE
42	0	U	4	1	0				INCLUDED IN THE ABOVE
42	1	U	4	1	1				INCLUDED IN THE ABOVE

11. Map (See instructions on pages 25 and 26)
Attach to this application a topographic map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in this map area. See instructions for precise requirements.
12. Facility Drawing (See instructions on page 26)
All existing facilities must include a scale drawing of the facility (see instructions for more detail).
13. Photographs (See instructions on page 26)
All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas (see instructions for more detail).
14. Comments (See instructions on page 26)
40 CFR 270.13(n): hazardous debris categories and contaminant categories to be disposed at the MWDU: a. Extraction technologies including physical, chemical, and thermal b. Destruction technologies including biological, chemical, and thermal, and c. Immobilization technologies the above technologies must be performed to the standards and contaminant restrictions identified in 40 CFR 268.45

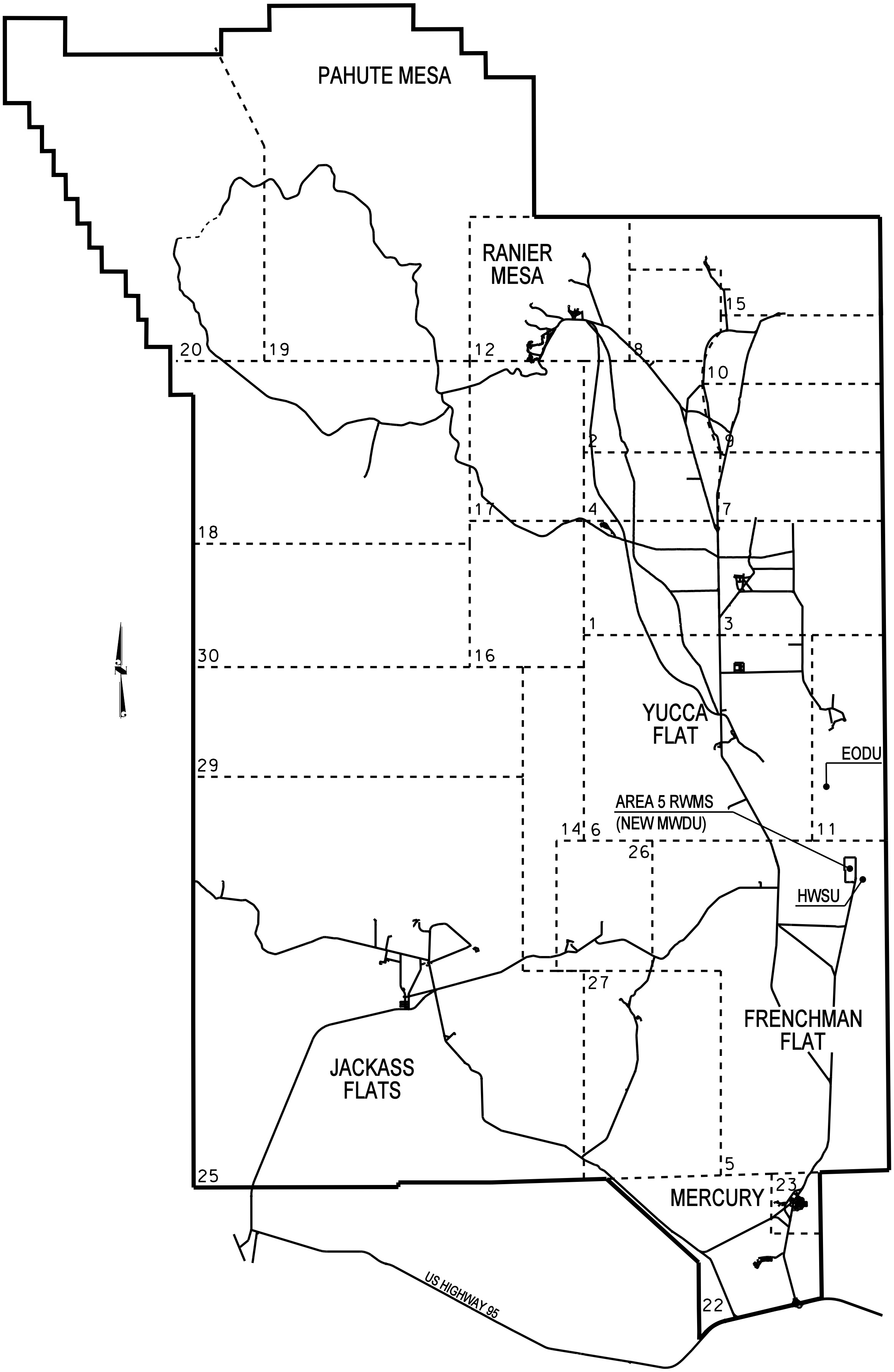
EPA NV3 890 090 001
Section 6 - Attachment C
List of Existing Permits

Type	Number	Type, Area, Location
E	NY-1086	Septic System, Area 25, Reactor Control Point
E	NY-1087	Septic System, Area 27, Able Compound
E	NY-1089	Septic System, Area 12 Camp
E	NY-1090	Septic System, Area 6, LANL Construction Campsite
E	NY-1091	Septic System, Area 23, Gate 100
E	NY-1103	Septic System, Area 22, Desert Rock Airport
E	NY-1110-HAA-A	Individual Sewage Disposal System, A-12, Bldg. 12-910
E	NY-1112	Commercial Sewage Disposal System, U1a, Area 1
E	NY-1113	Commercial Sewage Disposal System, Area 1, Building 121
E	NY-1124	Commercial Individual Sewage Disposal System, Area 6
E	NY-1128	Area 6 Yucca Lake Project
E	NY-17-06839	Septic Tank Pumping Contractor (5 units)
E	GNEV93001	Water Pollution Control General Permit
E	NEV96021	Water Pollution Control for E-Tunnel Waste Water Disposal System and Monitoring Well ER-12-1
E	2287-5146	NTS Hazardous Materials Permit
E	2287-5147	NonProliferation Test and Evaluation Complex Hazardous Materials Permit
R	NEVHW0021	NTS Hazardous Waste Management Permit (RCRA)
E	AP9711-0549.01	NTS Class II Air Quality Operating Permit
E	08-29	Open Burn Variance, Various Locations on the NTS
E	09-08	Open Burn Variance, NTS Area 5 (NTS Fire & Rescue Training Center)
E	NY-0360-12NTNC	Area 23 and Area 6
E	NY-4098-12NC	Area 25
E	NY-4099-12NC	Area 12
E	NY-0835-12NP	NTS (Water Hauler) #84846
E	NY-0836-12NP	NTS (Water Hauler) #84847
E	NY-1054	Septic System, Area 3, Waste Management Office
E	NY-1069	Septic System, Area 18, 820th Red Horse Squadron
E	NY-1076	Septic System, Area 6, (ART Hangar)
E	NY-1077	Septic System, Area 27, Baker Compound
E	NY-1106	Septic System, Area 5, Building 5-8
E	NY-1079	Septic System, Area 12 (U12g Tunnel)
E	NY-1080	Septic System, Area 23, Building 1103
E	NY-1081	Septic System, Area 6, CP-170
E	NY-1082	Septic System, Area 22, Building 22-1
E	NY-1083	Septic System, Area 5, Radioactive Material Management Site (RWMS)
E	NY-1084	Septic System, Area 6, Device Assembly Facility
E	NY-1085	Septic System, Area 25, Central Support Area
E	SW 13 000 01	Area 5 Asbestiform Low-Level Solid Waste Disposal Site
E	SW 13 097 02	Area 6 Hydrocarbon Disposal Site
E	SW 13 097 03	Area 9 U10c Solid Waste Disposal Site
E	SW 13 097 04	Area 23 Solid Waste Disposal Site

Section 11: Maps

Map A: Existing TSDFs

EPA ID NUMBER: NV3 890 009 001

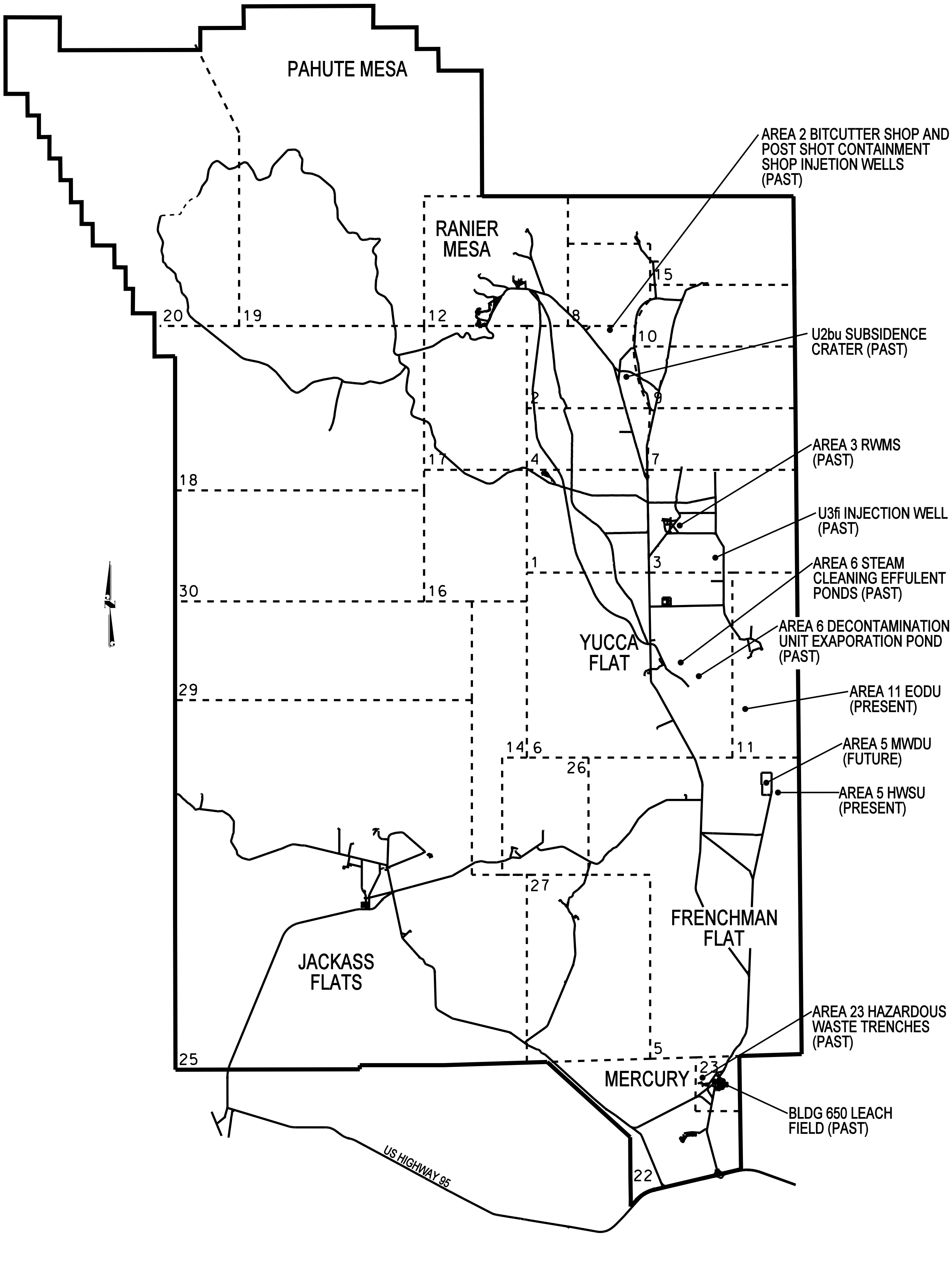


SECTION 11. MAP - A: EXISTING TSDFs

SCALE : NONE

Map B: Past, Present, and Future TSDFs

EPA ID NUMBER: NV3 890 009 001

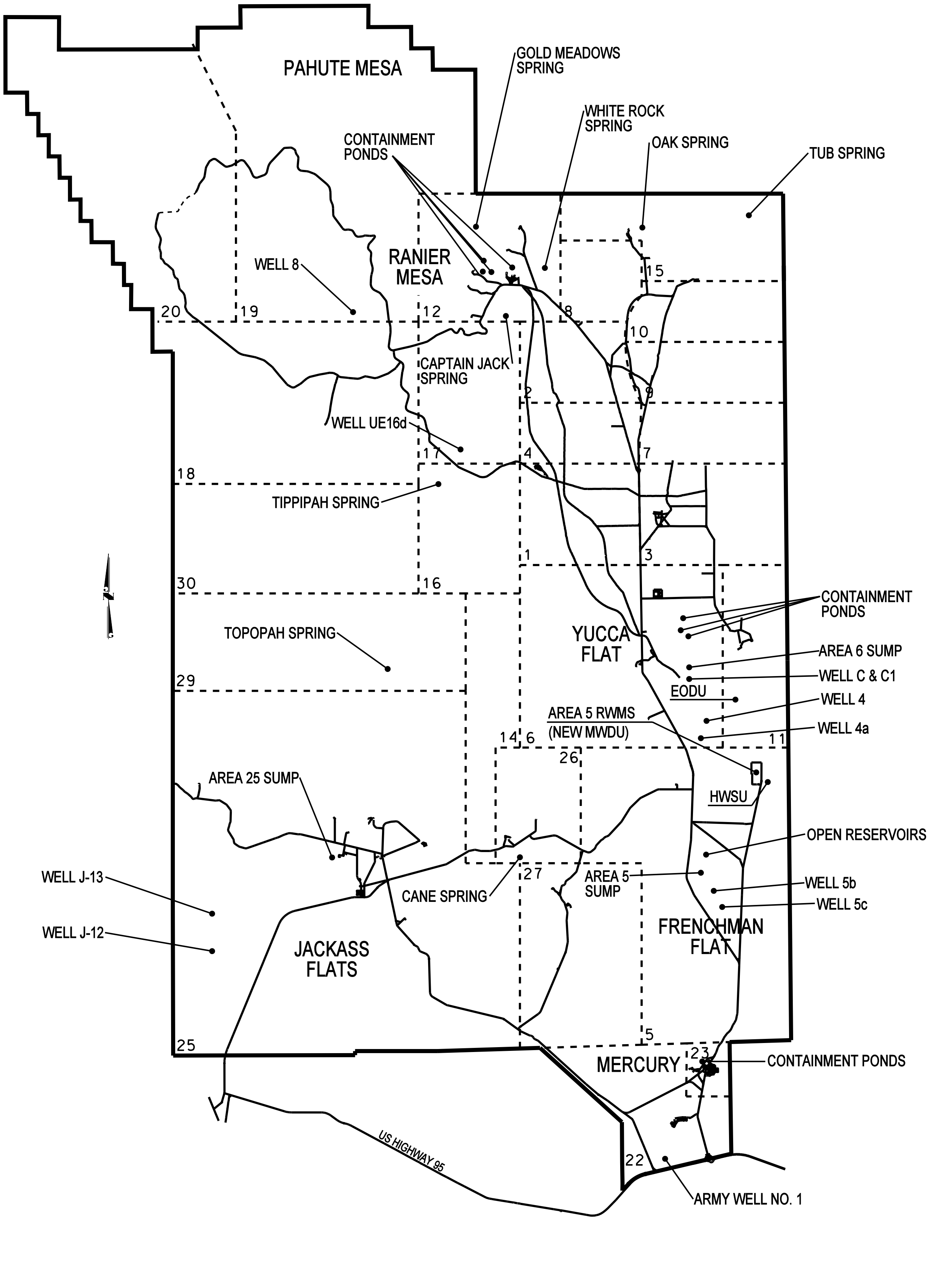


SECTION 11. MAP - B: PAST, PRESENT, & FUTURE TSDFs

SCALE : NONE

Map C: NTS Wells, Springs, and Surface Water Bodies

EPA ID NUMBER: NV3 890 009 001



SECTION 11. MAP - C: NTS WELLS, SPRINGS, & SURFACE WATER BODIES

SCALE : NONE

Map D: Topographical Features and Infrastructure of NTS

Reviewed and determined to be UNCLASSIFIED.
This review does not constitute clearance for public release.

Derivative Classifier: Rulan Morton Eng (Name/Organization)

Date: 3/25/09

GS

NO	DATE	REVISIONS	DRAWN	PREPARER	CHECKER	PROJ ENGR	APPROVER USER

NATIONAL NUCLEAR SECURITY ADMINISTRATION

NEVADA SITE OFFICE — LAS VEGAS, NEVADA

NEVADA TEST SITE — AREA 05

RWMS FIGURE SKETCHES

TOPOGRAPHIC FEATURES & INFRASTRUCTURE

DRAWN	PREPARER	CHECKER	PROJECT ENGINEER	APPROVER / USER
DATE	DATE	DATE	DATE	DATE

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

ENGINEERING NO. 09042 — ORIGINAL SIGNATURES ON FILE

DRAWING NUMBER / WORK ORDER NUMBER: SK-09042-C-1020

REVISION 0

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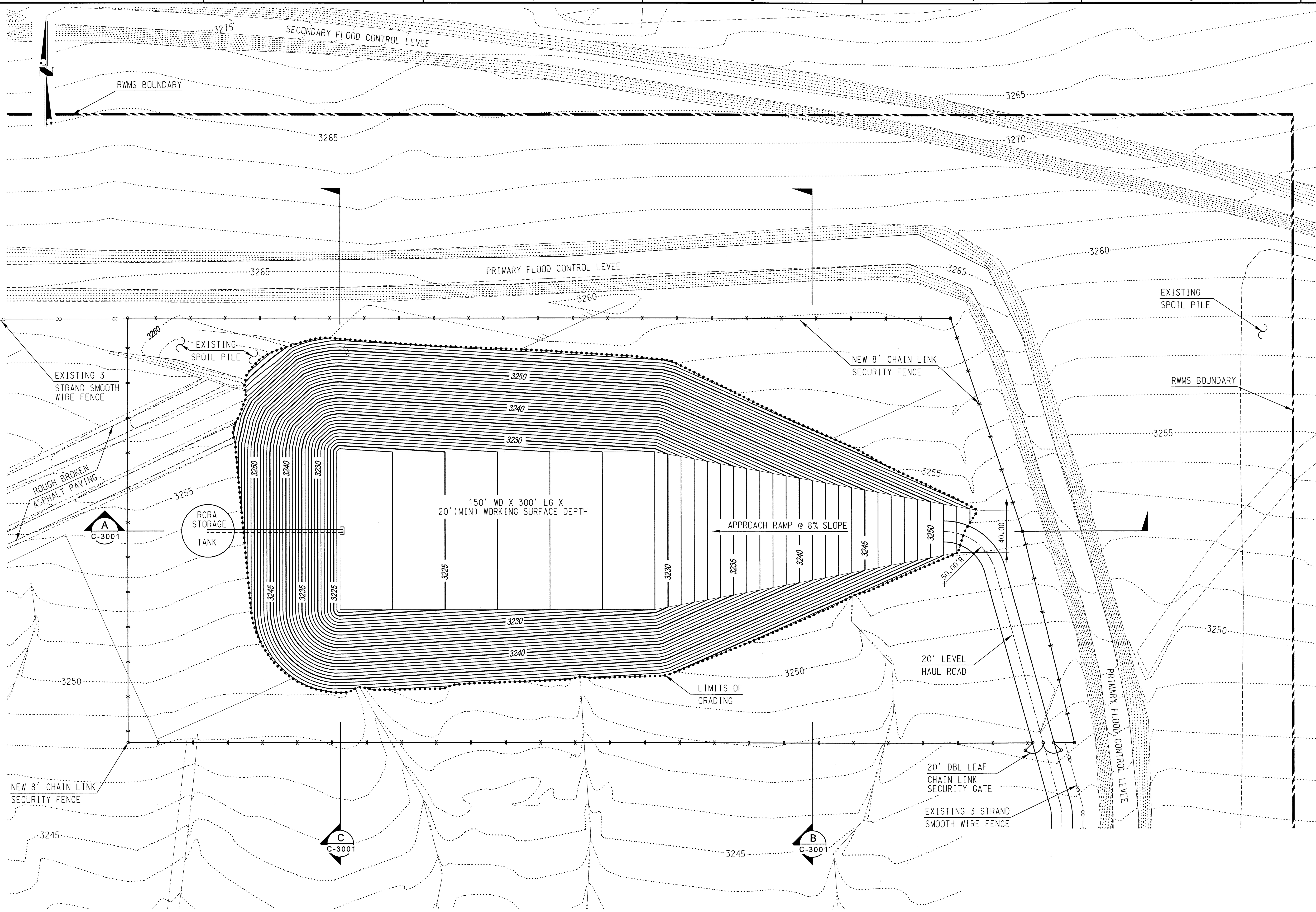
Map E: Disposal Cell Conceptual Drawing



PROPOSED SITE PLAN

SCALE : 1" = 50'

ESTIMATED QUANTITIES		
DESCRIPTION	QTY	UNIT
CUT	110,761	CY
FILL	0	CY
NEW PIT EXCAVATION (TO WORKING SURFACE) NET	110,761	CY

1. QUANTITIES PROVIDED ARE FOR NSTec ESTIMATING PURPOSES ONLY AND DO NOT INCLUDE CUT FACTORS.
2. EXISTING SPOILS PILE QUANTITIES ARE NOT INCLUDED IN THIS ESTIMATE.
3. NEW PIT WORKING SURFACE = 2% NEW PIT SIDE SLOPES = 33%

SECTION 11
MAP E

Reviewed and determined to be UNCLASSIFIED. This review does not constitute clearance for public release.
Derivative Classifier: V Sel-, NSTec (Name/Organization)
Date: 9-24-08

GS

NOT FOR CONSTRUCTION

GRAPHIC SCALE
0 50 100 150 FEET
1" = 50'
CONTOUR INTERVAL = 1'

FOR REFERENCE DRAWINGS SEE 08105-G-0001

NO	DATE	REVISIONS	DRAWN	PREPARER	CHECKER	PROJ ENGR	APPROVER USER

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

NEVADA TEST SITE — AREA 5
RADIOACTIVE WASTE MANAGEMENT SITE
NEW DISPOSAL CELL
CONCEPTUAL DESIGN
PROPOSED SITE PLAN

DRAWN	PREPARER	CHECKER	PROJECT ENGINEER	APPROVER / USER
DATE	DATE	DATE	DATE	DATE

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

ENGINEERING NO. 08105
ORIGINAL SIGNATURES ON FILE
DRAWING NUMBER / WORK ORDER NUMBER 08105-C-1003
REVISION B

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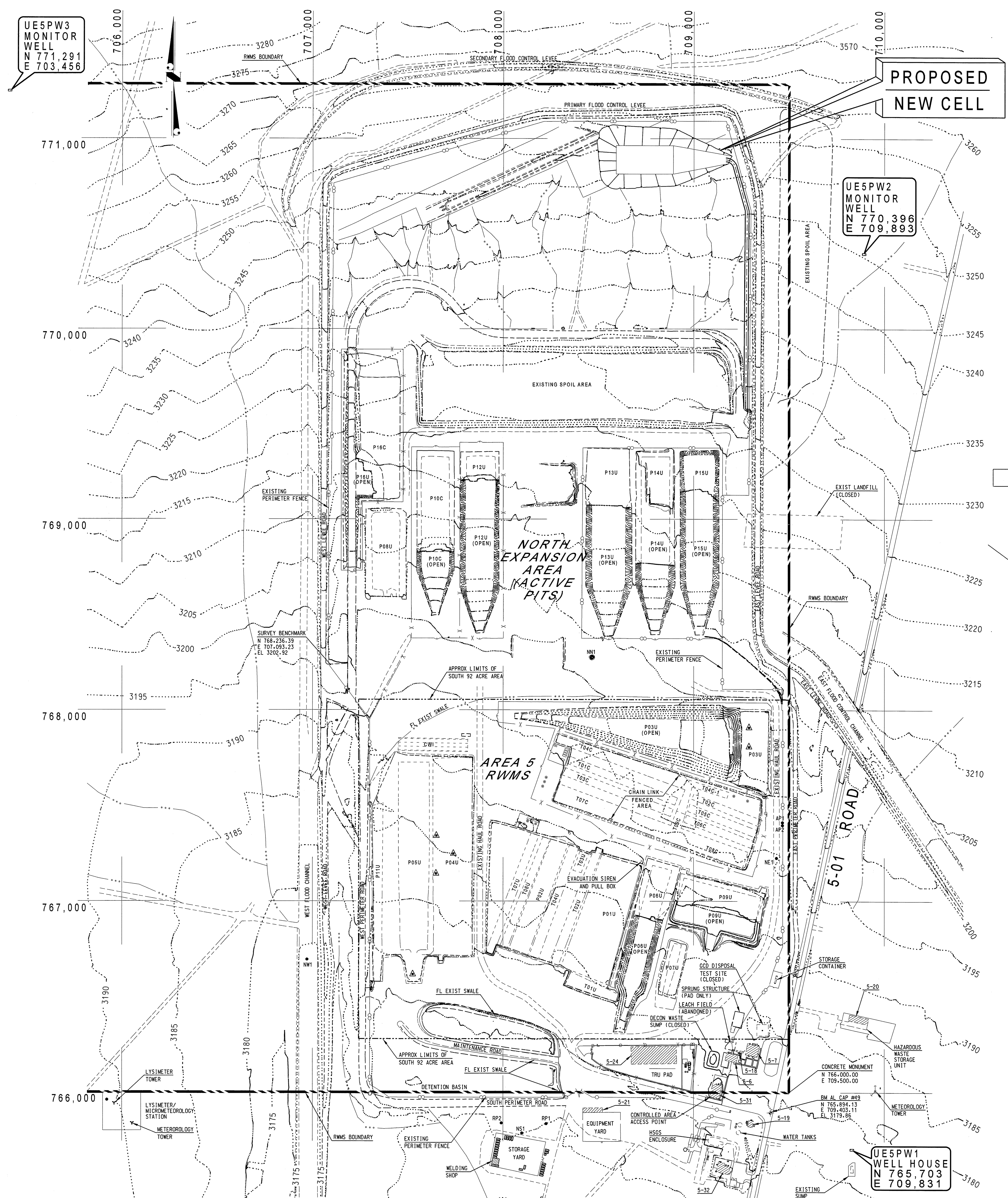
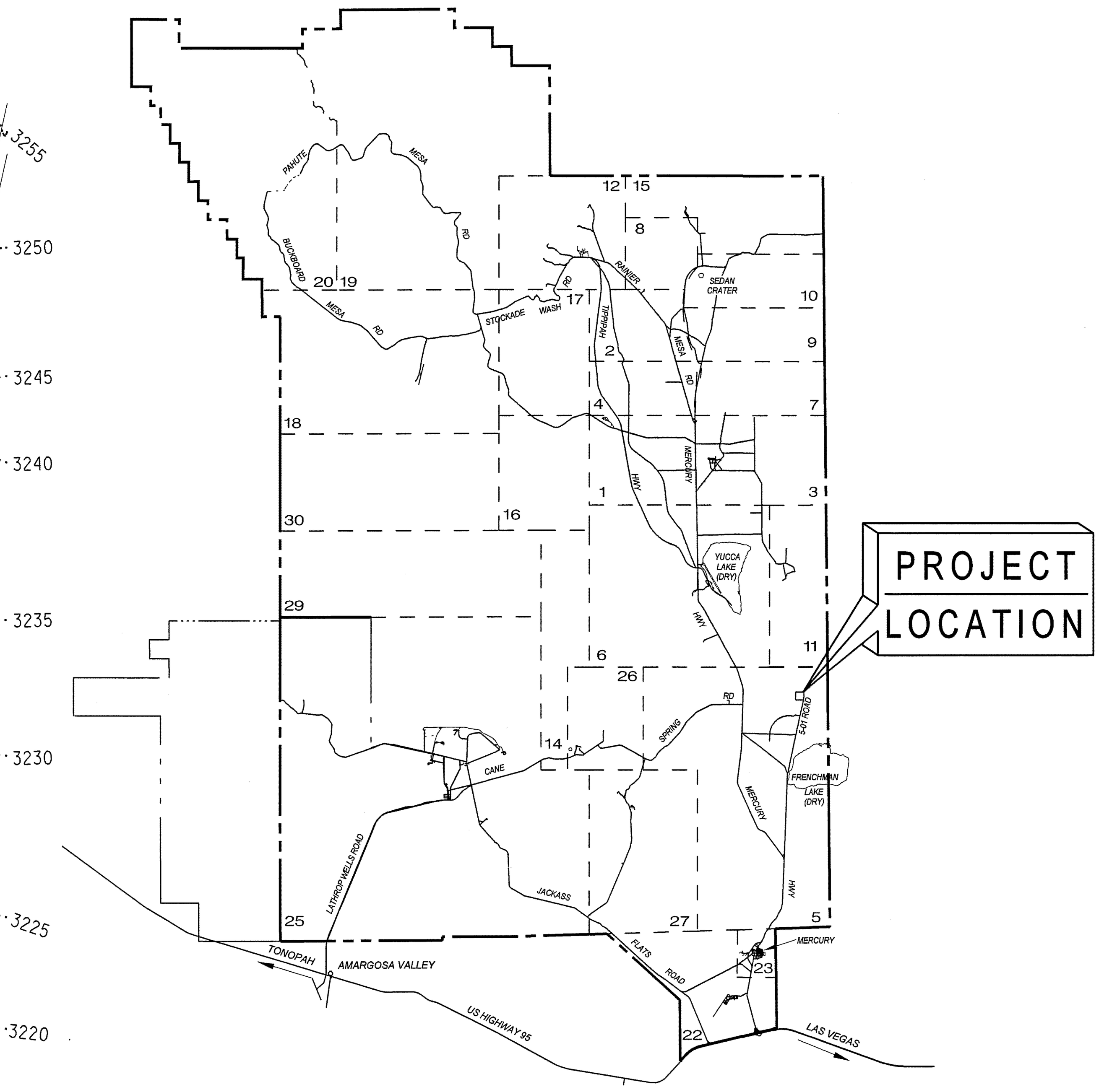
Section 12: Facility Drawings

Map A. Existing Facilities



OVERALL LOCATION MAP

SCALE : 1" = 300'



VICINITY MAP
NEVADA TEST SITE

SCALE : NONE

SECTION 12

MAP A

EPA ID NO: NV3 890 090 001

Reviewed and determined to be UNCLASSIFIED.
This review does not constitute clearance for public release.

Derivative Classifier: V Sel--, NSTec (Name/Organization)

Date: 9-24-08

NOT FOR CONSTRUCTION

GRAPHIC SCALE

0 300 600 900 FEET

1" = 300'

CONTOUR INTERVAL = 5 FEET

FOR REFERENCE DRAWINGS SEE 08105-G-0001

GS

NO	DATE	REVISIONS	DRAWN	PREPARER	CHECKER	PROJ ENGR	APPROVER/USER

NATIONAL NUCLEAR SECURITY ADMINISTRATION

NEVADA SITE OFFICE — LAS VEGAS, NEVADA

NEVADA TEST SITE — AREA 5

RADIOACTIVE WASTE MANAGEMENT SITE

NEW DISPOSAL CELL

CONCEPTUAL DESIGN

OVERALL LOCATION MAPS

DRAWN	PREPARER	CHECKER	PROJECT ENGINEER	APPROVER / USER
DATE	DATE	DATE	DATE	DATE

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

ENGINEERING NO. 08105

ORIGINAL SIGNATURES ON FILE

DRAWING NUMBER / WORK ORDER NUMBER: 08105-C-1002

REVISION B

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Section 13: Photograph

Figure A: Aerial Photograph of MWDU

Not Available for Public Viewing

MIXED WASTE DISPOSAL UNIT

RCRA Part B Permit Application for Waste Management Activities at the Nevada Test Site

September 2009

Table of Contents

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Table of Contents (continued)

List of Tables

List of Figures

Acronyms and Abbreviations

AC	Acres
BLM	Bureau of Land Management
CAU	Corrective Action Unit
CFR	Code of Federal Regulations
COE	Corps of Engineers
CM	Centimeter
CQA	Contractor Quality Assurance (plan)
DoD	Department of Defense
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
DOT	U.S. Department of Transportation
EODU	Explosive Ordnance Disposal Unit
EPA	U.S. Environmental Protection Agency
ERP	Emergency Response Procedure
ET	Evapotranspiration
FEMA	Federal Emergency Management Agency
FFACO	Federal Facility Agreement and Consent Order
FT	Foot, Feet
GAL	Gallon
HA	Hectares
HR	Hour
HWSU	Hazardous Waste Storage Unit
IN	Inch
KG	Kilogram
KM	Kilometer
LDR	Land Disposal Restriction
L	Liter
LBS	Pounds
LLW	Low-Level Waste
LLMW	Low-Level Mixed Waste
M	Meter
Mi	Mile
MREM	Millirem
MWDU	Mixed Waste Disposal Unit
NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NNSA/NSO	National Nuclear Security Administration Nevada Site Office
NRS	Nevada Revised Statutes
NSTec	National Security Technologies
NTS	Nevada Test Site
NTSWAC	Nevada Test Site Waste Acceptance Criteria
NTTR	Nevada Test and Training Range
PCB	Polychlorinated Biphenyl
PPE	Personal Protective Equipment
RCRA	Resource Conservation and Recovery Act
RTR	Real-Time Radiography
RWMC	Radioactive Waste Management Complex
RWMS	Radioactive Waste Management Site

Acronyms and Abbreviations (continued)

S	Second
TSDF	Treatment, Storage, and Disposal Facility
USGS	United States Geological Survey
TID	Tamper Indicating Device
UR	Use Restrictions
WAP	Waste Analysis Plan
YD	Yard

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

P18 is referred to herein as the proposed “Mixed Waste Disposal Unit “(MWDU). This permit application provides facility information on the design, processes, and security features associated with the proposed MWDU. The unit will receive and dispose of onsite and offsite containerized low-level mixed waste (LLMW) that has an approved U.S. Department of Energy (DOE) nexus.

The MWDU will be located in the remote southeastern portion of the Nevada Test Site (NTS), within the Area 5 Radioactive Waste Management Complex (RWMC). The RWMC includes transuranic waste storage, breaching, and re-packaging facilities, and the Area 5 Radioactive Waste Management Site (RWMS). The RWMS is an active disposal site for low level waste (LLW) and LLMW. Polychlorinated biphenyls that meet the requirements for disposal in a hazardous waste landfill as specified **40 CFR 761** and **NAC 444.9452** are also accepted. The MWDU will also accept low level waste containing friable and nonfriable asbestos.

Table 1 provides the metric conversion factors used in this application. Table 2 provides a list of existing permits. Table 3 lists operational RCRA units at the NTS and their respective regulatory status.

B.1.a MWDU Background

Closure of the current NTS MWDU (P03U) under Permit Number NEV HW0021 is scheduled for November 30, 2010. To continue the receipt and disposal of DOE generated LLMW, the National Nuclear Security Administration, Nevada Site Office (NNSA/NSO) proposes to permit, construct, and operate a hazardous waste landfill at the NTS. The proposed unit will be operated by National Security Technologies, LLC (NSTec) for NNSA/NSO. This is a new landfill; therefore, no wastes have been previously managed or disposed at this unit.

In addition to the requirements under the Resource Conservation and Recovery Act (RCRA), the MWDU is also subject to DOE, U.S. Department of Transportation (DOT) regulations (for receipt of offsite waste), and state requirements. General information and hazardous waste codes identified for disposal in the MWDU are described in Section B.2. State-only designated hazardous waste may also be received at the NTS as hazardous waste.

Conceptual design drawings of the proposed unit and a facility overview of the RWMS, buildings, disposal cells, and the proposed MWDU are provided in this Section.

B.1.a.1 NTS General Facility Description

The NTS is a DOE/NNSA 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 km (65 mi) northwest of Las Vegas, Nevada, the NTS is accessed from U.S. Highway 95, which roughly forms the southern boundary of the facility. The site is bordered to the west, north, and east by the Nevada Test and Training Range (NTTR), another government owned, restricted-access area. Public land to the south of the NTS is managed by the Bureau of Land Management (BLM). Land in the surrounding area is predominantly rural, undeveloped public desert lands used for grazing and agriculture.
The NTS is well buffered from public access. The greater Las Vegas area is the closest major population center to the NTS. Smaller, rural communities near the NTS include Amargosa Valley and Pahrump.

The NTS varies in distance 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 approximately 915 to 2,345 meters (m) (3,000 to 7,700 feet [ft]) above sea level. The terrain of the NTS is characteristic of the Basin and Range Physiographic Province in Nevada, Arizona, and Utah, which is a province of intervening valleys and ranges, all nearly parallel. There are numerous north to northeast trending mountain ranges separated by gently sloping linear valleys and broad flat basins. The principal valleys within the NTS are Frenchman Flat, Yucca Flat, and Jackass Flats, with the principal highlands consisting of Pahute Mesa, Rainier Mesa, Timber Mountain, and Shoshone Mountain. Generally, large portions of the NTS are within one of two elevation ranges from approximately 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 toward the northern and western boundaries.

Mercury, the base camp at the NTS, 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. NTS 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 nuclear testing, and radioactive waste management. Yucca Flat and Rainier Mesa both were used for underground nuclear tests and Yucca Flat was used for atmospheric nuclear tests. Pahute Mesa vicinity was used for higher yield underground nuclear tests.

Historically the primary mission of the NTS was to conduct nuclear weapons tests. Since the moratorium on nuclear weapons testing began in October 1992, this mission has changed to maintaining readiness to conduct these tests, if so directed. Because of its favorable environment and infrastructure, the NTS supports national security related research, development, and testing programs, as well as waste management activities.

Numerous government and/or research organizations use the NTS 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/NSO.

NSTec, the management and operations contractor, provides a number of services including designing and operating the functioning hazardous waste management units at the NTS. The contractor also provides onsite medical services and operates the NTS Fire and Rescue Department. Additionally, NNSA/NSO maintains separate contracts with Wackenhut Services, Incorporated, for 24-hour security services (armed patrol, access control) and the Nye County Sheriff's Office for law enforcement support on the NTS.

Table 1 Metric Conversion Factors

Unit	Equals
1 hectare	2.471 acres
1 in	2.54 cm
1 kg	2.205 lbs
1 L	0.2642 gal
1 m	3.281 ft
1 mi^3	35.315 ft^3
1 m^3	1.308 yd^3
1 km	0.614 mi
1 km^2	0.386 mi^2
1 metric ton	1.102 short tons
The actual value (or real value) is converted to the corresponding metric or English unit by 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
5000,000 – 1,000,000	1,000
> 1,000,000	10,000

Table 2 List of Existing Permits

Number	Type, Area, Location
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
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NEV96021	Water Pollution Control for E-Tunnel Waste Water Disposal System and Monitoring Well ER-12-1
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2287-5147	NonProliferation Test and Evaluation Complex Hazardous Materials Permit
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08-29	Open Burn Variance, Various Locations on the NTS
09-08	Open Burn Variance, NTS Area 5 (NTS Fire & Rescue Training Center)
NY-0360-12NTNC	Area 23 and Area 6
NY-4098-12NC	Area 25
NY-4099-12NC	Area 12
NY-0835-12NP	NTS (Water Hauler) #84846
NY-0836-12NP	NTS (Water Hauler) #84847
NY-1054	Septic System, Area 3, Waste Management Office
NY-1069	Septic System, Area 18, 820th Red Horse Squadron
NY-1076	Septic System, Area 6, (ART Hangar)
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
SW 13 000 01	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

Table 3 Operational Unit Locations and Regulatory Status

Unit Name	Location	Regulatory Status	Permit	Volume
Reserved (Mixed Waste Storage Unit)	N/A	N/A	N/A	2
Pit 3 MWDU	Area 5 RWMS	Interim Status – 12/2005	NEV HW0021	3
EODU	Area 11	Permitted – 12/2005	NEV HW0021	4
HWSU	Area 5	Permitted – 12/2005	NEV HW0021	5

Figure 1, “NTS General Location Map”; Figure 2 , “NTS Oversized Topographic Features and Infrastructure Map”; Figure 3, “NTS Land Use Map”; and Figure 4, “Aerial Photograph of the RWMS and Proposed MWDU Location,” provide additional NTS information to support this Part B Application.

B.1.a.2 RCRA Permit Application History

In 1985 and 1987, respectively, the DOE NNSA/NSO submitted Parts A and B of the RCRA Permit Application to Region 9 of the U.S. Environmental Protection Agency and the state of Nevada. The application provided detailed information regarding the disposal of low-level mixed waste at the Area 5 Pit 3 MWDU and the treatment of non-radioactive waste at the Area 11 Explosives Ordnance Disposal Unit (EODU). In September 1987, the Nevada Division of Environmental Protection (NDEP) concurred that the Pit 3 MWDU and the EODU met the regulatory requirements of interim status. In 1992, NNSA/NSO resubmitted the Part B Application with the addition of the Hazardous Waste Storage Unit (HWSU). From June 1992 through May 1995, NNSA/NSO provided subsequent revisions to the application, including the addition of a proposed Area 5 Low Level Mixed Waste Storage Unit in January 1995. In May 1995, NDEP issued a RCRA Part B Permit to NNSA/NSO for the operation of two units; the Area 5 HWSU for the storage 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, NNSA/NSO requested accelerated closure of Pit 3 MWDU and submitted a closure plan to NDEP. Low-level mixed waste shipments for Pit 3 are scheduled to end by December 2010.

Additionally, in September 1998, NNSA/NSO submitted a permit application for the operation of the Tactical Demilitarization and Demonstration Complex. This research and development permit was terminated in January 2000.

B.1.a.3 Summary of RCRA Operational Units

Figure 1 and Table 3 provide the locations of each RCRA operational unit on the NTS and its regulatory status. Specific information for Pit 3 MWDU, Area 11 EODU, and the Area 5 HWSU can be found in the RCRA Part B Permit Application, Volumes 1, 4, and 5 (DOE/NV-1053, May 2005), the NDEP Permit for a Hazardous Waste Management Facility (NEV-HW0021, December 2005), and the updated permit application information for Pit 3 MWDU - Volume 3 (NDEP approved October 2007).

- **Pit 3 MWDU**

Pit 3 MWDU is an interim status landfill that disposes of onsite and offsite containerized LLMW waste from the DOE weapons complex. The permitted capacity of the unit is 20,000 cubic meters (m^3) (26,160 cubic yards [yd^3]). The unit is scheduled to close by November 30, 2010.

- **EODU**

The Area 11 EODU is a permitted thermal treatment unit for conventional explosives. The unit encompasses approximately 8.1 hectares (ha) (20 acres [ac]) of land. A storage magazine is used to store detonation 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 [lbs]) of waste. The process design capacity of the EODU is 45 kg/hour (kg/hr) (100 lbs/hr).

- **HWSU**

The Area 5 HWSU is a permitted storage unit for hazardous non-radioactive waste generated on the NTS. It is located immediately to the east of the RWMS. The process design capacity of the HWSU is approximately 61,600 liters (L) (16,280 gallons [gal]).

B.1.b General Dimensions and Structural Description

The proposed MWDU is a new landfill and will be located at the RWMC on the NTS (Figures 5 through 9). The Area 5 RWMS is comprised of multiple low-level waste (LLW) disposal cells in the “92-acre area” and “expansion area” within the RWMC. Until 2001, all disposal activities at the RWMS were within the “92-acre area.” LLW disposal operations have since been ongoing north of the “92-acre area” in the “expansion area.” The MWDU (Figure 4) will be located near the northeastern corner of the “expansion area.”

B.1.b.1 Disposal Unit Design

Minimum dimensions for the proposed MWDU cell will be 45.7 x 91.4 x 20 m (150 x 300 x 6.1 ft) with a design capacity of 25,485 cubic meters (m^3) (33,333 yd^3). The disposal cell will be double lined **[40 CFR 264.301(c)]** with leachate collection and removal systems located above the first liner and between the first and second liner. The removal system between the liners will serve as a leak detection system. Conceptual design drawings are provided in Figure 5 through Figure 8. NNSA/NSO is seeking permit approval based on the conceptual design. Subsequent to approval, NNSA/NSO will solicit a subcontractor to provide a design package for the proposed unit. NDEP permit approval is contingent upon review and approval of the final construction drawings.

The leachate collection and removal system immediately above the top liner will be designed, constructed, operated, and maintained so that the leachate depth over the liner does not exceed 30.5 cm (12 in).

The requirements for a leak detection system are satisfied if the system installation is at minimum:

- Constructed with a bottom slope of one percent or more;
- Constructed of granular drainage materials with a hydraulic conductivity of 1 x 10^{2} cm/second (s) (4 x 10^{-3} in/s), and a thickness of 30.5 cm (12 in); or of a synthetic or geonet drainage materials with a transmissivity of 3 x 10^{5} m^2/s (3.6 x 10^{5} yd^2/s);
- Constructed of materials that are chemically resistant to the waste managed in the landfill and the leachate expected to be generated, and of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying wastes, waste cover materials, and equipment used at the landfill;
- Designed and operated to minimize clogging during the active life and post-closure care period; and
- Constructed with sumps and liquid removal methods of sufficient size to collect and remove liquids from the sump and prevent liquids from backing up into the drainage layer. The design of each sump and removal system must provide a method for measuring and recording the volume of liquids present in the sump and of liquids removed.

An aboveground tank will be used to contain leachate. The tank capacity will be designed to accommodate potential leachate generated based on the final cell design. The tank will be constructed of materials compatible with the leachate. Leak detection monitoring will be used for both the tank and the secondary containment. The tank will be located adjacent to the cell. Any underground piping components of the tank will be double wall fiberglass/fiberglass reinforced plastic construction. The tank will be managed as a 90-day accumulation unit that will be activated whenever leachate is placed in the tank. Collected leachate is accumulated in the tank pending treatment/disposal. NNSA/NSO will select one of the following options for tank operation based on the final construction configuration:

- Tank operations are automated; a sensor in the sump detects the liquid level, and automatically pumps the leachate to the storage tank. The tank will be equipped with an automated feed cutoff to prevent overfilling.
- The leachate is removed from the sump manually as a batch operation. The tank would be provided with a visual fill gauge that alerts the operator that the tank is nearing maximum capacity.

To ensure the constructed landfill and tank meet or exceed the design criteria and specifications of the permit, a written construction quality assurance (CQA) program will be developed and implemented as required by **40 CFR 264.19**. The CQA for the proposed MWDU will be provided with the final construction drawings.

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

Run-On Protection

The MWDU is protected from flooding from upstream watersheds by two flood control channels (west and east of the RWMS) and berms. The berms extend along the western, northern, and eastern sides of the RWMS. The channels were designed to divert the peak flow from a 25-year, 24-hour storm event, evaluated using the U.S. Army Corps of Engineer HEC-2 model. The 25-year flood peaks were derived using a HEC-1 model developed for the 100-year floodplain mapping, which 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 was documented at the RWMS on February 23-24, 1998 (French and Curtis, 1999). The observed flow depth in the West Channel during this storm was only a few inches. The channel is designed for 242 cubic meters per second (cms) (316 yd^3/s). The modeled peak for the event was 96 cms (126 yd^3/s) and the estimated flow rate corresponding to observed water depth in the channel was less than 1.5 cms (2.0 yd^3/s).

Runoff Protection

Runoff is not anticipated because of the construction of run-on controls and the slope of the MWDU.

Erosion Protection

Erosion from precipitation on the floor of the MWDU will be repaired to maintain the soil layer needed to protect the geomembrane/liner from the impacts of equipment and vehicles operating in the cell. Side slopes will be protected by a sacrificial layer of high-density polyethylene liner or by repairs to soil cover materials (slope dependent).

Figure 1 NTS General Location Map

FIGURE 1

Reviewed and determined to be UNCLASSIFIED.
This review does not constitute clearance for public release.

Derivative Classifier: [signature] RM Engr (Name/Organization)

Date: 3/25/09

NO	DATE	REVISIONS	DRAWN	PREPARER	CHECKER	PROJ ENGR	APPROVER USER

GS

NATIONAL NUCLEAR SECURITY ADMINISTRATION

NEVADA SITE OFFICE — LAS VEGAS, NEVADA

NEVADA TEST SITE — AREA 05

RWMS FIGURE SKETCHES

GENERAL LOCATION MAP

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DATE	DATE	DATE	DATE	DATE

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DRAWING NUMBER / WORK ORDER NUMBER: SK-09042-C-1001

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Figure 2 NTS Topographic Features and Infrastructure Map

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Derivative Classifier: Roberto Morton RM Ewg
(Name/Organization)

Date: 3/25/09

FIGURE 2

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NATIONAL NUCLEAR SECURITY ADMINISTRATION

NEVADA SITE OFFICE — LAS VEGAS, NEVADA

NEVADA TEST SITE — AREA 05

RWMS FIGURE SKETCHES

TOPOGRAPHIC FEATURES & INFRASTRUCTURE

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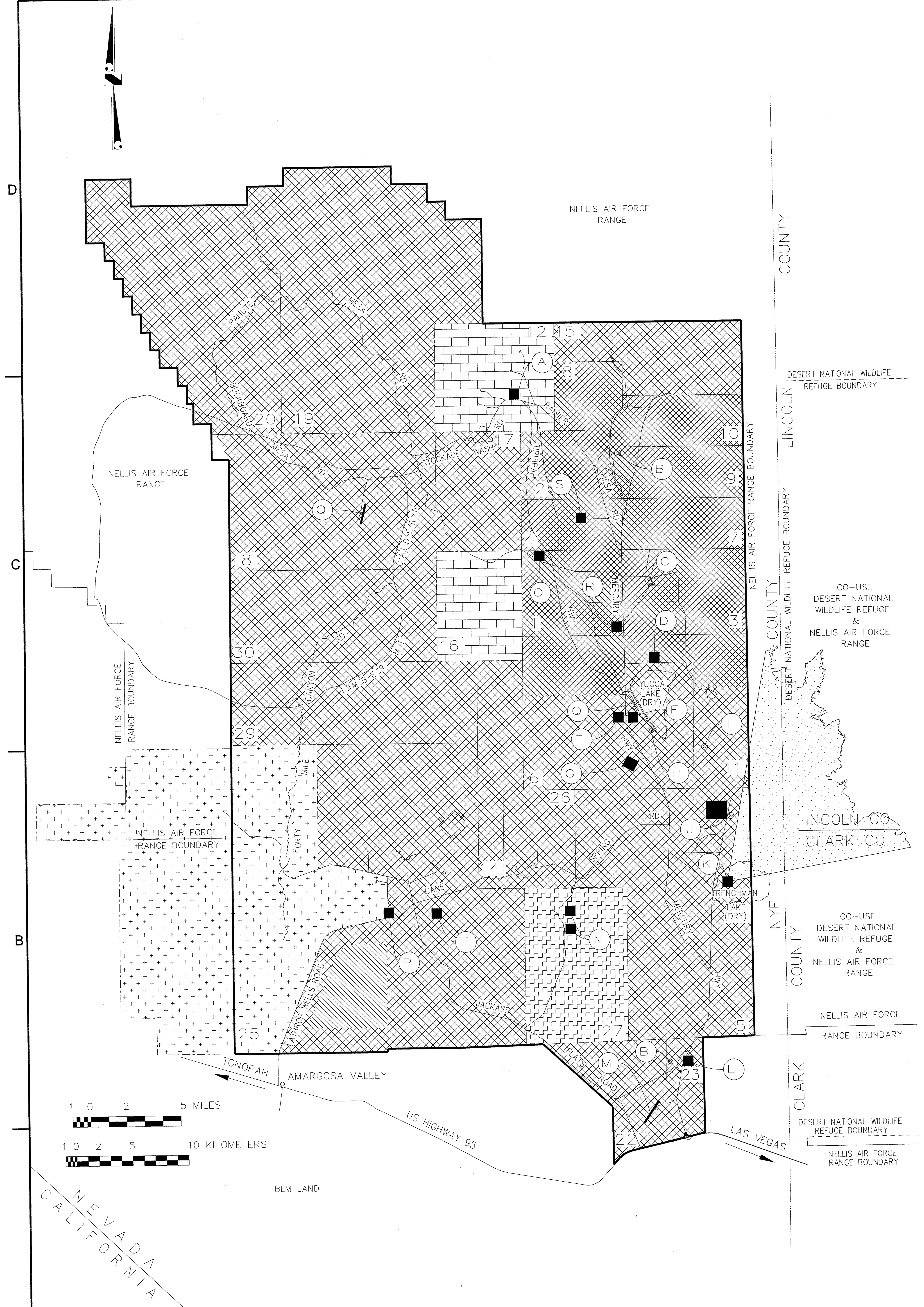
Figure 3 NTS Land Use Map



NTS LAND USE MAP

SCALE : NONE

LEGEND

- NUCLEAR TEST ZONE
- NUCLEAR / HIGH EXPLOSIVE TEST ZONE
- RESEARCH / TEST / EXPERIMENT ZONE
- YUCCA MOUNTAIN SITE CHARACTERIZATION ZONE
- CRITICAL ASSEMBLY ZONE
- LGFSTF IMPACT ZONE
- RESERVED ZONE
- WASTE MANAGEMENT SITE
- INDUSTRIAL, RESEARCH, SUPPORT SITE
- COUNTY LINE
- NEVADA TEST SITE BOUNDARY LINE
- NEVADA TEST SITE AREA BOUNDARY LINE
- NELLIS AIR FORCE RANGE BOUNDARY LINE
- DESERT NATIONAL WILDLIFE REFUGE BOUNDARY LINE

- (A) AREA 12 CAMP
- (B) SANITARY LANDFILL
- (C) AREA 3 RADIOACTIVE WASTE MANAGEMENT SITE (ZONE)
- (D) AREA 6 CONSTRUCTION FACILITIES
- (E) AREA 6 CONTROL POINT
- (F) YUCCA LAKE FACILITIES
- (G) DEVICE ASSEMBLY FACILITY (CRITICAL ASSEMBLY ZONE)
- (H) HYDROCARBON CONTAMINATED SOILS DISPOSAL SITE
- (I) EXPLOSIVES ORDNANCE DISPOSAL SITE
- (J) AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE, WASTE EXAMINATION FACILITY, HAZARDOUS WASTE STORAGE UNIT
- (K) NPTEC
- (L) MERCURY CAMP
- (M) DESERT ROCK AIRPORT
- (N) AREA 27 ASSEMBLY FACILITIES
- (O) AREA 1 INDUSTRIAL COMPLEX
- (P) YUCCA MT. SITE CHARACTERIZATION CENTRAL SUPPORT SITE
- (Q) AIRSTRIP
- (R) U1a FACILITY
- (S) BIG EXPLOSIVE EXPERIMENTAL FACILITY
- (T) BREN TOWER

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Derivative Classifier: Robert Mallon Engr (Name/Organization)

Date: 3/25/09

FIGURE 3

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NEVADA SITE OFFICE — LAS VEGAS, NEVADA

NEVADA TEST SITE — AREA 05

RWMS FIGURE SKETCHES

NTS LAND USE MAP

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Figure 4 Aerial Photograph of the RWMS and Proposed MWDU

NOT AVAILABLE FOR PUBLIC VIEWING

Figure 5 MWDU Conceptual Design Drawings

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NEVADA SITE OFFICE — LAS VEGAS, NEVADA

RADIOACTIVE WASTE MANAGEMENT SITE

AREA 5

NEW DISPOSAL CELL

CONCEPTUAL DESIGN

SCOPE OF WORK

THE PURPOSE OF THIS PROJECT IS TO ASSIST THE ENVIRONMENTAL MANAGEMENT DIRECTORATE (EMD) WITH DEVELOPMENT OF NECESSARY CIVIL ENGINEERING EXHIBITS FOR INCLUSION IN THE CD-0/1 SUBMITTAL FOR A NEW RCRA CELL IN AREA 5.

THE NEW CELL WILL HAVE BOTTOM DIMENSIONS OF 150' X 300'. THE CELL WILL BE DOUBLE LINED AND INCLUDE A LEACHATE COLLECTION AND REMOVAL SYSTEM. LEACHATE COLLECTED IN THE PRIMARY AND SECONDARY SUMP PITS WILL BE PUMPED TO THE SURFACE AND STORED IN A RCRA COMPLIANT TANK.

GENERAL NOTES

1. "DO NOT SCALE DRAWINGS". DIMENSIONS AND COORDINATES SHOWN ON DRAWINGS SHALL TAKE PRECEDENCE.

DRAWING INDEX

DRAWING NUMBER		DRAWING TITLE
TITLE		
08105-G-0001	REV B	TITLE SHEET
CIVIL		
08105-C-1002	REV B	OVERALL LOCATION MAPS
08105-C-1003	REV B	PROPOSED SITE PLAN
08105-C-3001	REV B	TYPICAL SECTIONS AND DETAILS

CAUTION NOTE:

INFORMATION SHOWN ON THESE DRAWINGS MIGHT NOT REFLECT CURRENT CONDITIONS OF FACILITY OR STRUCTURE. PERSONNEL SHALL USE CAUTION WHEN PERFORMING WORK BASED ON THE EXISTING INFORMATION SHOWN ON THE DRAWINGS.

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Derivative Classifier: V Sal- , NSTec
(Name/Organization)

Date: 9-24-08

FIGURE 5

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NEVADA TEST SITE — AREA 5
RADIOACTIVE WASTE MANAGEMENT SITE
NEW DISPOSAL CELL
CONCEPTUAL DESIGN
TITLE SHEET

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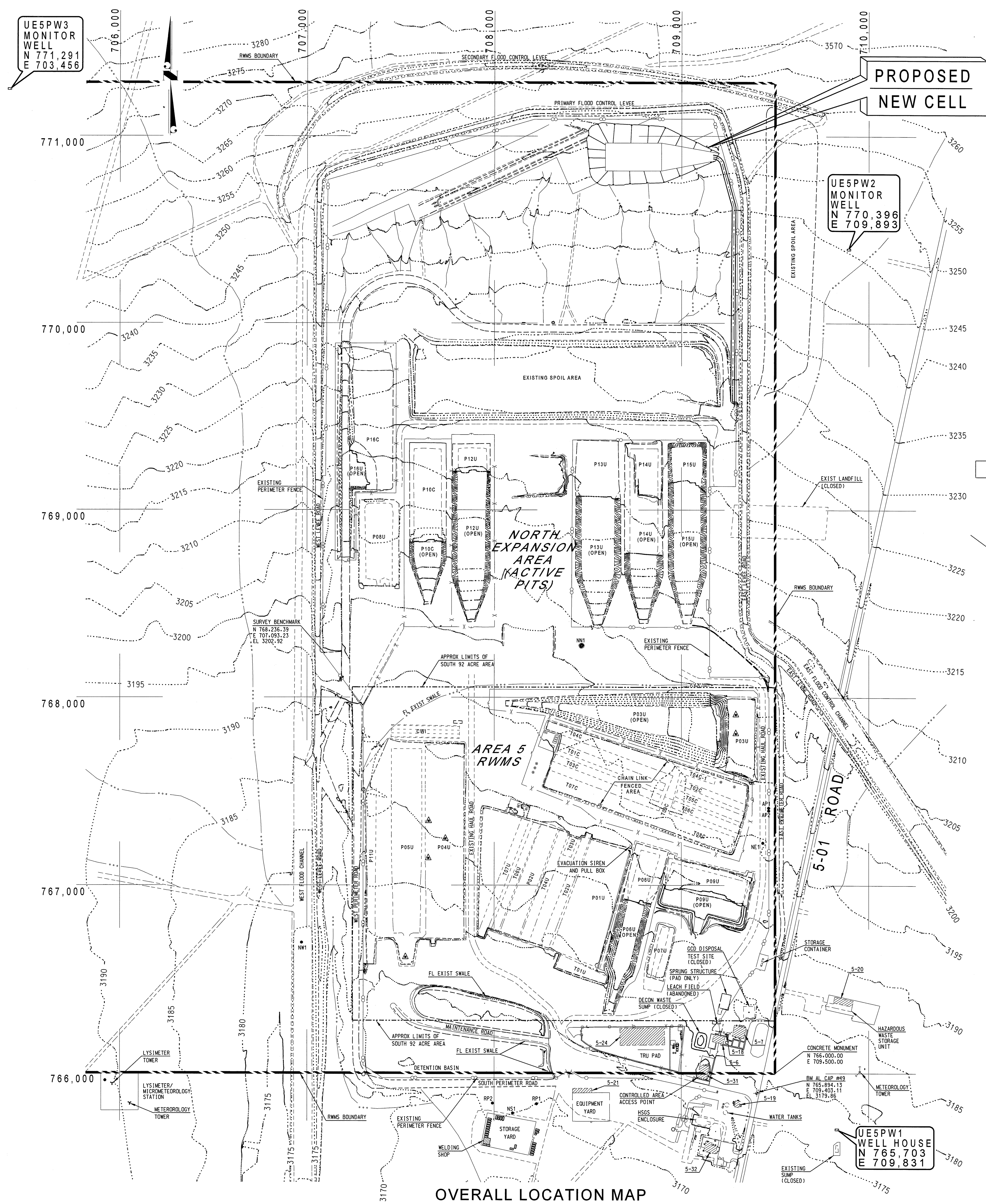
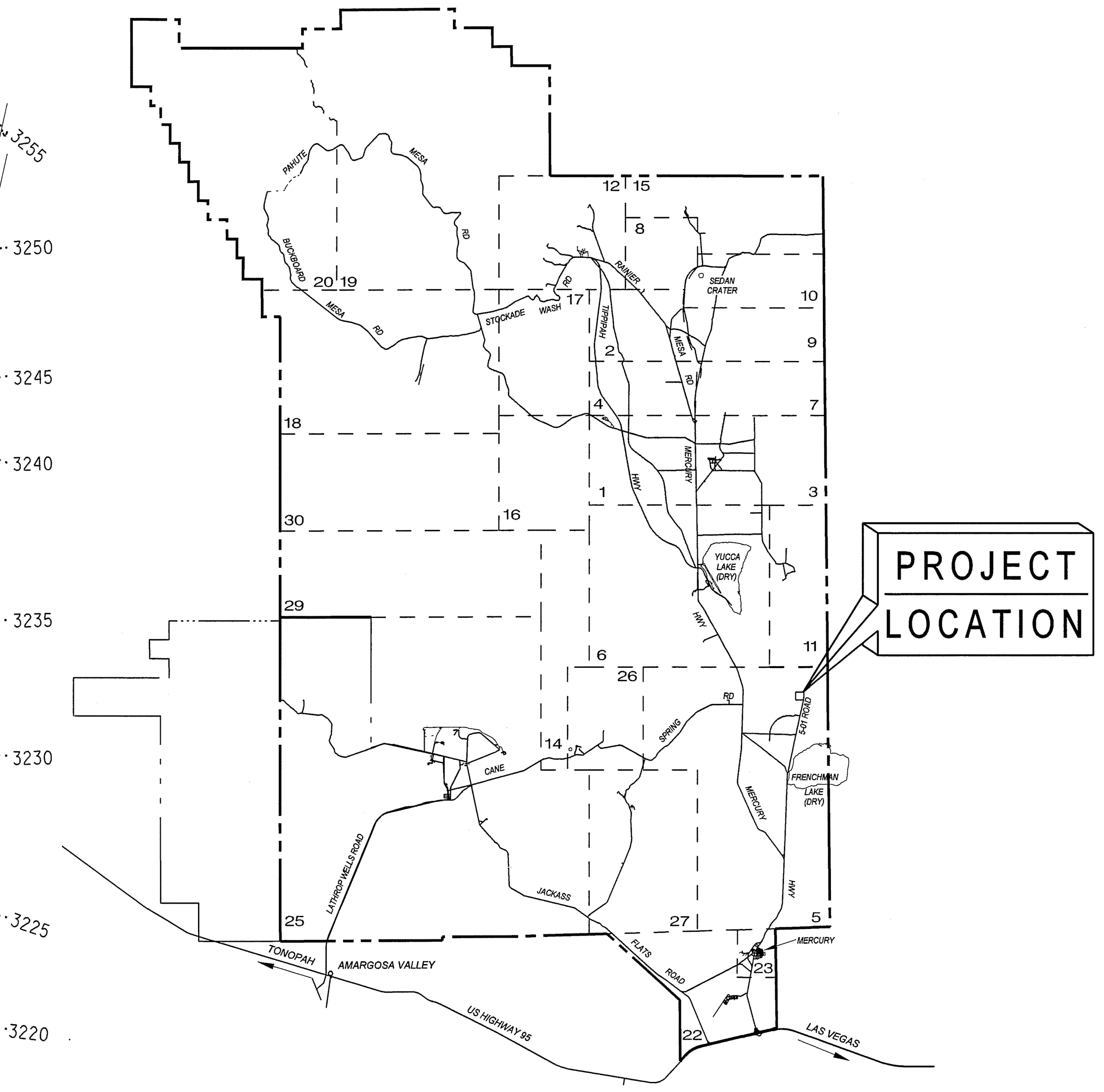
Figure 6 RWMS Overall Location Map



OVERALL LOCATION MAP

SCALE : 1" = 300'



VICINITY MAP
NEVADA TEST SITE

SCALE : NONE

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FIGURE 6

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NEVADA TEST SITE — AREA 5
RADIOACTIVE WASTE MANAGEMENT SITE
NEW DISPOSAL CELL
CONCEPTUAL DESIGN
OVERALL LOCATION MAPS

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GRAPHIC SCALE
0 300 600 900 FEET
1" = 300'
CONTOUR INTERVAL = 5 FEET

FOR REFERENCE DRAWINGS SEE 08105-G-0001

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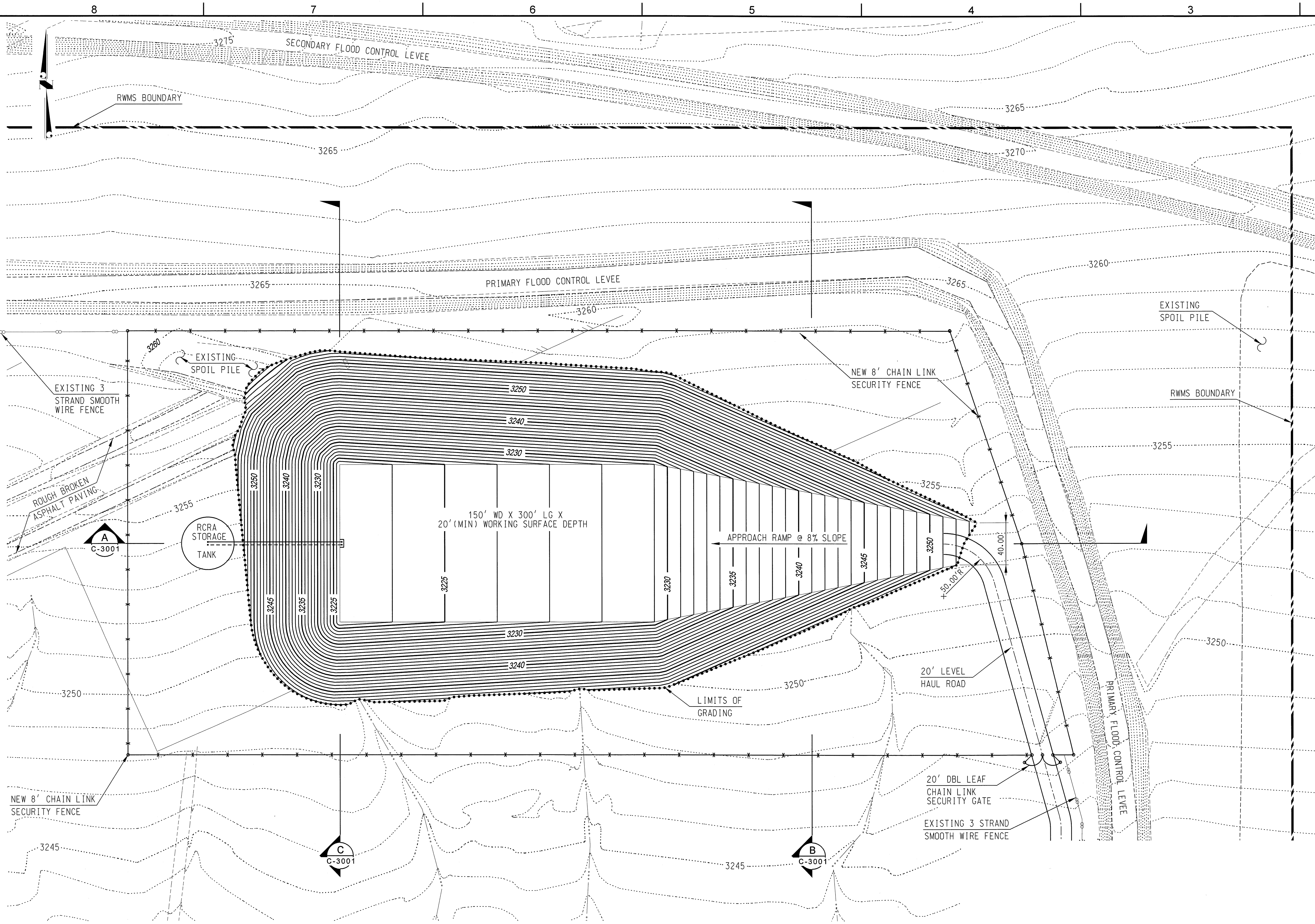
Figure 7 MWDU Conceptual Design Drawings



PROPOSED SITE PLAN

SCALE : 1" = 50'

ESTIMATED QUANTITIES		
DESCRIPTION	QTY	UNIT
CUT	110,761	CY
FILL	0	CY
NEW PIT EXCAVATION (TO WORKING SURFACE) NET	110,761	CY

1. QUANTITIES PROVIDED ARE FOR NSTec ESTIMATING PURPOSES ONLY AND DO NOT INCLUDE CUT FACTORS.
2. EXISTING SPOILS PILE QUANTITIES ARE NOT INCLUDED IN THIS ESTIMATE.
3. NEW PIT WORKING SURFACE = 2% NEW PIT SIDE SLOPES = 33%

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Date: 9-24-08

FIGURE 7

NOT FOR CONSTRUCTION

GRAPHIC SCALE

0 50 100 150 FEET

1" = 50'

CONTOUR INTERVAL = 1'

FOR REFERENCE DRAWINGS SEE 08105-G-0001

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NEVADA SITE OFFICE — LAS VEGAS, NEVADA

NEVADA TEST SITE — AREA 5

RADIOACTIVE WASTE MANAGEMENT SITE

NEW DISPOSAL CELL

CONCEPTUAL DESIGN

PROPOSED SITE PLAN

DRAWN	PREPARER	CHECKER	PROJECT ENGINEER	APPROVER / USER
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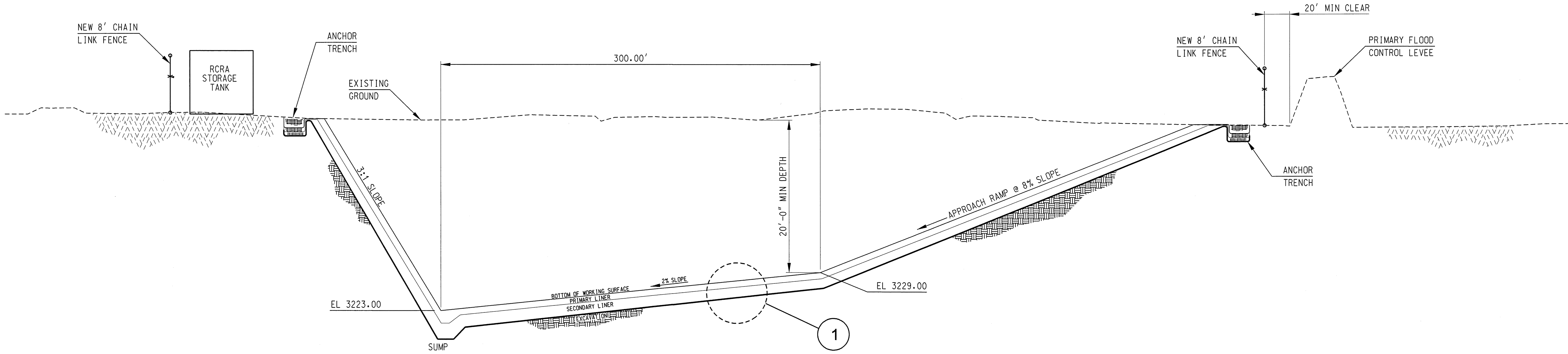
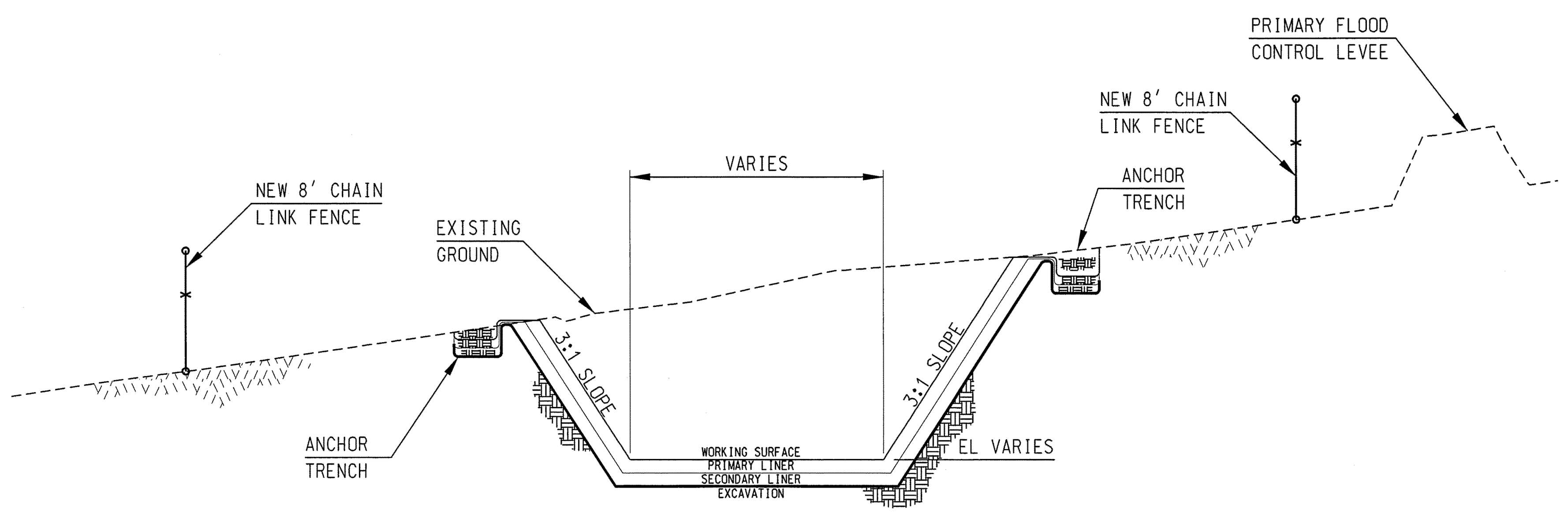
Figure 8 MWDU Conceptual Design Drawings



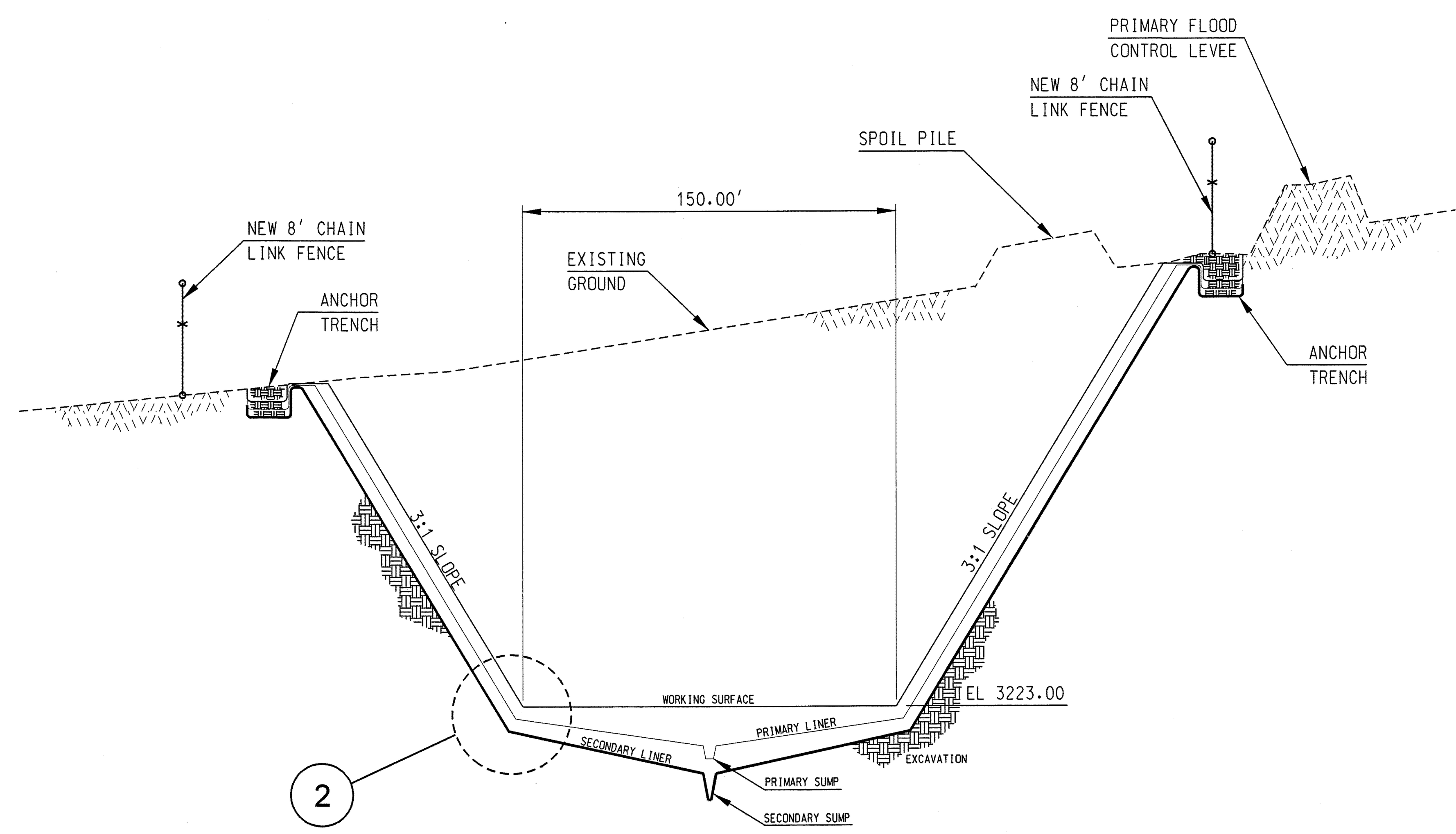
SECTION @ CL PIT (LOOKING NORTH) (A) C-1003

SCALE : 1"=50' HORIZ. - 1"=10' VERT.
NOTE: THICKNESS OF LINERS EXAGGERATED FOR CLARITY.
DRAIN PIPING FROM SUMP TO TANK NOT SHOWN FOR CLARITY.



SECTION @ RAMP (LOOKING WEST) (B) C-1003

SCALE : 1"=50' HORIZ. - 1"=10' VERT.
NOTE: THICKNESS OF LINERS EXAGGERATED FOR CLARITY



SECTION @ SUMP (LOOKING WEST) (C) C-1003

SCALE : 1"=50' HORIZ. - 1"=10' VERT.
NOTE: THICKNESS OF LINERS EXAGGERATED FOR CLARITY

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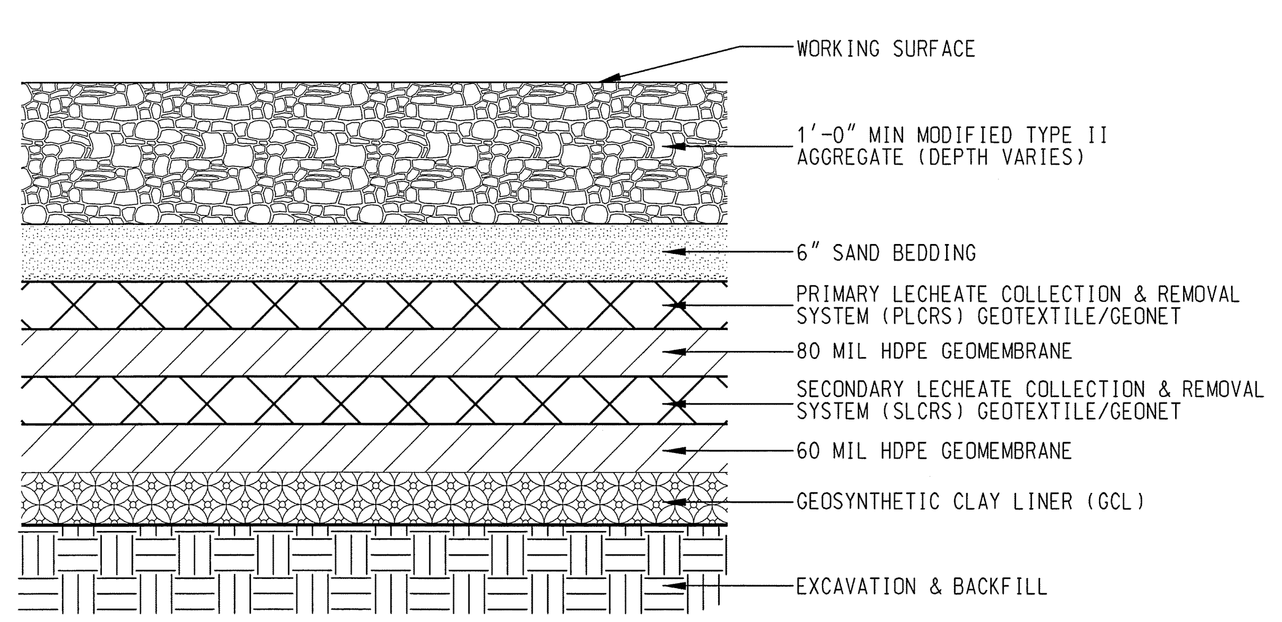
Derivative Classifier: V Sel-, NSTec
(Name/Organization)

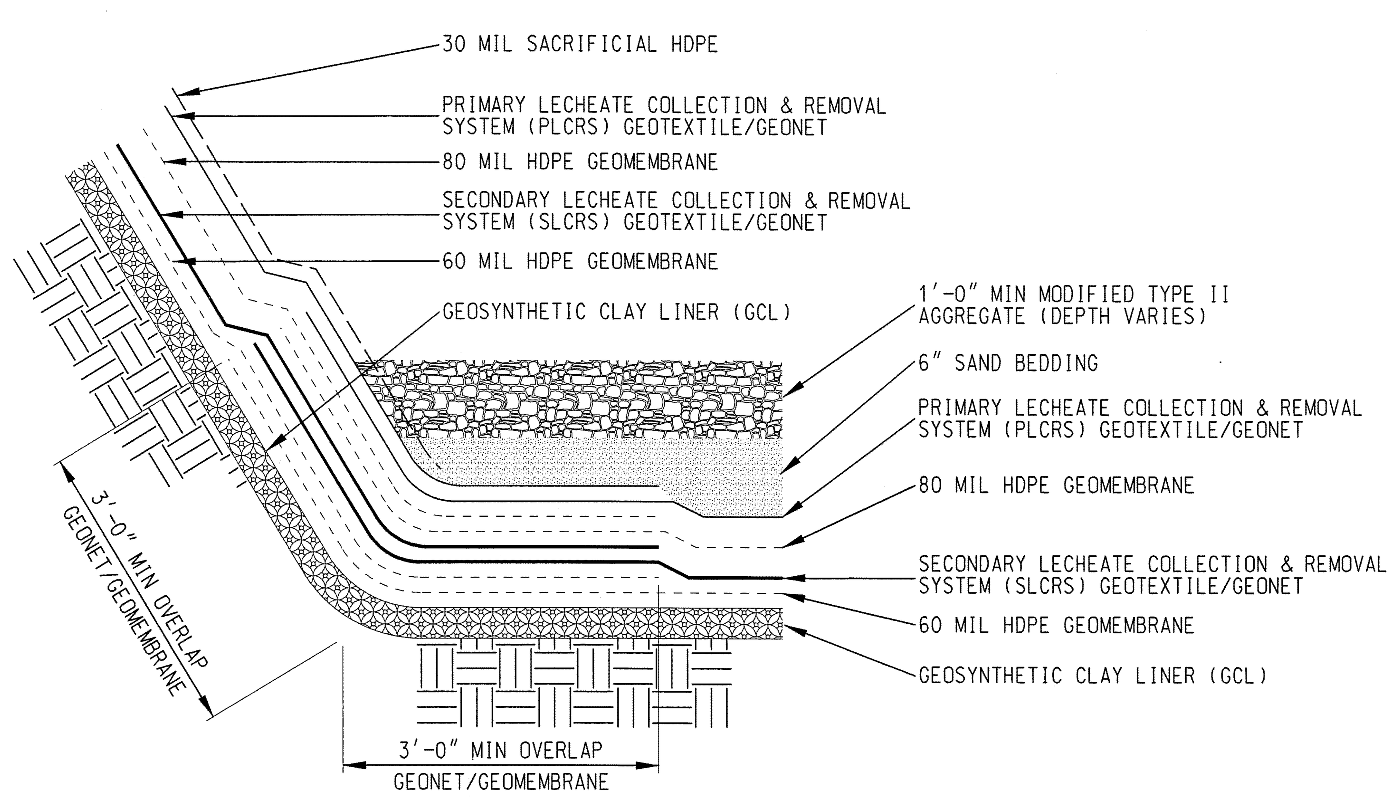
Date: 9-24-08

FIGURE 8



DETAIL (1)

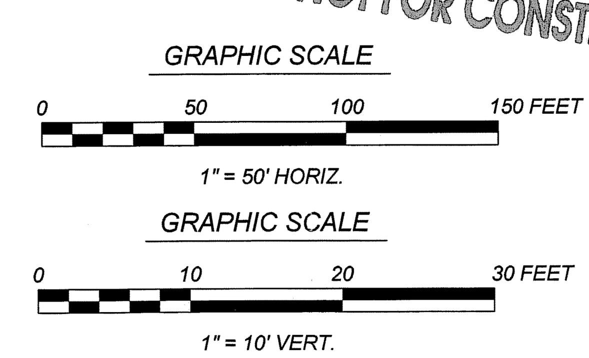
SCALE : NONE



DETAIL (2)

SCALE : NONE

NOT FOR CONSTRUCTION



FOR REFERENCE DRAWINGS SEE 08105-G-0001

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NEVADA SITE OFFICE — LAS VEGAS, NEVADA

NEVADA TEST SITE — AREA 5
RADIOACTIVE WASTE MANAGEMENT SITE
NEW DISPOSAL CELL
CONCEPTUAL DESIGN
TYPICAL SECTIONS AND DETAILS

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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)]

Table 4 provides general information on waste codes and design capacity of the proposed unit.

Table 4 General Information on Waste Codes and Design Capacity

Process Code	D80 (Landfill Disposal)
Waste Codes	D004 through D043, F001 through F009, F039, P001 through P018, P020 through P024; P026 through P032; P033, P034, P036 through P051, P054, P056 through P060, P062 through P078, P081, P082, 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 P205 U001 through U012, U014 through U039, U041 through U053, U055 through U064, U066 through U099, U101 throughU103, U105 through U138, U140 through U174, U176 through U194, U196, U197, U200 through U211, U213 through U223, U225 through U228, U234 through U240, U243, U244, U246 through U249, U271, U278, U279, U280, U328, U353, U359, U364, U367, U372, U373, U387, U389, U394, U395, U404, U409, U410, U411
Process Design Capacity	25,485 m^3 (33,333 yd^3) [Estimated]

NNSA/NSO's Low Level Mixed Waste Disposal Unit Waste Analysis Plan (WAP) (Exhibit 1) includes requirements for waste certification programs, characterization, traceability, prohibited items, waste profiling, waste form, and packaging and shipment of waste.

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

The WAP also provides detailed requirements for LLMW containers. General requirements are:

- Incompatible wastes or incompatible wastes and materials shall not be placed in the same container.
- LLMW containers of 416 L (110 gal) or less must be marked for the hazardous characteristics of the waste.
- LLMW packages must be 90 percent full.
- 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).
- Inter-modal containers that are emptied and returned to the generator are prohibited.

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

Exhibit 1 is the latest revision of the WAP. The plan provides examples of expected waste streams, waste description and sources, waste characteristics, characterization/acceptable knowledge requirements, sampling and analysis protocols, physical and chemical screening methods, prohibited waste, notification/certification requirements, and waste generator approval process.

B.3.a Wastes to be Landfilled 270.14(b)(2)]

Wastes for landfill in the MWDU contain both radioactive and hazardous materials components as defined by the Atomic Energy Act (AEA), RCRA **(40 CFR 261.24 through 261.35)**, Nevada Revised Statutes (NRS), and Nevada Administrative Code **(NAC Chapters 444 and 459)**.

LLMW streams accepted for disposal may carry only the EPA hazardous waste numbers listed in Table 4. Waste must also meet the Land Disposal Restrictions (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 technologies **[40 CFR 268.42(b)]** approved by NDEP will also be accepted.

LLMW will include waste that contains metals, solvents, organics, and listed constituents; or wastes from specific processes regulated in **40 CFR 261**. Wastes containing friable or non-friable asbestos and polychlorinated biphenyl (PCB) wastes allowed for disposal in RCRA permitted landfills will also be disposed. State only designated hazardous waste may also be received at the NTS as hazardous waste.

LLMW containing friable or non-friable asbestos will be disposed in the MWDU. LLW containing friable or non-friable asbestos may be disposed in the MWDU. For LLW containing friable asbestos that has been macro encapsulated (rendered non-friable), the requirements of **NAC 444.971** do not apply. An “asbestos cell” will not be designated within the MWDU; instead the location of asbestos wastes disposed will be documented as described in Section B.20.a.7.

Two types of LLMW containing PCBs will be disposed in the MWDU:

- Bulk PCB remediation waste at a concentration ≥50 ppm PCBs **[40 CFR 761.61(a)(5)(I)(b)(2)(iii)]**; and
- PCB bulk product waste at a concentration of ≥50 ppm or leaches PCBs at ≥10 micrograms/L **[40 CFR 761.62(a)(3)].**

Exhibit 1, Mixed Waste Disposal Unit Waste Analysis Plan

National Nuclear Security Administration
Nevada Site Office

MIXED WASTE DISPOSAL UNIT

WASTE ANALYSIS PLAN

REVISION 0

April 2009

MIXED WASTE DISPOSAL UNIT
WASTE ANALYSIS PLAN
Revision 0

MIXED WASTE DISPOSAL UNIT (MWDU)
WASTE ANALYSIS PLAN (WAP) [40 CFR 264.13 and 270.21(a)]

The Nevada Test Site (NTS) Waste Acceptance Criteria (NTSWAC) establishes the requirements generators shall meet to dispose of waste at the NTS. It includes requirements for waste certification programs, characterization, traceability, prohibited items, waste profiling, waste form, packaging and shipment of waste. The NTSWAC outlines the process requirements for generators to receive National Nuclear Security Administration Nevada Site Office (NNSA/NSO) Assistant Manager for Environmental Management (AMEM) approval to ship radioactive Low-Level Waste (LLW) and Low-Level Mixed Waste (LLMW) to the NTS. Applicable portions of this WAP are incorporated into the NTSWAC. This WAP applies to LLMW disposed in the MWDU. References are made throughout this plan to regulations promulgated by the EPA regarding waste analysis requirements for hazardous waste management facilities. These requirements are generally found in Title 40 Code of Federal Regulations (CFR) Part 264, Subpart B, and unless otherwise stated have been adopted by reference in the Nevada Administrative Code (NAC).

1.0 Waste Description and Sources

Accepted wastes will be generated from U.S. Department of Energy (DOE) and NNSA 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; macroencapsulated debris and lead, and soil. NNSA/NSO may also accept wastes treated by equivalent technologies, provided the Nevada Division of Environmental Protection (NDEP) has approved the technologies. Acceptable hazardous waste codes are provided in Table 1.

Table 1: General Information – MWDU

PROCESS CODE:	D80 (Landfill Disposal)
WASTE CODES:	D004 through D043 F001 through F009, F039 P001 through P205 U001 through U249, U271, U278, U279, U280, U328, U353, U359, U364, U367, U373, U387, U389, U394, U395, U404, U411.
Other Wastes:	PCBs, Friable Asbestos, State Regulated.

2.0 Waste Characteristics

The LLMW waste disposed in MWDU contains both radioactive and hazardous material components as defined by the Atomic Energy Act (AEA), the Resource, Conservation, and Recovery Act (RCRA), Nevada Revised Statues (NRS), and NAC. LLMW streams accepted at the MWDU for disposal may carry only the EPA hazardous waste numbers listed in Table 1 and must meet the NTSWAC. Waste must also meet the Land Disposal Restriction (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 may also be accepted. State-only designated hazardous waste may be received at the NTS as hazardous waste. Polychlorinated Biphenyls that meet the requirements for the disposal in permitted hazardous waste landfill as specified in 40 CFR Part 761 and NAC 444.9452 are also accepted.

LLMW waste received from generators will include waste containing metals, solvents, organics, and listed constituents; or waste from specific processes regulated in **40 CFR 261**.

3.0 Waste Identification Parameters

The NTS onsite generators, DOE offsite generators, and the treatment, storage, and/or disposal facilities (TSDF) sending DOE waste for disposal in the MWDU will be referred to as the "generator." The operating organization is required to test certain LLMW, depending on the type of treatment standard, to ensure that the waste or treatment residual is in compliance with applicable LDR requirements. Such testing is performed according to the frequency specified in this WAP.

Characterization data must be developed under **40 CFR Part 261**. Data may be obtained from acceptable knowledge and/or sampling and analysis.

When demonstrating that a concentration-based LDR treatment standard has been met, a representative sample of the waste shall be submitted to a laboratory accepted under Section 12.4 for analysis. This sample shall be taken by the generator and is required to demonstrate compliance with the LDR treatment standards contained in **40 CFR 268.40**. When demonstrating that a treatment technology standard has been met, a LDR certification shall be submitted.

4.0 Waste Form and Containers

4.1 Prohibited Waste forms

a. RCRA D, F, P, K, or U waste numbers other than those listed in Table 1.
b. Wastes which contain only a hazardous component.
c. Non LDR (40 CFR part 268) compliant waste.
d. Pathogens, infectious wastes, or other etiologic agents.
e. Compressed gases - aerosol cans must be punctured and valve mechanisms removed from expended gas cylinders.
f. 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.
g. Non – biodegradable sorbents - Examples of nonbiodegradable sorbents are found in 40 CFR 264.314[e].
h. PCBs requiring disposal in chemical waste landfills.
i. Chelating or complexing agents in amounts greater than 1% of the waste - unless stabilized or solidified.

4.2 LLMW Containers

Containers must meet the following requirements:

a. Incompatible wastes, or incompatible wastes and materials shall not be placed in the same container if such placement:
   (1) Generates extreme heat or pressure, fire or explosion, or violent reaction;
   (2) Produces uncontrolled toxic mists, fumes, dusts, or gases in sufficient quantities to threaten human health;
   (3) Produces uncontrolled flammable fumes or gases in sufficient quantities to pose a risk of fire or explosions; or
   (4) Damages the structural integrity of the device containing the waste.
b. LLMW containers of 416 liters (110 gallons) or less must be marked for the hazardous characteristics of the waste. Containers must be marked with the following:
   (1) 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";
   (2) Generator's Name and Address; and
   (3) Manifest Document Number.
c. LLMW container marking must be:
   (1) Durable;
   (2) In English;
   (3) Printed on or affixed to the surface of a package or on a label, tag, or sign;
   (4) Displayed on a background of sharply contrasting color;
   (5) Unobscured by other labels or attachments; and
   (6) Located away from any marking that could substantially reduce its effectiveness.
d. LLMW packages must be at least 90 percent full (40 CFR 264.315[a]).
e. A TID may be employed on packages that are inspected off site 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).
f. Intermodal containers that are emptied and returned to the generator are prohibited.

5.0 LDR Notification and Certification

40 CFR 268.7(a) requires each generator 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 NTS. 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 MWDU, generators are required to submit all information, notifications, and certifications described in 40 CFR 268.7 to the operating organization. If the waste changes, the generator must send a new notice and certification to the operating organization.

6.0 Waste Profile and Data Quality Assurance Process

Characterization data must be sufficient to verify compliance with the WAC, ensure safe management, identify UHCs, and verify waste meets LDR treatment standards prior to disposal. The waste profile shall provide a clear picture of the waste's radiological, physical, and chemical characteristics; its regulatory classification; and packaging. Generator-supplied data are the primary means by which NNSA/NSO 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. TCLP) to use when performing hazardous waste determinations and identifying UHCs.

Generators' waste characterization data must be based on samples collected using methods specified in EPA SW-846 or other equivalent methods.

6.1 General Waste Profile Requirements

a. Waste profiles will be submitted to NNSA/NSO for review and approval.
b. 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.
c. Waste profiles shall have annual expiration dates if not recertified by the generator.
d. Generators shall notify NNSA/NSO in writing when terminating an approved waste profile.

6.2 Specific Waste Profile Requirements

The following information shall be included:

a. EPA waste codes
b. Applicable state waste codes
c. Identification of sorbent(s) used and certification of the use of nonbiodegradable sorbents
d. Chemical, physical, radiological, and general characteristics and properties
e. Compliance with WAC items prohibitions
f. Container type, size, weight, dose rate, and approximate number
g. Demonstration of compliance with LDR standards including compliance with Universal Treatment Standards, if applicable
h. Supplemental attachments consisting of container drawings, process flow information, analytical data, etc., if necessary.
i. Visual inspection forms; analytical results or log books; and/or procedures or treatability tests results, as necessary.

7.0 Pre-Acceptance Approval Process

The NTSWAC establishes the requirements generators shall meet to dispose of waste at the NTS. It includes requirements for waste certification programs, characterization, traceability, prohibited items, waste profiling, waste form, packaging and shipment of waste. The NTSWAC outlines the process requirements for generators to receive AMEM approval to ship radioactive LLW and LLMW to the NTS. Applicable portions of this WAP are incorporated into the NTSWAC. Approval flow diagrams are provided in Exhibit 1.

The NTSWAC establishes a facility evaluation system (audit and surveillance) to approve the generator's shipment of waste to the NTS. These evaluations, conducted by the operating organization, include rigorous attention to the characterization, certification, and 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 identifying the root cause, corrective actions, and actions to preclude re-occurrence. The generator is not approved until all CARs are closed.

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

7.1 Generator Approval Process

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

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 2) will be 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 will be submitted for post-treatment final waste forms. For waste already treated, the generator will submit the waste profile. The notification and/or waste profile is submitted to NNSA/NSO 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 are used for waste from offsite generators, and onsite waste manifest forms are used 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.

7.2 Notification Review

If treatment is required but has yet to occur, the operating organization will review the notification form, determine the physical screening frequency (section 7.4), and schedule offsite verification activities with the generator. See Exhibit 2 for an example of a notification review form.

7.3 Waste Profile Review

The operating organization will review 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 will demonstrate that the waste meets the WAC 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 (see Exhibit 3 for an example of a Waste Stream Recommendation Form).

The operating organization will evaluate 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 will be determined.

Generators who submitted a notification form will include any verification activity documentation with the waste profile. This information will be reviewed for final approval of the waste profile. After approval, generators can schedule waste shipments.

7.4 Screening Frequency

The screening frequency is determined by the operating organization using the following process.

a. Review of the generator waste profile information 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:
    (1) documented waste management program
    (2) waste stream characterization information
    (3) potential for inappropriate segregation
    (4) waste type and packaging.
b. Establishment of the physical screening frequency for the waste stream:
    (1) The physical screening minimum is five percent of the waste stream

7.5 Screening Options

The following are the screening options available:

a. offsite (at generator or treatment facility) visual inspection
b. offsite chemical screening
c. offsite or onsite (NTS) review of photographs, videos, RTR images, and/or RTR recordings of treatment
d. onsite RTR
e. onsite visual inspection of container exterior (performed 100%)

8.0 Physical and Chemical Screening

Verification activities are performed as required in 40 CFR 264.13[c]. The activities include container receipt inspection and could also include physical screening 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. Any 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 RWMS, tamper-indicating devices (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 and waste content. Written procedures are maintained detailing 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.

8.1 Physical Screening

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

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.

8.1.2 Physical Screening Exceptions

a. Waste that cannot be physically screened at the Area 5 RWMS may be visually inspected at the generator location (e.g., classified LLMW, large components, remote-handled containers that cannot be opened, will not fit in RTR).
b. A 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 any historical analytical data for acceptability.

8.1.3 Physical Screening Methods

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

a. Visual inspection
b. RTR

8.1.4 Physical Screening QC

Physical screening QC is used to ensure 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.

8.1.5 Physical Screening Parameters

The following methods are approved for use.

8.1.5.1 Visual Inspection

<u>Rationale</u>: Because the NTS 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.

<u>Method</u>: 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, digital images, etc. of the treatment and packaging process to ensure compliance.

<u>Failure Criteria</u>: 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); and (4) void space greater than 10 percent.

8.1.5.2 Real-Time-Radiography

<u>Rationale</u>: 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.

<u>Method</u>: 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.

<u>Failure Criteria</u>: A container fails inspection criteria for any of the following reasons: (1) undocumented or improperly packaged waste, (2) discovery of prohibited articles as

identified in the NTSWAC and section 4.1 of this document, (3) image data inconsistent with the waste profile or shipment documentation; and (4) void space greater than 10 percent.

8.2 Chemical Screening

Chemical screening will be performed before the waste is shipped to the Area 5 RWMS. The operating organization will determine 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.

8.2.1 Chemical Screening Frequency

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

8.2.2 Chemical Screening Exceptions

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

a. Waste subject to a technology based treatment standard.
b. Chemical containing equipment removed from service (e.g., ballasts, batteries).
c. Waste containing regulated asbestos.
d. Waste containing beryllium
e. Waste, environmental media, and/or debris from the cleanup of spills or release of single substance or commercial product or otherwise known material (e.g., material for which a material safety data sheet can be provided).
f. Confirmed noninfectious waste (e.g., xylene, acetone, ethyl alcohol, isopropyl alcohol) generated from laboratory tissue preparation, slide staining, or fixing processes.
g. Hazardous debris.
h. Package is greater than 100 mrem/hr at 30 cm

8.2.3 Chemical Screening Sampling

The chemical screening methods do not require any 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 2 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.

8.2.4 Chemical Screening QC

The following QC elements are used when performing chemical screening.

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

8.2.5 Chemical Screening Parameters

The following methods are approved for use in performing chemical screening.

8.2.5.1 pH Screen

Rationale: To identify the pH and corrosive nature of waste and to confirm consistency with the shipment documentation.

Method: Full-range pH paper is used for the initial screening. If the initial screen indicates a pH below 4 or above 10, a pH meter could be used, or a narrow-range pH paper. 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.

8.2.5.2 Peroxide Screening

Rationale: To determine the presence of organic peroxides in solvent waste, to alert personnel to potential hazards, and to confirm consistency with the shipment documentation. The test is sensitive to low parts per million (ppm).

Method: Solids are tested by first wetting the test strip with water and contacting a small sample of the waste. A color change indicates a positive reaction. The color change can be 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.

8.2.5.3 Paint Filter Test

Rationale: To verify 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 five 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 in waste matrices constitutes failure of the container. Exceptions: small quantities of condensate trapped in inner plastic liner folds are acceptable.

8.2.5.4 Oxidizer Screen

Rationale: To determine if a waste exhibits oxidizing properties and to confirm 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 manufacturer's suggested method.

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

8.2.5.5 Water Reactivity Screen

Rationale: To determine 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 screen is performed in accordance with written procedures or manufacturer's suggested method

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

8.2.5.6 Cyanide Screen

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

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

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

8.2.5.7 Sulfide Screen

Rationale: To indicate 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 screen is performed in accordance with written procedures or manufacturer's suggested method.

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

9.0 Preshipment Authorization Process for Approved Wastes

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

a. Container identification number
b. Profile number
c. Waste description
d. Generator information (e.g., name, address, point of contact, telephone number)
e. Container information (e.g., type, size, weight)
f. EPA waste codes
g. Waste composition
h. Packaging materials and quantities
i. Applicable treatment standard/technology.

Where potential conformance issues exist in the information provided (i.e., waste characteristics do not match the waste profile information, WAC, or additional constituents are expected to be present that do not appear on the documentation), the generator is contacted and the issue addressed. Container data are compared to the 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.

9.1 Paperwork Review.

Every shipment is reviewed to ensure that the waste meets the WAC. If the shipment information is verified to be acceptable, the operating organization determines if any of the waste containers are required to be RTR'd.

9.2 Visual inspection and Chemical Screening Documentation Review.

For those waste streams that underwent verification at the generator's or TSDFs site, the verification documentation will be reviewed for completeness.

9.3 RTR Container Selection.

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

10.0 Waste Acceptance and Verification Procedures Upon Arrival of Shipment

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

10.1 RWMS Paperwork Review

<u>Rationale</u>: Each shipment's paperwork is reviewed for completeness.

Method: The shipment is documented on a shipping/receiver log upon arrival at the Area 5 RWMS. 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, the original package storage and disposal request, and the 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.

10.2 Area 5 RWMS Visual Examination

Rationale: Each container in the shipment is inspected in its entirety for possible damage or 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 the container is off-loaded, markings, and labels are inspected and compared with the 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) incorrect container numbers, (3) incorrect marking or labeling, (4) missing marking or labeling, (5) broken or missing TID, and/or (6) discrepancy in TID number.

10.3 Area 5 RWMS RTR Examination

See Section 8.1.5.2 for the rationale, method, and failure criteria for the RTR.

11.0 Manifest Tracking and Record Keeping

The generator will contact the operating organization, prior to shipment of waste to arrange for waste verification and shipment. The generator will be responsible for the identification and tracking of the waste shipment. Upon receipt of waste, each shipment will be screened according to the above sections. Once a shipment is accepted, the manifest will be:

a. Signed and dated on each copy to certify that the LLMW covered by the manifest was received;
b. Any significant discrepancies noted on each copy;
c. One signed copy given to the transporter;
d. Within 30 days of delivery, a copy will be sent to the generator; and
e. Will be retained at the facility for at least three years from date of delivery.

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

a. The RWMS will maintain the waste profile, supporting documentation, shipping documentation, and any associated QA/QC data.

b. Errors and omissions (e.g., transcription errors, typographical errors, errors in calculations) shall be corrected as information becomes available. These corrections shall be in ink and initialed and dated by the person making the correction.
c. Documentation from sampling events.

12.0 Sampling and Analysis

LLMW must be sampled and analyzed by the test methods specified in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (EPA Publication SW-846 [SW-846]) or approved equivalent methods. Analysis must be performed by an accepted laboratory as discussed in Section 12.4. The recommended sampling devices, EPA methods, parameters, and rationale for parameter selection for characterization and LDR requirements are identified in Tables 2 and 3.

Compliance with LDR [40 CFR 268.40] for wastes that have a treatment standard expressed as constituent concentrations in wastes can be shown using any appropriate method. If the waste treatment standard is expressed as constituent concentrations in waste extracts, then the Toxicity Characteristic Leaching Procedure (TCLP), must be performed.

For other parameters or methods not otherwise specified, the following are acceptable sources of testing methods (standard methods):
a. The most recently promulgated version of EPA SW-846.
b. Other current EPA methods, as applicable to the matrix under evaluation.
c. Standard Methods for the Examination of Water and Wastewater, American Public Health Association (APHA), American Water Works Association, Water Environment Federation.
d. Annual Book of ASTM Standards, American Society for Testing and Materials.
e. AOAC Official Methods of Analysis, AOAC (Association of Official Analytical Chemists), International.

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.

Table 2: Sampling Devices

Material	Equipment
Liquid	Coliwasa, Dipper, Weighted Bottle
Soil and Soil-like Material	Thief, Trier, Scoops, Shovels, Auger, Veihmeyer Soil Sampler

Table 3: EPA Methods, Parameters, and Rationale for Parameter Selection

EPA Method[1]	**Parameter**	**Rationale for Parameter Selection**
9040, 9041, or 9045	PH	To assign hazardous waste number and identify prohibited waste.
ASTM D 93-79, D 93-80, D 3278-78, or 1030	Ignitability	To assign hazardous waste number and identify prohibited waste.
9014, 9034	Reactivity	To assign hazardous waste number and identify prohibited waste.
9095	Free liquids	To assign hazardous waste number and identify prohibited waste.
1311[2]	Toxicity characteristic leaching procedure (TCLP)	To assign hazardous waste numbers and verify compliance with LDR treatment standards.
2540C	Total Suspended Solids	To determine whether LDR wastewater or non-wastewater treatment standards apply.
6010, 6020, or 7000 series	TCLP metals analysis	To assign hazardous waste numbers and verify compliance with LDR treatment standards.
8000 series	Volatiles analysis	To assign TC hazardous waste numbers and verify compliance with LDR treatment standards.
8000 series	Semi volatiles analysis	To assign TC hazardous waste numbers and verify compliance with LDR treatment standards.
8000 series	Halogenated organic compounds (HOCs)[3]	To verify applicability of LDR requirements of soil.
8082	Polychlorinated biphenyls (PCBs)	To identify prohibited items, meet Toxic Substances Control Act (TSCA) requirements 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 listed in this column.
[2] An alternative to performing Method 1311 is to perform total contaminant concentration analysis and assume all contaminants to be leachable using the Toxicity Characteristic Leachate Procedure (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 mg/kg in order to determine whether a TCLP limit has the possibility of being exceeded.
[3] As specified in 40 CFR 268.2(a) and Appendix III to 40 CFR 268.

12.1. Sampling Equipment and Preservation

Table 2 contains waste forms and sample equipment used to sample referenced waste. Sample preservation follows EPA SW 846 protocol.

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 (refer to 12.4). The operating organization will determine the proper sampling protocol (simple random, stratified simple random, etc) for the grab sample(s) based on the waste type and form. Table 3 illustrates the EPA methods, parameters, and the rationale for parameter selection.

Sampling typically includes the following:

a. Obtain a unique sample identification number and complete the sample tag before sampling.
b. Obtain a precleaned sampling device and sample bottles.
c. For sampling liquid waste, a Coliwasa sampler or pipette is used to sample for two-phase liquids. Homogeneous liquids in small containers are poured into a sample bottle.
d. For sampling solid waste, a scoop, trier, or hand auger is used to obtain a sample of the waste. For large containers of waste, composite several augers or scoops to ensure samples are representative.
e. Exterior surfaces of the sample bottles are wiped clean.
f. Attach sample label to sample bottles.
g. Complete the chain of custody forms.
h. 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.
i. Seal and mark the receptacle.
j. Transfer receptacle to the analytical laboratory as appropriate to meet sample holding times.
k. Properly clean and decontaminate nondisposable sampling equipment or package for return to central sampling equipment decontamination area according to onsite requirements.

12.3 Establishing QA and QC Procedures for Sampling

The operating organization maintains compliance with DOE Order 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, copy of the chain of custody form, 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. These log entries are made while sampling is performed. The logs or copies of logs are maintained by appropriate personnel after completion of sampling activities. A chain of custody record 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:

a. Sampling methods as defined by EPA SW 846, Chapter 9
b. Appropriate sample containers and equipment for specific waste streams
c. Samples numbered and labeled
d. Traceable labeling system
e. Field QA/QC samples
f. Equipment calibration
g. Chain of custody.

12.4 Laboratories and Treatment Facilities

The DOE Consolidated Accreditation Program (DOECAP) provides audits of commercial mixed waste 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 (ISO 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:

a. Industrial and Chemical Safety
b. Environmental Compliance/Permitting
c. Quality Assurance Management Systems
d. Radiological Control
e. Transportation Management
f. Sampling and Analytical Data Quality
g. 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 the following documentation: copies of the QA/QC documents, records of surveillances/inspections, audits, nonconformances, and corrective actions.

12.5 Evaluation of Analytical Results

The 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:

<u>Precision</u>. The overall precision is the agreement between the collected samples (duplicates) for the same parameters, at the same location, 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, 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 the 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 is found to be insufficient the operating organization may require: re-analysis, data validation and/or re-sampling.

13.0 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:

a. Mass balance from a controlled process that has a specified input and output
b. Material safety data sheet on chemical products
c. Test data from a surrogate sample
d. 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:

a. Interview information
b. Logbooks
c. Procurement records
d. Qualified analytical data
e. Radiation work package
f. Procedures and/or methods
g. Process flow charts
h. Inventory sheets
i. Vendor information
j. Mass balance from an uncontrolled process (e.g., spill cleanup)
k. Mass balance from a process with variable inputs and outputs (e.g., washing/cleaning methods).

Acceptable knowledge may be used for determining:

a. Hazardous waste constituents
b. Wastes that are listed under 40 CFR 261.31, 261.32, and 261.33
c. UHCs
d. Necessary confirmatory sampling
e. 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 the regulations and waste acceptance criteria (WAC), 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 1, and the NTSWAC.

14.0 Issue Resolution

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

a. The operating organization compiles all information concerning the possible conformance issue(s).
b. 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) identified, no further action is required.
c. The operating organization and the generator discuss the conformance issue and identify the appropriate course of action to resolve the container/shipment in question;
d. 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 non-conformance, (5) increase physical screening frequencies, (6) ensure issue is included during the next scheduled generator facility evaluation, (7) schedule a facility evaluation, (8) return waste container and/or shipment to a generator specified facility.
e. On the issuance of a CAR, the operating organization requests the generator to provide a corrective action plan (CAP) that clearly states the reason for the failure and describes the actions to be completed to prevent reoccurrence.
f. The operating organization reviews the CAP for adequacy.
g. Issues and their corresponding resolutions will be recorded and tracked by the operating organization.
h. On resolution of the initial conformance issue, the operating organization requests the generator to provide a corrective action plan (CAP) that clearly states the reason for the failure and describes the actions to be completed to prevent reoccurrence.
i. The generator may request a reduction in verification of unaffected waste streams. This request must be accompanied by a justification that identifies why this waste stream(s) would not exhibit the same conformance issue.
j. 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.

15.0 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.

16.0 Frequency of Analysis

16.1 Facility Evaluations

Generators are evaluated according to the NTSWAC. CARs may be issued for quality affecting problems. These 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), the NNSA/NSO may:

a. Allow continued shipment of all approved waste streams.
b. Suspend one or more waste streams from shipments,
c. Suspend the entire waste shipment program.

16.2 Waste Profiles

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

a. Requested by the operating organization due to insufficient data,
b. After one year (365 days) from waste profile approval (see Exhibit 4),
c. The generating process has changed,
d. On submission of a waste profile revision regarding characterization changes (if revision is submitted within one year of previous evaluation),
e. 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 is re-reviewed.

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

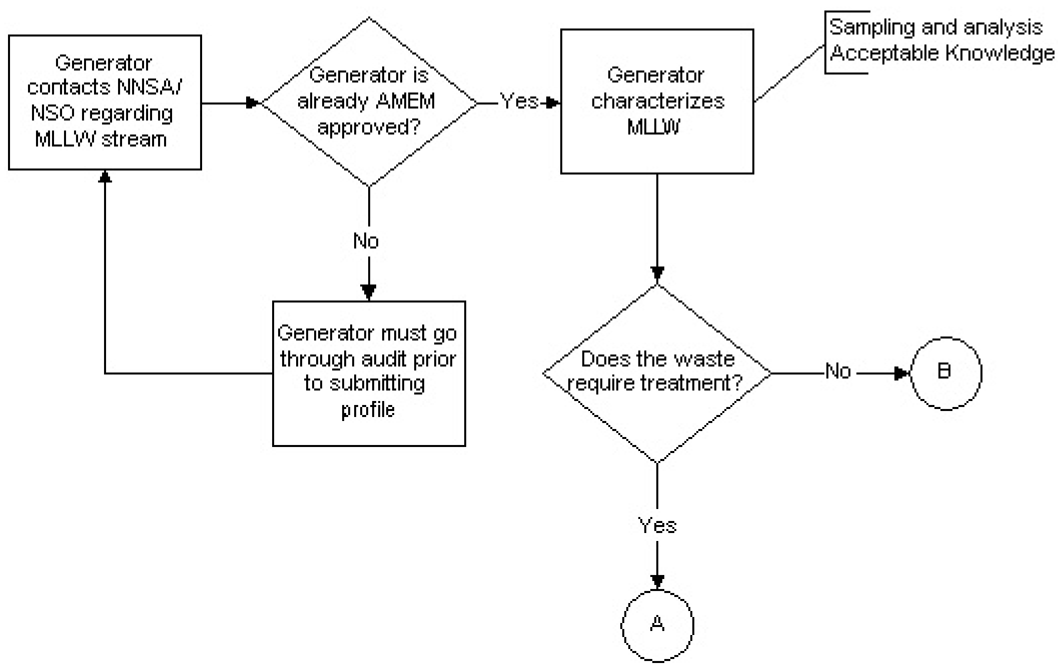
a. Verify that the current waste profile is accurate
b. Supply a new waste profile
c. Submit a sample for analysis
d. Cancel the waste profile.

Exhibit 1

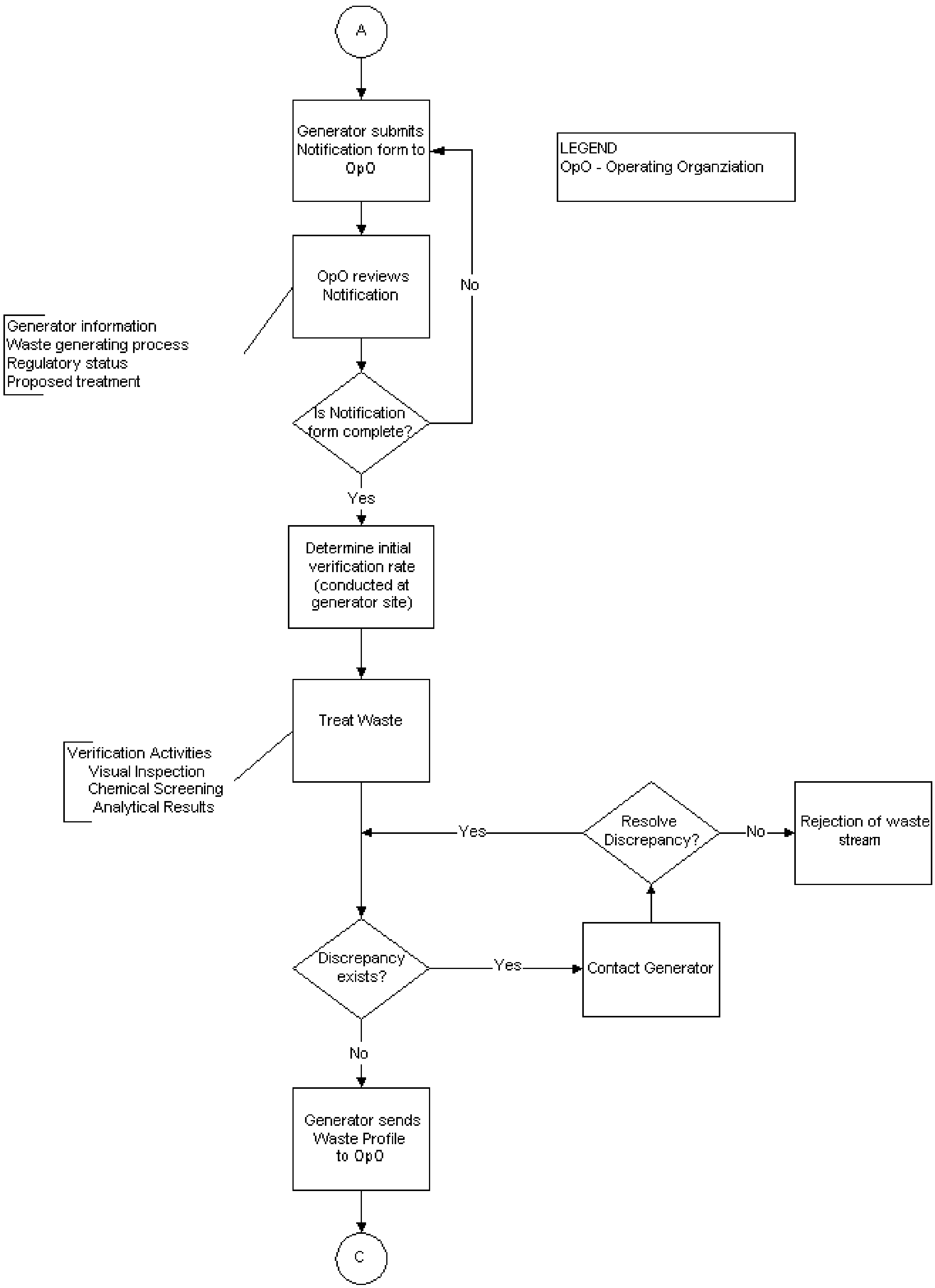
Process Flow Diagrams

WASTE GENERATOR APPROVAL

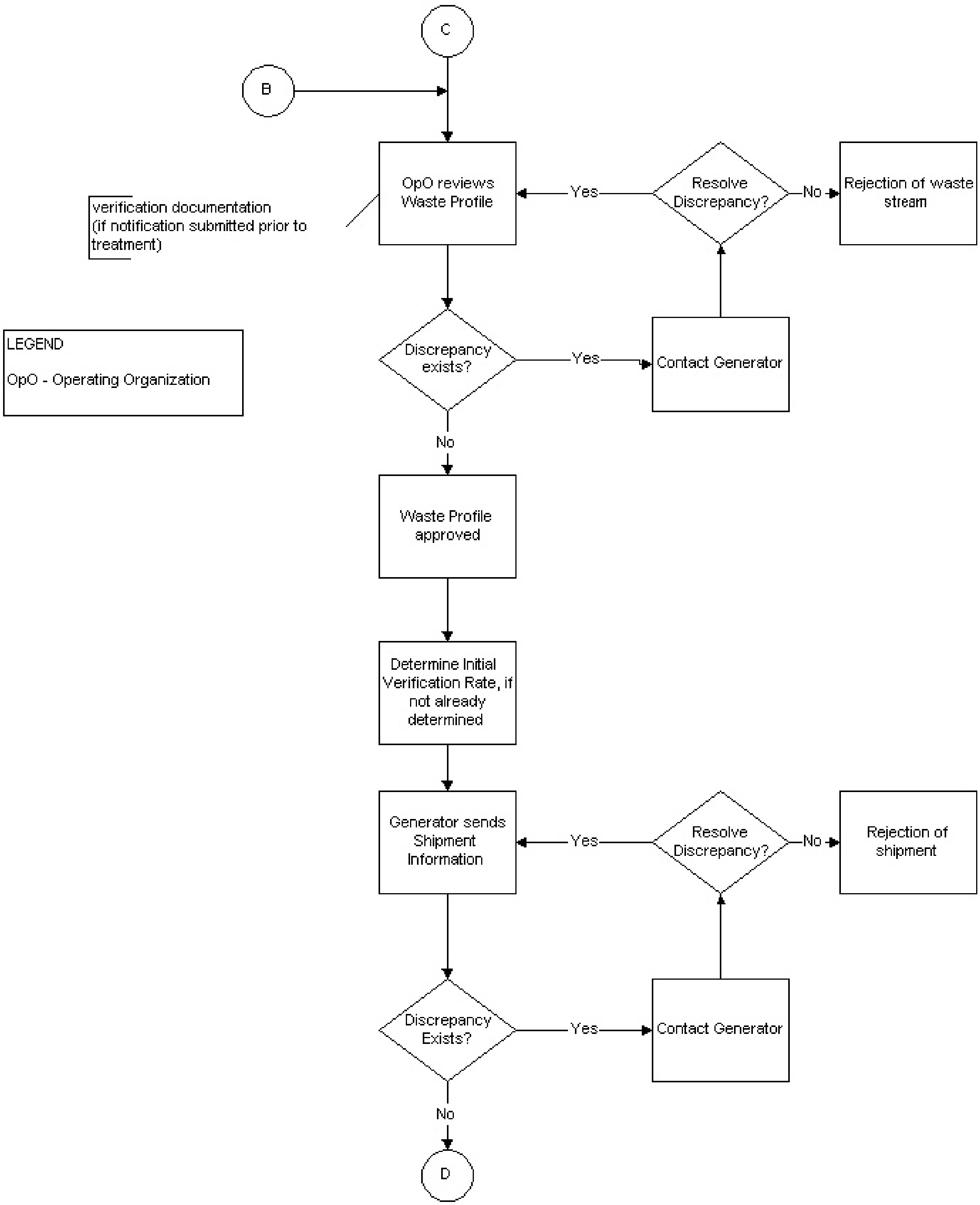
AMEM - Assistant Manager Environmental Management
NNSA/NSO - National Nuclear Security Administration Nevada Site Office
MLLW - Mixed low-level radioactive waste



PRE-TREATMENT NOTIFICATION



POST TREATMENT PROFILE



SHIPMENT VERIFICATION

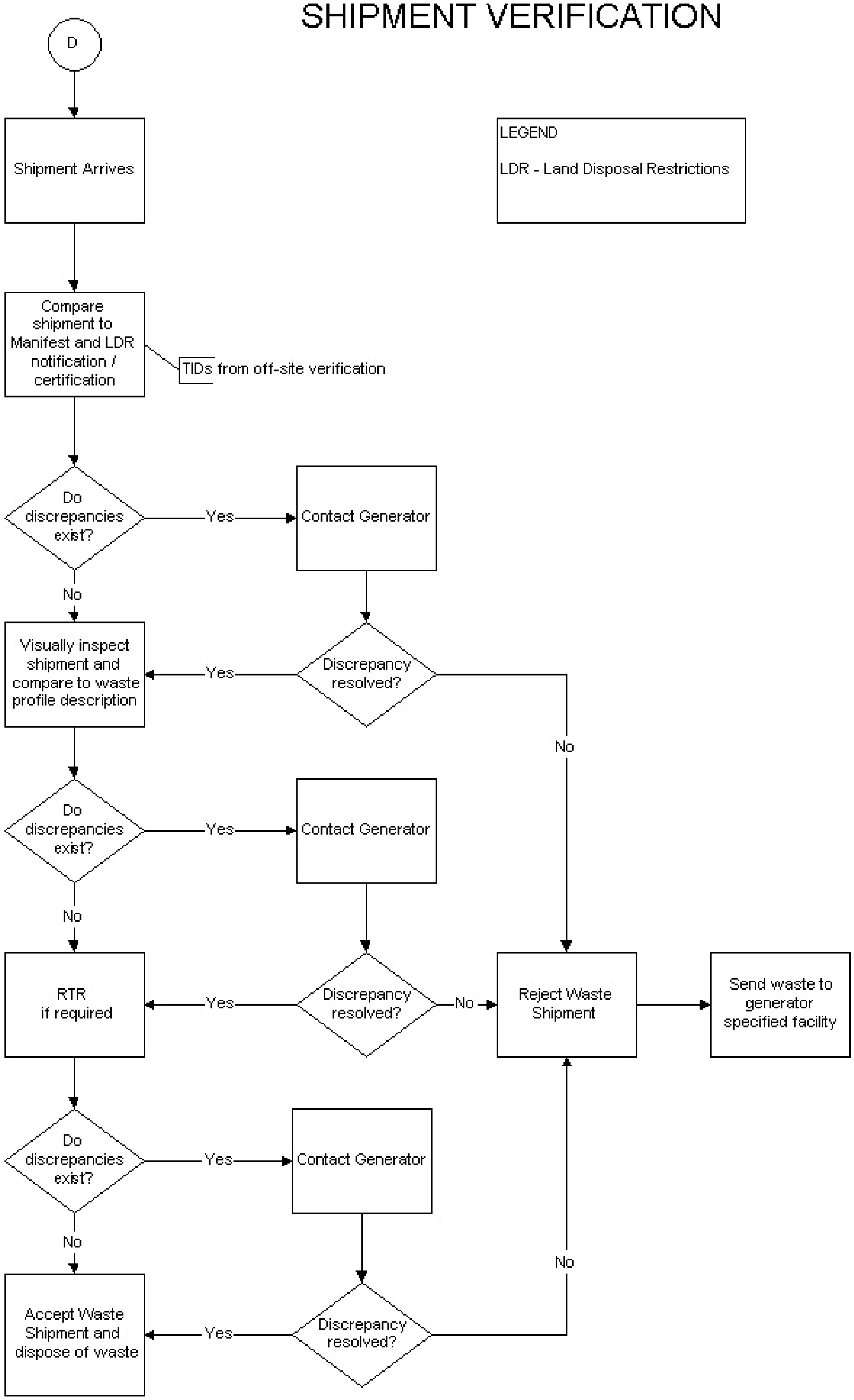


Exhibit 2

NTS Pre-Treatment Notification Form for Mixed Waste Example

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:

7. 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 3

Waste Stream Recommendation Example

Waste Stream Recommendation Example

General Information:

Generator Facility: ______________________________

Waste Stream Title: ______________________________

Waste Profile No./Rev.: ______________________________

Summary Review: ☐ **Limited**

Recommendation:

☐ Approved – NTS and Hanford ☐ Reject

☐ Approved – NTS ONLY ☐ Approved – HANFORD ONLY ☐ Conditional Approval

☐ Low-Level Waste Subject to Physical Verification
☐ RTR ☐ Visual

☐ Mixed Low-Level Waste Subject to Physical Verification (minimum 5% required).
Estimated number of mixed waste containers: _____

☐ RTR ☐ Visual Verification Frequency: ☐ Five Percent ☐ Other: _____ Percent

☐ Mixed Low-Level Waste Subject to Chemical Screening (requires minimum 10% of physically inspected containers)
Verification Frequency: ☐ Ten Percent ☐ Other: _____ Percent ☐ Exempt

☐ Special Instructions (See Summary or Waste Profile)

WARP Participants:

RWAP Task Manager	Signature	Organization	Date
WARP Lead	Signature	Organization	Date
Disposal Operations Representative	Signature	Organization	Date
Performance Assessment Representative	Signature	Organization	Date
Criticality Safety Review, SME	Signature	Organization	Date
Hanford Representative	Signature	Organization	Date
Review Lead	Signature	Organization	Date

Exhibit 4

Mixed Waste Profile Annual Certification Example

Mixed Waste Profile Annual Certification Example

Waste Profile Number:

Waste Profile Revision No.: Expiration Date:

Facility: WCO:

The above Mixed Waste Profile (MWP) is about to expire. The NTSWAC requires generators to recertify MWPs 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 waste 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/NSO WMP. Upon approval, a letter will be sent which authorizes continued shipment of the waste stream for up to an additional year.

Check 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 NTS 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 NTSWAC.

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 waste 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 NTS?
☐ No	☐ Yes	Do you have any new waste analysis data that confirms or improves your waste characterization?

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: ______________________________________

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

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

In addition to its remote location, NNSA/NSO maintains a contractor security force of highly trained security personnel who are present at the NTS 24 hours a day, 7 days a week, including holidays. These personnel monitor entry to and exit from the NTS and provide security measures throughout the NTS. The size and location of the NTS with respect to public highways have made the construction of a facility boundary fence impractical. General security measures taken at the NTS are maintained by a two-level system: (1) security stations at all authorized entrances to the NTS, 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 NTS Access

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

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

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

B.4.b RWMS Access

Additional security safeguards are provided by the RWMS personnel and engineered structures. The active area of the RWMS is surrounded by a fence. **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 RWMS is via a controlled gate. All personnel entering the RWMS must log in at the main office building before access is granted.

Within the RWMS, the MWDU will be surrounded by a fence and the entrance secured by a locked gate. The unit will remain secured except during authorized operations such as vehicle off-loading, waste stacking, disposal operations, maintenance, or inspections. A sign warning unauthorized personnel to keep out will be posted on the entrance gate. Fencing will be inspected once a week for signs of intrusion or deterioration/damage.

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

The inspection schedule will address 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 human health or environmental hazards. Observations and descriptions of repairs or corrective actions will be noted on the inspection forms. Completed inspection forms will be filed at the RWMS as a record of inspection.

Weekly inspections will include items such as spill control materials, fencing, gates, signage, and container holding areas, exposed packages, run-on/runoff control, pits/trenches, and general housekeeping. Table 5 provides a detailed list of inspection items and frequencies for the MWDU. A sample of an inspection checklist is provided in Figures 9 and 10.

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

Table 5 MWDU Inspection Schedule

Inspection Criteria	Description	Frequency
Exposed Waste Packages	Ensure no damage, deterioration, leaks or spills	Weekly
General Areas	Housekeeping (no trash or debris) areas free of spills, leaks, releases	When waste handling operations occur/weekly
Fencing/Gates	Ensure fencing/gates intact with no corrosion, breaches, or deterioration	Weekly
Signs	Ensure signs posted in proper location, visible, and adequate with entry requirements	Weekly
Run-on/Runoff Control	Ensure integrity of berms/dikes (erosion, sloughing), adequacy of stacking	Weekly/after storms
Spill Control	Ensure adequate supplies with replacement after use	Weekly
Fire Extinguishers[1]	Verify hoses are in good condition and pressure gauges are in the appropriate range	Monthly
Communications Equipment	Ensure that communication equipment is functioning properly	Before entering MWDU
Leachate Storage Tank/Secondary Containment	Ensure tank/containment leak detection and overfill protection is operational, check tank liquid level, inspect valves (leaks/proper orientation), ensure secondary containment is empty (liquids/debris), check tank and containment for signs of leakage or deterioration	Each operating day
Leachate Sump	Ensure pumpable liquids are removed to minimize head on the liner, document liquid levels	Weekly/after storms

[1] Fire extinguishers are inspected monthly by RWMS personnel and certified annually by trained personnel according to National Fire Protection Association requirements

AREA 5 AWEEKLY PERMIT CHECKLIST	Page 1 of 2	
P03U – Mixed LLW Disposal Cell	**Yes**	**No**
Are the signs posted on the perimeter fence and entry gate readable?	□	□
Is the access gate locked and fencing intact?	□	□
Is the spill kit available and complete?	□	□
Are portable fire extinguishers readily accessible and nearby?	□	□
Are the pit walls free of erosion and instability?	□	□
Are exposed MLLW packages free of damage or deterioration?	□	□
Are exposed MLLW packages free of leaks or spills or indications thereof?	□	□
Are exposed container labels legible?	□	□
Is there a communication system available to facility personnel to signal an emergency?	□	□
P06U – Asbestos Disposal Cell		
Are the signs posted on the perimeter fence and entry gate readable?	□	□
Access gate locked and secured?	□	□
Perimeter fencing in good condition?	□	□
Portable fire extinguishers readily accessible and nearby?	□	□
Run-on control structure free of erosion?	□	□
Covered material free of settling?	□	□
Good housekeeping practices followed in the cell?	□	□
Waste Verification Holding Area		
Is the spill kit available and complete?	□	□
Is there material in the Waste Verification Holding Area requiring inspection? If “No,” remaining questions need not be answered.	□	□
Are all waste containers in the Waste Verification Holding Area closed and in good condition with no leakage or signs of deterioration?	□	□
Is there adequate space for personnel and equipment to respond to emergencies?	□	□
Are all wastes in the Waste Verification Holding Area positioned in a manner to prevent rupture or leakage?	□	□
Are all waste containers in the Waste Verification Holding Area segregated within the area to maintain requirements for compatibility?	□	□
Area all waste containers in the Waste Verification Holding Area positioned in a manner to prevent rupture or leakage?	□	□
Are containers in the Waste Verification Holding Area marked with the words “HAZARDOUS WASTE” and other identifying information?	□	□
Do the Waste Verification Log Book entries equal the waste items actually held in the Waste Verification Holding Area?	□	□
Is there a communication system available to facility personnel to signal an emergency?	□	□
Have all RCRA hazardous waste containers in the Waste Verification Holding Area been held for less than 60 days?	□	□

Figure 9 Sample Inspection Checklist

AREA 5 WEEKLY PERMIT CHECKLIST		Page 2 of 2
Remarks: (IF "NO" is marked for any item, document all noncompliances and all corrective actions taken.)		
INSPECTOR Name	Signature	Time/Date
WFOM Name	Signature	Time/Date
FM Name	Signature	Time/Date

Figure 10 Sample Inspection Checklist (continued)

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

RWMS emergency response activities are performed by the DOE contractor and/or subcontractor. Contractor emergency services located on the NTS include the NTS Fire Department, NTS Occupational Medicine, and the Nye County Sheriff's Office. Verbal and written notification requirements to the appropriate state and federal agencies will be performed by an NNSA/NSO representative.

DOE maintains Memorandums of Understanding (MOU) for emergency activities with Nye County, the Bureau of Land Management, Creech Air Force Base, and the U.S. DOE Office of Secure Transportation. Las Vegas area hospitals that are notified will include University Medical Center, Mountain View Hospital, Sunrise Hospital, and Mercy Flight for Life air ambulance service. NNSA/NSO also maintains an Agreement-in-Principal with the state of Nevada.

Because of the complexity of operations at the NTS, facilities are required to maintain individual emergency response procedures. Exhibit 2 provides a copy of the Emergency Response Procedure (ERP) for the Area 5 RWMC. As required in **40 CFR 264.56(j)**, any imminent or actual emergency requiring implementation of the ERP will be recorded in the operating record and a written report will be submitted to NDEP by NNSA/NSO within 15 days of the incident. The written report will include the following information:

- Name, address, and telephone number of the owner or operator
- Name address, and telephone number of the facility
- Date, time, and type of incident
- Name and quantity of materials involved
- Extent of injuries (if any)
- An assessment of actual or potential hazards to human health or the environment (as applicable)
- Estimated quantity and disposition of recovered material that resulted from the incident

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

Exhibit 2 provides a copy of the Emergency Response Procedure for the Area 5 RWMC.

Exhibit 2, Emergency Response Procedure for Area 5 Radioactive Waste Management Complex

National Security Technologies LLC
Vision • Service • Partnership

National Security Technologies

Emergency Response Procedure

for

Area 5
Radioactive Waste Management Complex (RWMC)

ERP-1009

Revision No. 7

This ERP supersedes ERP-1009, Rev. 6, dated August 20, 2008.

M.W. Millard — 4-15-09

Michael Millard — Date
Facility Manager
National Security Technologies, LLC

4-15-09

James H. Daniels — Date
Emergency Planning and Preparedness Department Manager
National Security Technologies, LLC

1.0 INTRODUCTION

This Emergency Response Procedure (ERP), in conjunction with National Security Technologies (NSTec) Company Manual CM-2120.001, "Emergency Services and Operations Support Emergency Preparedness and Response Manual," provides guidance in the response to incidents and emergencies at Area 5 Radioactive Waste Management Complex (RWMC). The technical basis for this procedure is the facility-specific Emergency Planning Hazards Assessment EPHA-1009, "Emergency Planning Hazards Assessment for Area 5 Radioactive Waste Management Complex." The planning basis for this ERP is based on the following potential events, which, at a minimum, would include the protective actions of shelter-in-place and/or evacuation. These events are as follows: natural phenomena (earthquake, flood, and windstorm); law enforcement-type events (civil disorder/riot, sabotage/malevolent acts); accidents (aircraft, chemical, biological, and/or radiological materials); fires/explosions; suspicious mail/suspicious packages; bomb threats; or power failures.

2.0 SCOPE

2.1 This procedure applies to NSTec-managed organizational elements located on or within Area 5 RWMC.

2.2 Based on EPHA-1009: *(Place an "X" on the applicable item.)*

__ There are no analyzed emergencies that would warrant categorization as an Operational Emergency Requiring Classification.

_X There are analyzed emergencies that may warrant categorization as an Operational Emergency Requiring Classification with subsequent classification as an Alert, Site Area Emergency, or General Emergency.

3.0 ROLES AND RESPONSIBILITIES

3.1 The following have responsibilities in this procedure:

- **Facility Manager (FM)/Facility Owner (FO):** Ensures the subject ERP is adequate and maintained. Ensures facility personnel are trained on the subject ERP.
- **Local Emergency Director (LED):** Recognizes potential emergency conditions and initiating and directing the appropriate response as directed in the subject ERP. Performs the initial incident command tasks, including protective actions and facility response management until the tasks are assumed by a First Responder or the Incident Commander.

  Note: The LED acts as the Emergency Coordinator for Resource Conservation and Recovery Act (RCRA) and occurrence reporting issues.

- **LED Communicator:** During a non-security emergency, establishes an ongoing communication line between the responding F&R personnel and the Operations Coordination Center (OCC) Duty Manager, or the Emergency Management Center (EMC) if activated. During a security emergency, establishes and maintains communication between the responding security force and the Tactical Operations Center (TOC).
- **Recorder:** Develops an information timeline that chronologically captures ongoing activities.
- **Emergency Action Team (EAT):** Assists the LED with notifications, event documentation, personnel accountability, and other tasks as assigned by the LED.
- **Radiological Control Technicians:** Performs activities involving radiological monitoring, sampling, surveys, decontamination activities, and other supporting activities, as assigned by the LED or Health Physics Advisor.
- **Building/Facility/Area/Work Location Occupants:** (See Appendix F)

4.0 EMERGENCY RESPONSE

4.1 Checklists that outline LED, EAT, Occupant, and other position duties and responsibilities for responding to emergencies at Area 5 RWMC are found in the appendices. These checklists are used during emergency response by the applicable responder, based on the situation and the protective action(s) taken (evacuation or shelter-in-place).

4.2 Based on CM-2120.001, this procedure: *(Place an "X" on all that apply.)*

__ Complies with Section 2.0, "Emergency Preparedness and Response," listed in CM-2120.001 in its entirety, with no additions or exceptions.

X Complies with Section 2.0, "Emergency Preparedness and Response," listed in CM-2120.001, with the following **additions** not listed in the CM. These additions are reflected in the attached applicable facility-specific appendices.

Additions:

WSI personnel on duty at or near the Area 5 RWMC or Area 5 HWSU will be directed by WSI during any emergency event or incident. WSI personnel will not be directed by RWMC or HWSU management. However, WSI will satisfy their jurisdictional requirements by acting under the National Incident Management System (NIMS).

__ Complies with Section 2.0, "Emergency Preparedness and Response," listed in CM-2120.001, with the following **exceptions** to those listed in the CM.

These exceptions are reflected in the attached applicable facility-specific appendices.

5.0 CONTINGENCY PLAN

This contingency plan is designed to minimize hazards to human health or the environment from fires, explosions, or any unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to air, soil, or surface water. This contingency plan covers response to both Off-Normal Conditions that can be safely mitigated by “qualified” facility personnel and Emergency Event Conditions that require resources outside of the facility boundary for event response, mitigation, and recovery.

Due to the remoteness and large geographic area, the Nevada Test Site (NTS) maintains a baseline onsite Emergency Response Organization (ERO). The NTS ERO consists of NTS Fire and Rescue (F&R), Nye County Sheriff’s Office (NCSO), Safeguards and Security contractor; underground mine rescue teams, radiological and chemical emergency response teams, EMC, Emergency Operations Center (EOC), and TOC.

If an event occurs at a nearby facility, this contingency plan will be invoked and response measures will be taken to protect facility personnel from the consequences of a hazardous material release.

5.1 Amendment of Contingency Plan

The contingency plan must be reviewed annually, and if necessary amended whenever:

- Applicable regulations are revised.
- The plan fails in an emergency.
- The facility changes in its design, construction, operation, maintenance, or other circumstances in a way that materially increases the potential for fires, explosions, or releases of hazardous waste or hazardous waste constituents.
- The list of emergency coordinators changes.
- The list of emergency equipment changes.

5.2 Event Recognition (Situational Awareness)

5.2.1 Personnel directly involved in the incident shall provide the LED with the following information (at a minimum):

- The identity of the individual reporting.

- The nature and location of the incident.
- Any associated injuries.
- The potential for fire, explosion, or spill.
- Unique shipment and package number.
- The size or volume of the actual or potential release.
- Action taken to mitigate or isolate the event, if any, (i.e. place lid on container, place tarp over spill, etc.).

5.2.2 Personnel witnessing the incident will (as applicable):

- Take initial measures to protect personnel in the area (e.g., move to a safe location; notify personnel in the area, isolate the area).
- Call 911, or announce “Mayday, Mayday, Mayday” on any NTS radio, or activate the emergency button on any NTS radio.
- Notify Facility Manager, LED, and appropriate supervisor(s).

Note: During off-hours, the OCC Duty Manager must notify the Area 5 RWMC Facility Manager of the incident. Emergency response actions by NTS F&R or WSI shall not be delayed due to the LED not being onsite at the time of the event.

5.3 **Emergency Event Conditions - Facility Response**

The initial response to any fire, explosion, spill, or other event conditions shall be to protect human health and safety, and then the environment.

Small fires not involving hazardous materials (in the insipient stage) can be extinguished or controlled by trained facility personnel using an ABC-type fire extinguisher until the arrival of NTS F&R. Action should only be taken if it is safe to do so and can be accomplished from an upwind position. The supervisor or LED shall be responsible for all fire extinguishing efforts until F&R arrives. Upon arrival, F&R shall assume control of firefighting operations.

5.3.1 The LED will assess the event conditions and determine if an emergency has occurred at the facility. Upon determination of an emergency, the LED will immediately:

- Initiate Notifications: 911 Fire Dispatch, OCC Duty Manager 5-0311, and Wackenhut Services, Inc (WSI) Central Alarm Station (CAS) 5-3881.

Note: If an off-normal event condition has occurred and can be safely mitigated by “qualified” facility personnel, proceed to Section 5.11.

5.4 Categorization/Classification

5.4.1 The LED will review Emergency Action Level (EAL) Tables 7-7 through 7-27, from EPHA-1009, and the criteria specified in U.S. Department of Energy DOE Order 151.1C to determine if the event conditions meet categorization/classification criteria.

- The LED must categorize an event as an Operational Emergency as promptly as possible, but no later than 15 minutes after recognition/identification/discovery.

Upon categorization of an Operational Emergency, the LED must verbally notify the OCC Duty Manager to ensure the reporting requirements to DOE are met. The notification requirements begin from the "Official Time" the LED categorizes/classifies the event as documented on the LED Emergency Action Checklist, Appendix D, and not the time the OCC Duty Manager is verbally notified of the event.

5.5 Protective Actions

5.5.1 The LED will implement protective actions (Shelter or Evacuate) based on the EALs in EPHA-1009, designation. Methods for communicating protective actions include hand-held radio announcement and/or public address system.

- The LED is responsible for implementing protective actions for Area 5 RWMC according established EALs in EPHA-1009, Tables 7-7 through 7-27.

For Operational Emergencies Not Requiring Classification, the LED will take recommended protective actions based on OI-2120.169, "Categorization of Operational Emergencies Not Requiring Classification," Appendix A

- **IF** the primary Evacuation Assembly Area is identified as unsafe **THEN** the LED will direct personnel to evacuate to the secondary location (Storage / Bone Yard) or other locations, as event conditions warrant a change.

The OCC Duty Manager will implement protective actions for balance of plant, when applicable.

WSI personnel on duty at or near the Area 5 RWMC or Area 5 HWSU will be directed by WSI during any emergency event or incident. WSI personnel will not be directed by Area 5 RWMC or Area 5 HWSU management. Notifications to the WSI CAS will ensure WSI personnel at or near the facility are notified in a timely manner to implement their own protective measures. However, WSI will satisfy their jurisdictional requirements by acting under the National Incident Management System (NIMS).

5.6 Facility ERO Response Actions

5.6.1 If the Event is declared to be or has potential to be an Operational Emergency, the LED will immediately:

- Make follow-up notifications to the OCC Duty Manager and WSI CAS.
- Establish a Command Post.
- Appoint an LED Communicator.
- Appoint a Recorder.
- Notify the facility EAT.
- Initiate the Personnel Accountability Process and notify the OCC Duty Manager of accountability status (i.e. full accountability, missing persons, in progress).
- Complete or direct the completion of the attached Emergency Action Checklist, Appendix D, and fax to the OCC, EMC, and TOC (if activated).

5.6.2 **LED Communicator will assist the LED by:**

- Maintain communications with the OCC Fire Dispatch, OCC Duty Manager, or EMC (if activated). Monitor incoming phone calls from the OCC or EMC (if activated).
- During Security Emergencies, maintain communications with the WSI CAS, or TOC (if activated).
- Provide follow-up reports to the OCC Duty Manager, 5-0311, or the EMC Crisis Manager Communicator, 5-1810 (if activated), as often as necessary, during significant changes and at the termination of the emergency. During Security Emergencies, provide the TOC, 5-5411, with follow-up reports (if activated).
- Ensure no classified or sensitive information is transmitted over unsecured communications methods.

5.6.3 **Recorder will:**

- Establish a timeline of events throughout the event until termination. Gather data from the Area 5 RWMC ERO elements and maintain document control.
- Assist the LED with tasks as requested.

5.6.4 **Emergency Action Team will:**

- Conduct sweeps of assigned facilities, if it is safe to do so.
- Maintain communications with the LED and provide ongoing status reports.

- Instruct personnel to evacuate or shelter in place based on directions from the LED.
- Ensure classified material is secured if applicable.
- Report to the assembly area if directed.
- Assist in the accountability if requested by the LED.
- Assist the LED in controlling the assembly area.

5.6.5 **Radiological Control Technicians will:**

- Wear appropriate personal protective equipment (PPE) according to established radiological control procedures.
- Establish a radiological control boundary in a safe location to control the spread of radiological contamination.

Note: Actual or potentially contaminated personnel should be evacuated to a safe location, but segregated from non-contaminated personnel.

- Perform radiological surveys and decontamination according to established radiological control procedures. Document results according to established procedures.

Note: Recognition and emphasis should be focused on medical treatment versus radioactive contamination for injured personnel that are contaminated. However, all measures possible should be taken to prevent personal exposure and the spread of contamination.

- Notify the Health Physics Supervisor.
- Maintain communications with the LED and provide ongoing event condition information.
- Complete additional tasks in support of the LED or the Incident Commander.

5.6.6 The LED will ensure emergency responders are aware of all developing hazards. If significant event conditions change prior to the arrival of first-responders, the LED must notify 911 Fire Dispatcher immediately or contact F&R on ERO-14 Radio Network.

Note: While responding to any event at the Area 5 RWMC, F&R Dispatch shall relay current weather conditions including wind direction to the responding crews. This is necessary to ensure that all responders do not inadvertently enter into a toxic or radioactive plume.

5.7 **Ongoing Communications**

- Meet-Me Calls. Meet-me calls are conducted frequently throughout the emergency between the IC/LED, EMC Crisis Manager, EOC Emergency Manager, OCC Duty Manager, and TOC (if activated). These status reports/calls ensure that all tiers of emergency facilities and responders are current in ongoing activities, event conditions, and updated on a continual basis. The ERO is responsible for maintaining continuous, effective, and accurate communications throughout an Operational Emergency.

5.8 **First-Aid/Medical Treatment**

5.8.1 Facility personnel should initiate first-aid (at a level of their training or comfort) when employees are injured.

- Injured personnel in imminent danger that can be safely moved should be evacuated to a safe location. The LED and first-responders should be immediately notified of the location of any victims.

- Injured personnel that can't be safely moved should be cared for (if safe) and location reported to the LED and first-responders.

- NTS F&R will provide emergency medical care for injured personnel.

5.9 **Operational Emergency Termination and Recovery**

5.9.1 Termination process begins when personnel in charge of the response effort determines that conditions are sufficiently stabilized and current conditions meet pre-established termination criteria outlined in NSTec Plan PLN-1004, "Emergency Management Plan."

- Termination of an Operational Emergency requires approval from the U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office (NNSA/NSO) EOC Emergency Manager.
- Preliminary Recovery Plan Outline must be completed prior to termination.

5.9.2 Upon termination criteria being met, the LED in coordination with the NTS IC, EMC, and other Unified Command elements assist in the development of a Preliminary Recovery Plan Outline.

- Preliminary Recovery Plan Manager and Team are identified.
- Preliminary Recovery Plan Outline requires approval from the NNSA/NSO EOC Emergency Manager.

5.9.3 The facility should be returned to pre-emergency conditions, if possible. Personnel should be advised to return to work, go home, or other measures as applicable.

5.9.4 All emergency equipment listed in the contingency plan should be cleaned and fit for its intended use before operations are resumed (see Appendix H).

5.10 Recovery Considerations and Reporting

5.10.1 Recovery "clean-up activities" will meet all current and applicable standards and regulations.

5.10.2 No waste that may be incompatible with the released material is treated, stored, or disposed of until cleanup procedures are completed.

5.10.3 The LED as Emergency Coordinator for purposes of RCRA reporting (where appropriate) must notify the Environmental Services Manager that the facility is in compliance with the below requirement before operations are resumed in the affected area(s) of the facility.

Requirement: The LED/Emergency Coordinator must note in the operating record the time, date, and details of any incident that requires implementing the contingency plan.

5.10.4 Within 10 days after the incident, the LED/Emergency Coordinator or designee must submit a written report on the incident to the Environmental Services Manager. The report must include:

- Name, address, and telephone number of the owner or operator
- Name, address, and telephone number of the facility
- Date, time, and type of incident (e.g., fire, explosion)
- Name and quantity of material(s) involved
- The extent of injuries, if any
- An assessment of actual or potential hazards to human health or the environment, where applicable
- Estimated quantity and disposition of recovered material that resulted from the incident

5.11 Off-Normal Event Conditions

5.11.1 Off-Normal event conditions may occur at the Area 5 RWMC, which can be isolated, controlled, and mitigated by qualified facility personnel. Off-Normal event conditions should be handled according to established facility-specific and site plans and procedures.

Note: Event conditions that meet any applicable Operational Emergency criteria outlined in EPHA-1009 should be handled according to Section 5.3.

5.11.2 A spill or material release (that does not exceed protective action criteria and is not determined to be an emergency) may occur during container loading/unloading, movement, and storage at the Area 5 RWMC. Typically, small spills can be contained and controlled by trained facility personnel in appropriate PPE. Appropriate facility-specific and site plans and procedures should be followed.

5.11.3 The initial response to any spill would be to protect human health and safety. Identification, containment, treatment, and disposal shall be the secondary response. Actions in response to controlling and reporting spills and materials releases shall be consistent with the provisions outlined in NSTec Company Directive CD-0442.009, "Spill Reporting and Control."

5.11.4 Upon an indication of a minor spill, leak, or release of a hazardous waste constituent, non-essential personnel should be evacuated away from the area. Only those persons involved in overseeing or performing clean-up operations will be allowed within the designated hazard area. The Facility Manager and applicable Supervisor should be notified.

5.11.5 Personnel directly involved in the incident shall provide the Facility Manager and Supervisor with the following information:

- The identity of the individual reporting
- The nature and location of the incident
- Any associated injuries
- The potential for fire
- Unique shipment and package number
- The size or volume of the release
- The mitigating action, if any, that was undertaken

5.11.6 The Facility Manager shall consult with Health Physics and Industrial Hygiene personnel, as necessary, to determine the appropriate level of PPE to be worn, ensuring that efforts meet all current and applicable standards and regulations, and supervise Area 5 RWMC personnel during the performance of mitigation activities for non-emergency conditions.

5.11.7 The FM shall ensure that the containers containing clean-up materials are properly labeled and marked. All containers requiring transport outside the Area 5 RWMC compound shall be packaged as specified in Title 49 CFR 173, 178, & 179 and shall be labeled properly. All spilled wastes will be contained. Solid wastes and contaminated materials, such as soil, shall be packaged in approved U.S. Department of Transportation containers.

6.0 APPENDICES

Appendices A through F are required for each NSTec-managed facility. Additional facility-specific appendices are attached to this ERP, if applicable. These checklists serve as the primary tool during emergency response.

Appendix A: Emergency Evacuation Route Map(s)

Appendix B: Evacuation Assembly Area Route Map(s)

Appendix C: Designated Shelter-in-Place Areas and Contact Information

Appendix D: Local Emergency Director Checklists

Appendix E: Emergency Action Team Checklists

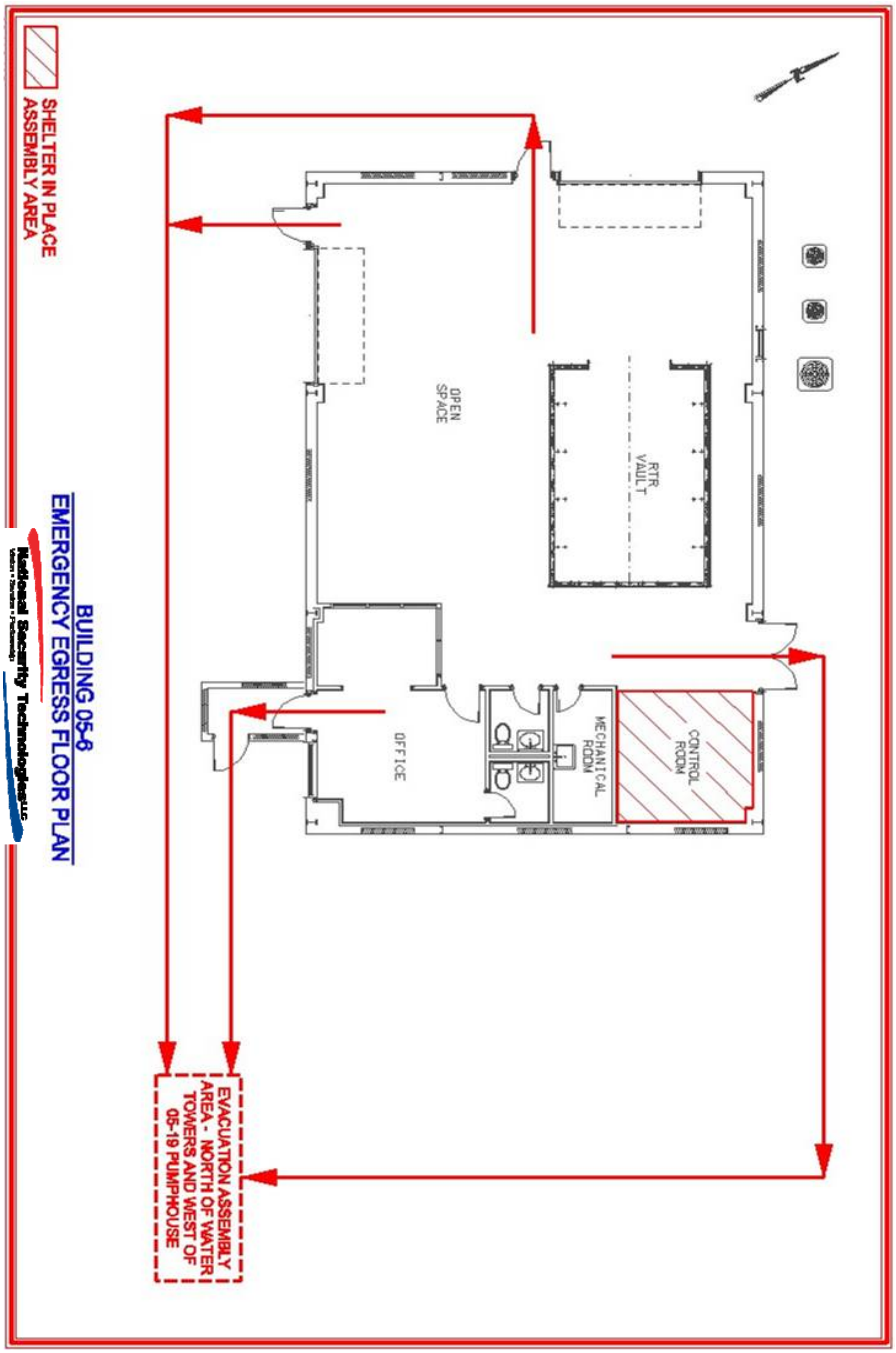
Appendix F: Building/Facility/Area/Work Location Occupants Guidelines

Appendix G: Local Emergency Director/Emergency Coordinator Contact Information

Appendix H: List of Emergency Equipment

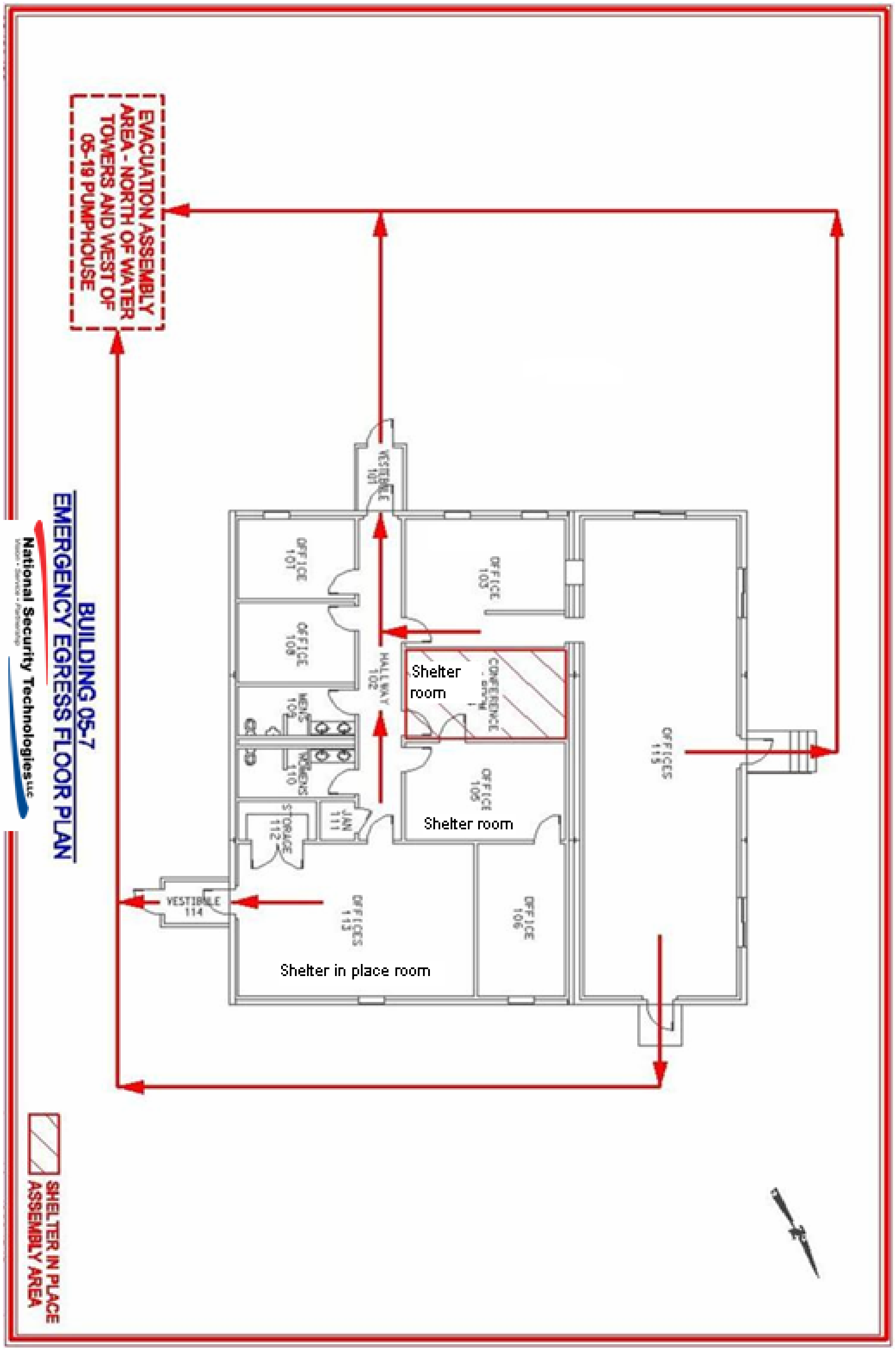
APPENDIX A
Emergency Evacuation Route Map(s)

Building 5-6 Emergency Evacuation Route Map



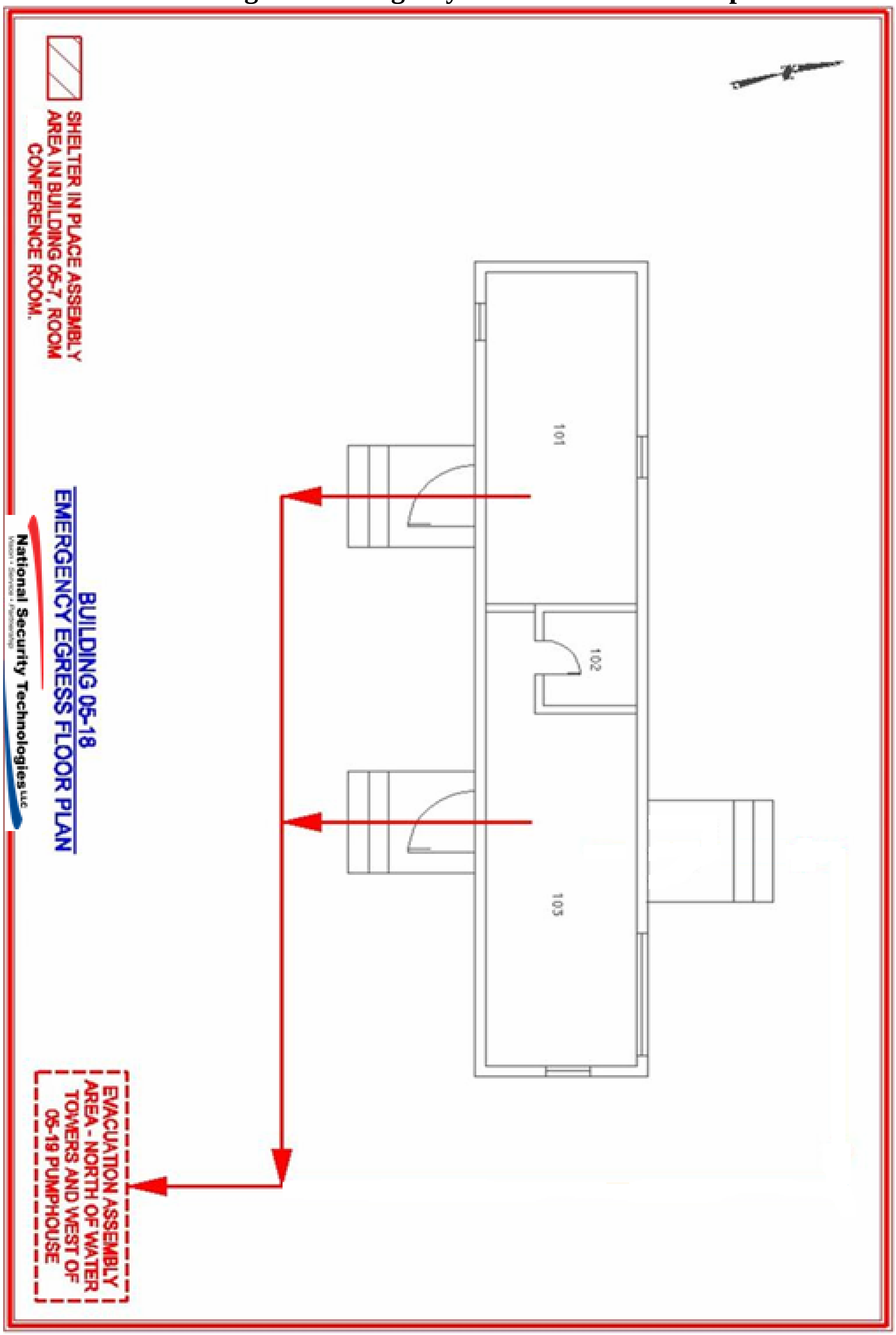
APPENDIX A (cont)
Emergency Evacuation Route Map(s)

Building 5-7 Emergency Evacuation Route Map



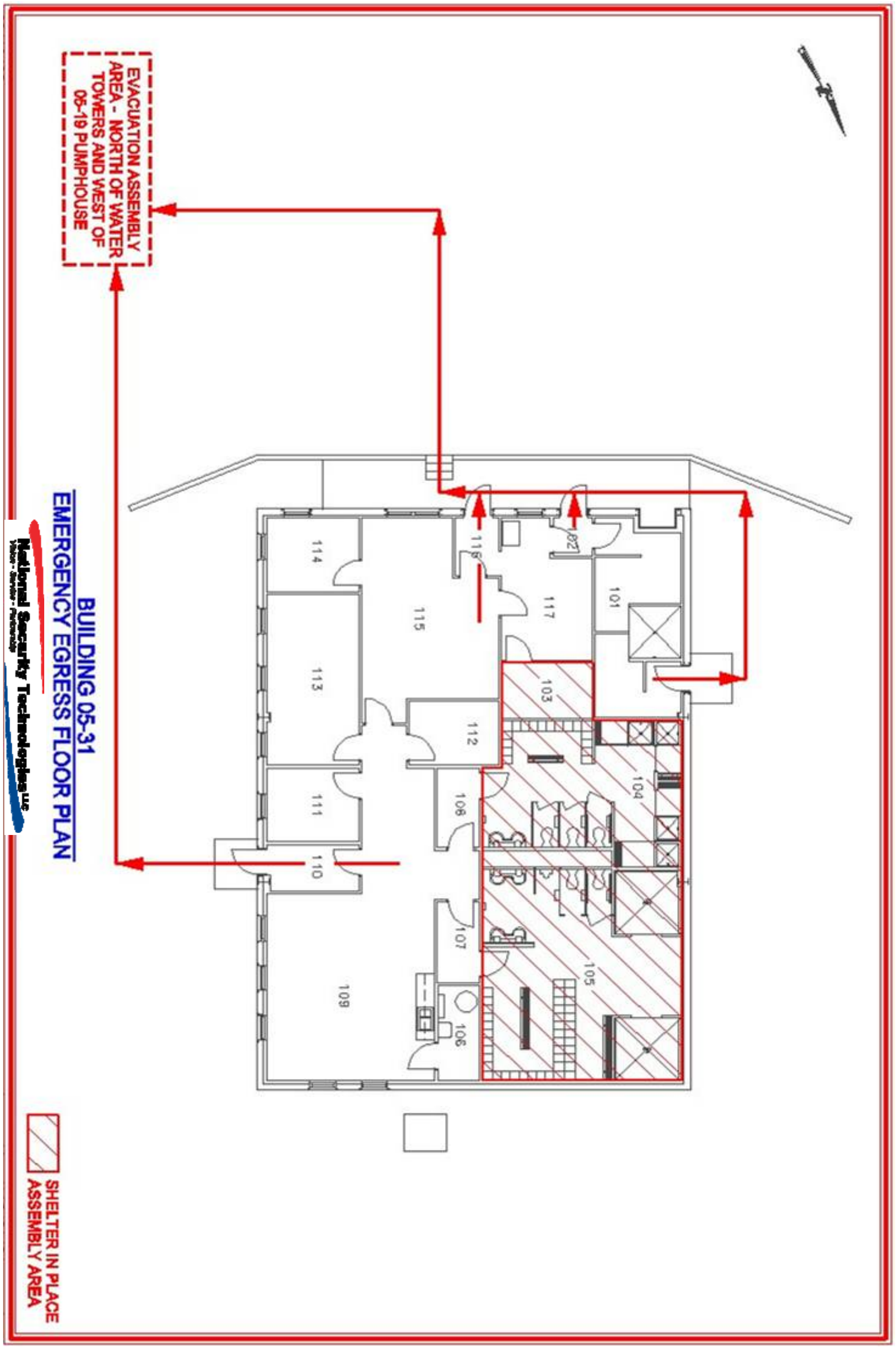
APPENDIX A (cont)
Emergency Evacuation Route Map(s)

Building 5-18 Emergency Evacuation Route Map



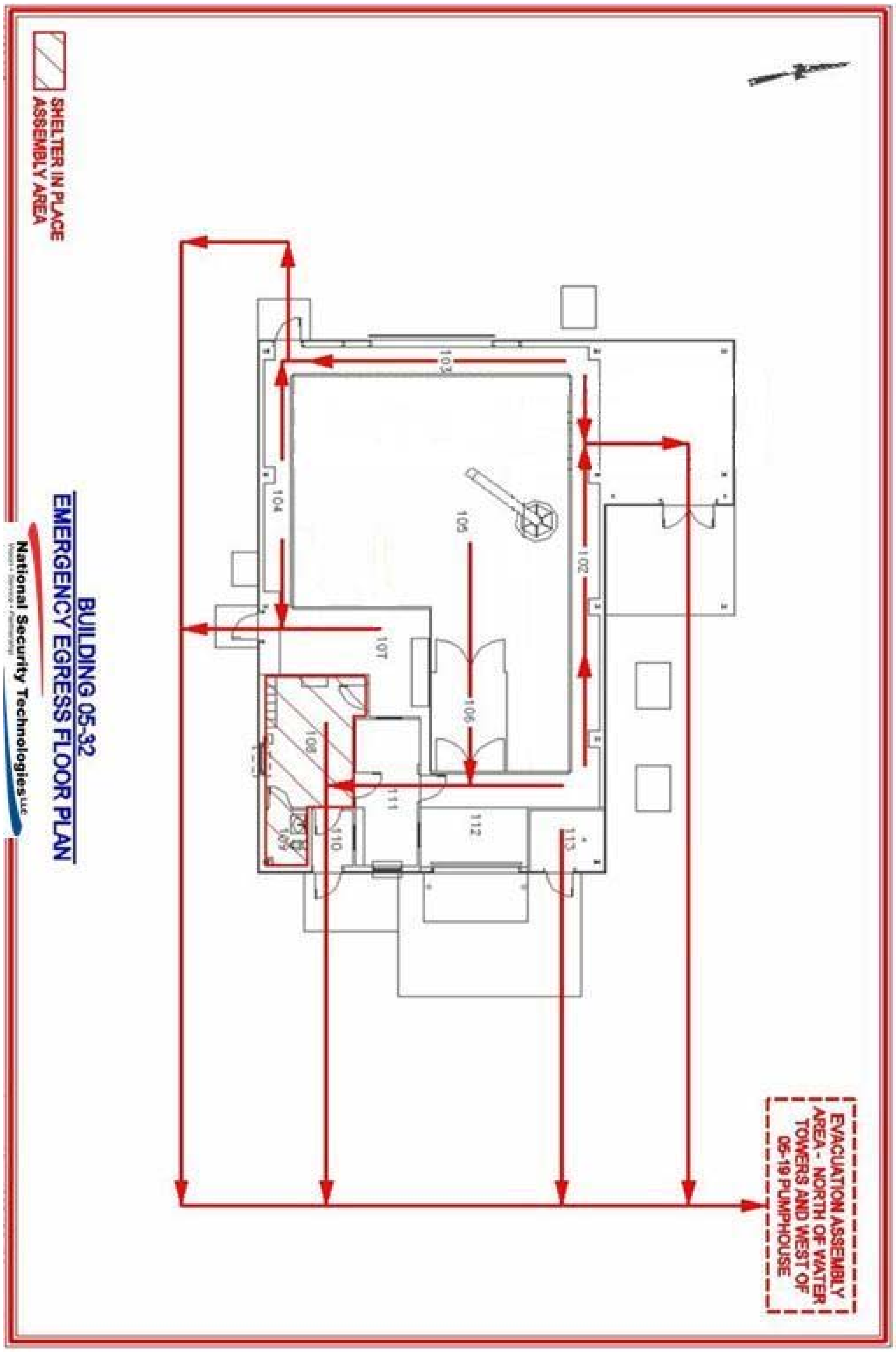
APPENDIX A (cont)
Emergency Evacuation Route Map(s)

Building 5-31 Emergency Evacuation Route Map



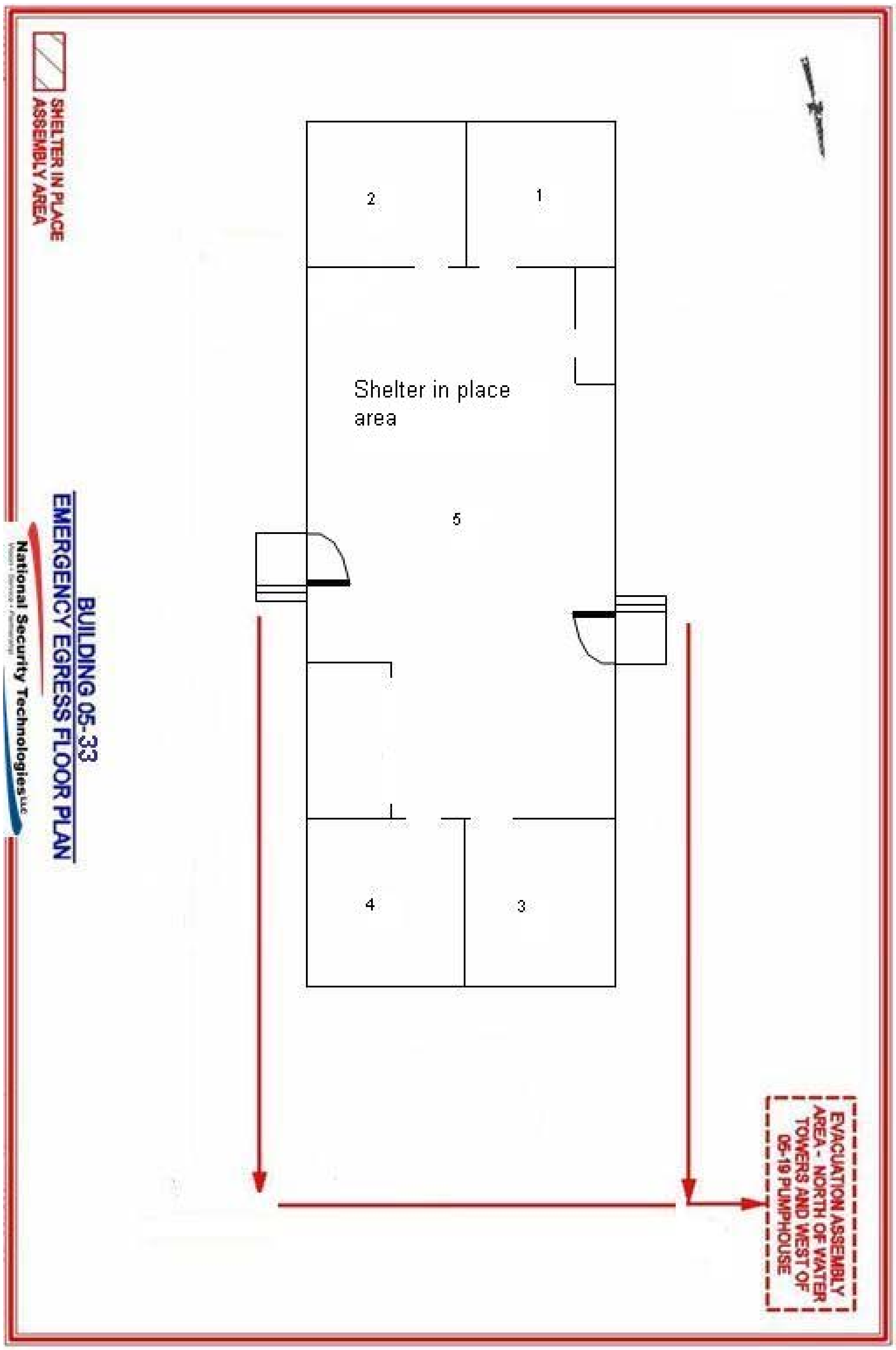
APPENDIX A (cont)
Emergency Evacuation Route Map(s)

Building 5-32 Emergency Evacuation Route Map



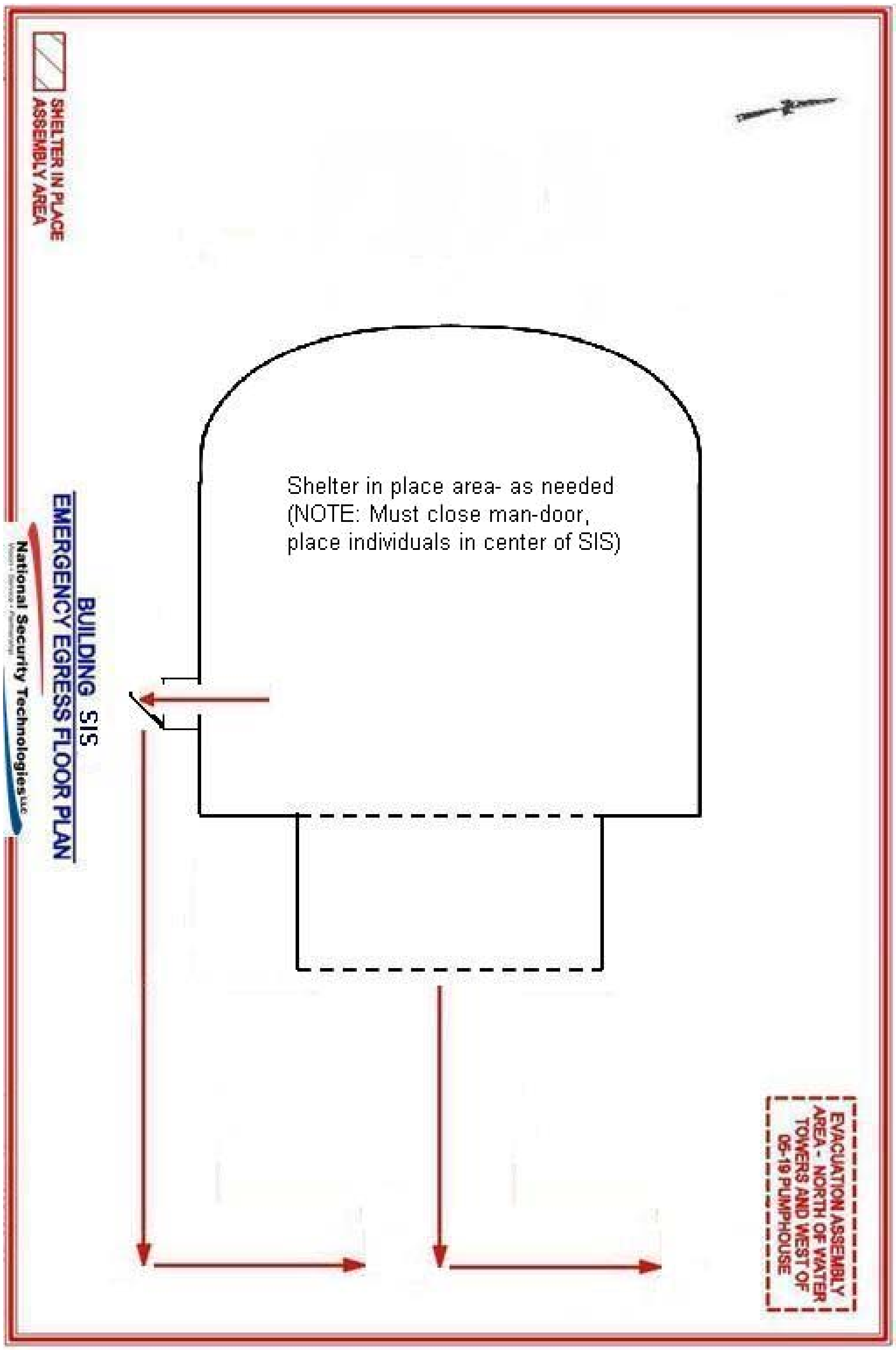
APPENDIX A (cont)
Emergency Evacuation Route Map(s)

Building 5-33 Emergency Evacuation Route Map



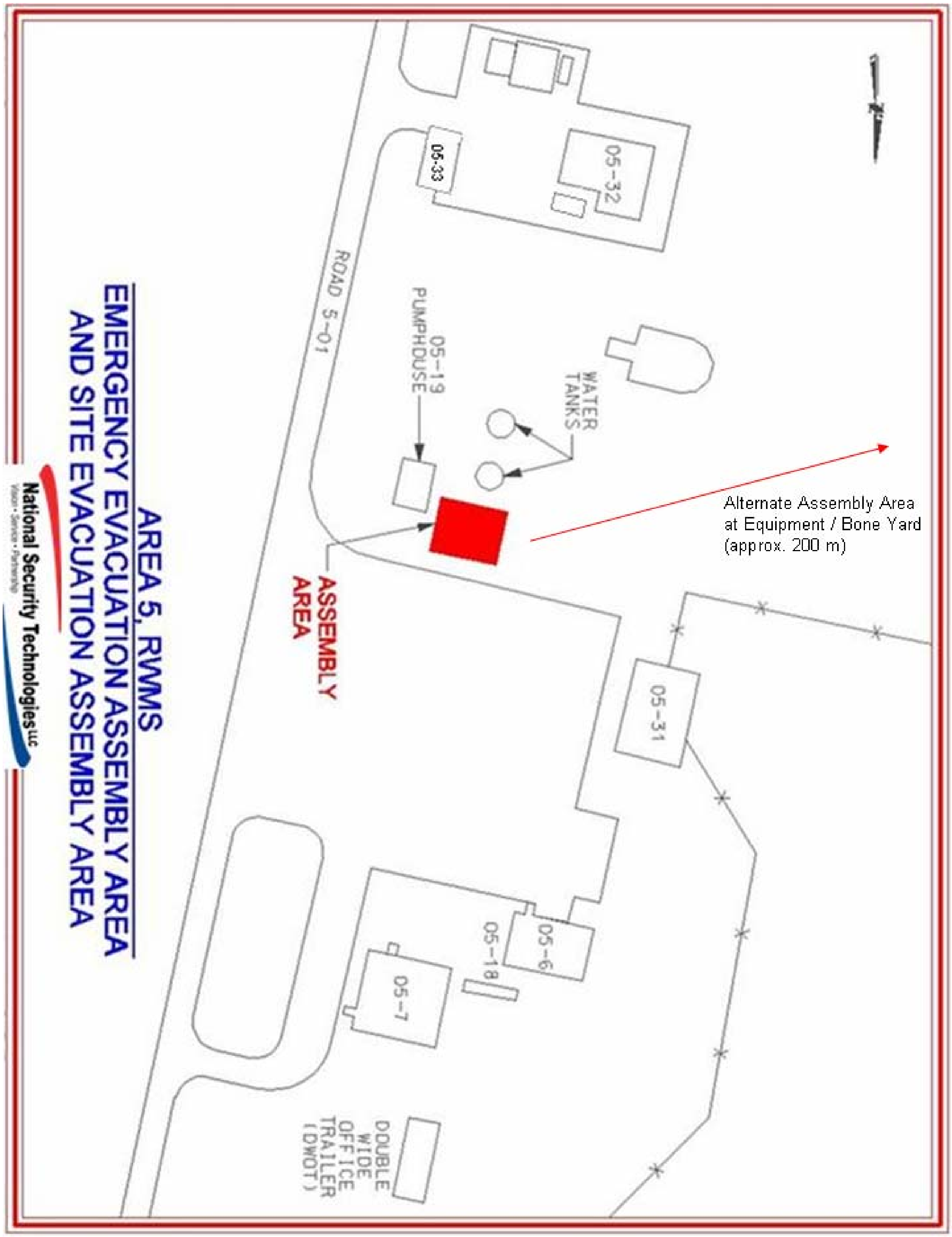
APPENDIX A (cont)
Emergency Evacuation Route Map(s)

Building SIS Emergency Evacuation Route Map



APPENDIX B
Evacuation Assembly Area Route Map(s)

Area 5 RWMC Emergency Facility Assembly Area



APPENDIX C
Designated Shelter-In-Place Areas and Contact Information

ERP No.: 1009 **ERP Revision No.:** 7 **Date:** April 2009

Check the box for the location covered by this Emergency Response Procedure:

☒ NTS Area: 05

☐ NLVF ☐ CF ☐ NSF

☐ RSL - Andrews ☐ RSL - Nellis

☐ STL ☐ LAO ☐ LO

Complete all required information in the table below for Shelter-in-Place areas covered by this Emergency Response Procedure. Identify a cellular telephone number or radio net if the Shelter-in-Place area does not have a telephone. Identify a point of contact who might be available if there is no response from the designated Shelter-in-Place area.

SIP Area Info.	SIP Contact Info.	POC Name	POC Contact Info.
Include: • Building number • Floor • Room number or description of area	Telephone Number, Cellular Number, or Radio Net (include area code)		Include Telephone Number, Cellular Number, or Radio Net (include area code)
Bldg. 05-6	295-4452	Steve Wolf	Radio Net: RWMS-1
Bldg. 05-7	295-9306	Katie Enockson	Radio Net: RWMS-1
Bldg. 05-31	295-4506	Bob Stueckrath	Radio Net: RWMS-1
Bldg. 05-32	295-2799	Lou Gregory	Radio Net: RWMS-1
Bldg. 05-33	295-6808	Jerry Freter	Radio Net: RWMS-1
SIS	295-5234	Sherry Peczka	Radio Net: RWMS-1

Submit the original and any revisions to this form to the OCC Duty Manager at M/S NTS778.

APPENDIX D
LED Checklists

The following pages provide assistance to the LED during emergency events.

Local Emergency Director Event Worksheet

Date:	**Time:**		**Page:** _____ of____
Local Emergency Director	**Recorder (Scribe)**	**Communicator**	**Other**

Notes	**Things to Consider:**
	☐ Notifications: - 911 Dispatcher - WSI (Central Alarm Station 5-3881) - OCC Duty Manager (5-0311)
	☐ LED checklists
	☐ Establish LED station
	☐ Appoint: - Recorder - Communicator
	☐ Activate EAT
	☐ Protective Actions - Evacuate - Shelter-in-Place
	☐ Categorization/Classification - EPHA-1009 / Tables 7-7 thru 7-27
	☐ Follow-up notifications
	☐ Entry for Responders - Known Hazards
	☐ Accountability
	☐ Provide briefing to First Responders
	☐ Unified Command
	☐ Meet-Me Calls (5-9773)
	☐ Recovery Planning
	☐ Termination
	☐ Post Event Critique
	☐ Return to Normal Operations

APPENDIX D (cont)

LED Emergency Action Checklist

01	**EVENT TYPE**	☐ **FIRE** ☐ **MEDICAL** ☐ **SECURITY** ☐ **SAFETY** ☐ **RAD** ☐ **HAZMAT** ☐ **OTHER** ☐ Bomb Threat ☐ Natural Phenomenon ☐ Malevolent Act ☐ Environmental ☐ Biological ☐ Chemical ☐ Wildland Fire ☐ Transportation ☐ Work Place Accident ☐ Aircraft Accident ☐ Underground ☐ Explosion
02	**EVENT DESCRIPTION**	INJURIES: ☐ YES ☐ N/A ☐ UNKNOWN IF YES, TYPE: RELEASE IN PROGRESS: ☐ YES ☐ N/A ☐ UNKNOWN IF YES, DESCRIBE: RELEASE TYPE: ☐ AIRBORNE ☐ SPILL ☐ LEAK ☐ FIRE ☐ EXPLOSION ☐ OTHER: RELEASE LOCATION: **SOURCE TERM INFORMATION:** Material Released: Form: ☐ Gas ☐ Liquid ☐ Solid ☐ Particulates ☐ Estimated Quantity: ________ ☐ Assumed 100 % of MAR ☐ PE grams ________________ ☐ Actual Quantity: __________ ☐ ________ % of MAR ☐ Fissile G Equ (FGE)____________
03	**EMERGENCY NOTIFICATIONS**	☐ **911 NTS Emergency Dispatcher FAX: 5-1968** ☐ **5-3881 WSI Central Alarm Station (CAS) FAX 4-5300** ☐ **5-0311 Duty Managers Office FAX: 5-1968** ☐ **5-1810 Emergency Management Center FAX: 5-0708** ☐ INITIAL ☐ SCHEDULED UPDATE ☐ CHANGE ☐ TERMINATION DATE: TIME: ☐ AM ☐ PM
04	**PROTECTIVE ACTIONS**	☐ NONE ☐ SHELTER-IN-PLACE – Bldg. No. Telephone: FAX: ☐ EVACUATION LOCATIONS: ☐ PARs: OFF-SITE ☐ SIP ☐ EVACUATION ☐ N/A
05	**EMERGENCY CATEGORIZATION/ CLASSIFICATION**	☐ **OPERATIONAL EMERGENCY:** Not Requiring Classification (See EPHA-1009, Appendix A, OENRC) ☐ Health & Safety ☐ Security & Safeguards ☐ Environmental ☐ Offsite DOE Transportation ☐ **OPERATIONAL EMERGENCY:** Requiring Classification ☐ **ALERT** ☐ **SITE AREA EMERGENCY** ☐ **GENERAL EMERGENCY** OFFICIAL TIME Categorization / Classification Time: ______________ ☐ AM ☐ PM **EAL Release Designation:** ______________ **EAL Evacuation Distance:** _______________ ☐ meters ☐ km
06	**METEOROLOGICAL INFORMATION**	WIND: ☐ Calm ☐ Steady ☐ Gusty WIND DIRECTION From _____________ TEMPERATURE _________ ☐ F° ☐ C° MET CONDITIONS: ☐ Clear ☐ Cloudy ☐ Rain ☐ Snow ☐ Night ☐ Other:
07	**ACCOUNTABILITY**	☐ PERSONNEL — ☐ ALL ☐ Number Missing: Last Location: **Call Duty Manager upon completion of accountability** ☐ SNM — ☐ ALL ☐ Quantity Missing: ☐ N/A ☐ CLASSIFIED MATERIAL — ☐ ALL ☐ Items Missing: ☐ N/A
08	**ADDITIONAL NOTIFICATIONS**	Phone: Fax: Time: Contact: ☐ ☐

APPENDIX D (cont)

LOCAL EMERGENCY DIRECTOR CHECKLISTS

INITIAL RESPONSE

- ☐ Assess the situation, initiate protective actions, and assume the role of LED.
- ☐ Make initial notifications:
  - Alert all personnel in the area to initiate protective actions.
  - Activate Emergency Action Team (EAT) members.
  - Call 911 to request assistance.
  - Call the Operations Coordination Center Duty Manager (702-295-0311) to initiate notification and reporting.
- ☐ Don orange emergency vest.
- ☐ Perform steps in the Evacuation or Shelter-in-Place Checklist as well as performing the steps below:
- ☐ Isolate the area/provide barriers, if safe.
- ☐ Direct safe shutdown of operations, time and conditions permitting.
- ☐ Direct EAT in implementing protective actions.
- ☐ Safeguard scene security, if possible.
- ☐ Assume responsibility for management of the incident scene and initiate protective actions.
- ☐ Categorize/Classify the emergency, if applicable, and immediately notify the OCC Duty Manager (702-295-0311):
  - ☐ Significant Event
  - ☐ OENRC*
  - ☐ OERC**
    - ☐ Alert
    - ☐ Site Area
    - ☐ General
- ☐ Formally transfer responsibility for the incident scene to the IC when relieved by the arriving IC.
- ☐ Remain at the ICP; provide technical and management support to the IC and EMC or Emergency Support Center (ESC), if activated.

EVACUATION

- ☐ Complete the actions specified in LED "Initial Response" Checklist.
- ☐ Evacuate the occupants using available audible and visual alarms.
- ☐ Verify that classified material and vital records are secured.
- ☐ Ensure that government vehicle keys are available, if applicable.
- ☐ Ensure EAT members perform complete sweeps.
- ☐ Ensure exterior doors are marked with "Building Evacuated – Do Not Enter" stickers when the sweeps are complete.
- ☐ Report to the evacuation assembly area.
- ☐ Collect accountability information from Supervisors/Managers and/or EAT members and provide to the OCC Duty Manager (702-295-0311).
- ☐ Control assembled personnel.
- ☐ Provide status updates to assembled personnel and the OCC Duty Manager, as applicable and requested.

SHELTER-IN-PLACE

- ☐ Complete the actions specified in LED "Initial Response" Checklist.
- ☐ Initiate shelter-in-place using available audible and visual alarms. Instruct occupants outside to move inside.
- ☐ Verify that classified material and vital records are secured.
- ☐ Ensure windows and doors are closed and turn off environmental controls, if applicable.
- ☐ Ensure EAT members perform complete sweeps and government vehicle keys are available, if applicable.
- ☐ Verify the interior of exit doors are marked with "Shelter-in-Place – Do Not Exit" stickers.
- ☐ Report to the designated shelter-in-place area.
- ☐ Collect accountability information (and/or headcounts) from Supervisors/Managers and/or EAT members and provide to the OCC Duty Manager (702-295-0311), if requested.
- ☐ Control personnel at the assembly area.
- ☐ Provide status updates to assembled personnel and the OCC Duty Manager, as applicable and requested.

APPENDIX D (cont)

LOCAL EMERGENCY DIRECTOR CHECKLISTS

POWER FAILURE

- ☐ Complete the actions specified in LED "Initial Response" Checklist, as applicable.
- ☐ Assess the situation and determine the estimated amount of time for the power outage, if possible.
- ☐ Instruct building occupants to remain calm, set equipment to "off," secure classified material, and proceed to a lighted area.
- ☐ Notify the OCC Duty Manager (702-295-0311) of the power failure.
- ☐ Consider potential environmental, safety, and health impacts, and determine if protective actions are required.
- ☐ Notify the OCC Duty Manager if initiating protective actions.
- ☐ Follow the appropriate LED Checklist (evacuation or shelter-in-place) to implement protective actions.
- ☐ Direct WEF Supervisor to perform actions as specified by the Facility Manager.
- ☐ See Back-up Generator checklist.

TERMINATION

- ☐ Analyze the current situation with the IC and determine if the emergency can be terminated.
  - ☐ If a Significant Event, co-ordinate termination with IC.
  - ☐ If an outlying OENRC* with the EOC activated, develop a Preliminary Recovery Plan Outline and submit to the EOC Emergency Manager for approval.
  - ☐ If an NTS OERC** with EMC activated, follow OP-2120.004, develop a Preliminary Recovery Plan Outline, and request termination approval from the EOC Emergency Manager when termination criteria are met.
  - ☐ If the NLVF ESC is activated, follow OP-2120.031, develop a Preliminary Recovery Plan Outline, and submit to the EOC Emergency Manager.
- ☐ Notify the OCC Duty Manager (702-295-0311) of event termination.
- ☐ Provide direction to personnel (e.g., "all clear").
- ☐ Remove the "Building Evacuated – Do Not Enter" or "Shelter-in-Place – Do Not Exit" stickers. Ensure building-specific controls are returned to pre-emergency condition, if applicable.
- ☐ Secure the scene and preserve evidence, if applicable.
- ☐ Complete LED checklists.
- ☐ Document participation of ERO personnel on FRM-0062, using Course No. RQ00027EX. For LEDs in the LED qualification program, complete another FRM-0062 with Course No. RQ00020EX. Submit FRM-0062(s) to NSTec Training.

TERMINATION -Continued

- ☐ Conduct a post-event briefing and identify strengths and areas for improvement.
- ☐ Collect and review ERO checklists.
- ☐ Document the event on the Drill/Event Report form and submit to ESOS within 8 days.
- ☐ Complete other reporting, as required (e.g., Occurrence Reporting)
  - ☐ If an OENRC*, work with ESOS to complete the Final Emergency Report.
- ☐ Complete incident reporting requirements outlined in CD-0400.002, if applicable.

COMMENTS/NOTES

*OENRC: Operational Emergency Not Requiring Classification
**OERC: Operational Emergency Requiring Classification.

Name:

ERO Position:

Date of Event:

Building/Facility/Area/Work Location:

***Directions**: Complete all applicable checklists and the above box, and provide them to the appropriate Facility Manager or Facility Owner at the conclusion of the emergency, drill, or exercise.*

For more detailed information, refer to CM-2120.001, "Emergency Services and Operations Support Emergency Preparedness and Response Manual."

APPENDIX E

EMERGENCY ACTION TEAM CHECKLISTS

INITIAL RESPONSE	EVACUATION	SHELTER-IN-PLACE
☐ Make initial notifications: ▪ Alert all personnel in the area to initiate protective actions. ▪ Call 911, or verify 911 has been called, to request emergency assistance. ▪ Notify the Facility Manager (FM)/Facility Owner (FO)/Local Emergency Director (LED). ▪ Ensure the Operations and Coordination Center Duty Manager has been called (702-295-0311) to initiate notification and reporting. ☐ Don orange emergency vest. ☐ Isolate the area and provide barriers, if safe to do so. ☐ Perform steps listed in the applicable Evacuation or Shelter-in-Place Checklist.	☐ Complete the actions specified in EAT "Initial Response" Checklist. ☐ Instruct personnel to evacuate, go to the evacuation assembly area, and assemble for accountability. ☐ Conduct a thorough sweep of assigned area(s), verifying no one remains. ☐ Ensure government vehicle keys are available, if applicable. ☐ Verify that classified material and vital records are secured. ☐ Ensure safe shutdown of operations, as applicable. ☐ Mark **exterior** doors with "Building Evacuated - Do Not Enter" stickers when the sweeps are complete. ☐ Report to the evacuation assembly area. ☐ Assist in collecting accountability information, if requested. ☐ Control assembled personnel and follow the instructions of the LED.	☐ Complete the actions specified in EAT "Initial Response" Checklist. ☐ Initiate shelter-in-place using available audible and visual alarms. Instruct personnel outside to move inside. ☐ Close windows and doors, if applicable. ☐ Mark the **interior** of exit doors with "Shelter-in-Place - Do Not Exit" stickers. ☐ Conduct a thorough sweep of assigned area(s). ☐ Collect government vehicle keys, if applicable. ☐ Ensure classified material and vital records are secured. ☐ Report to the designated shelter-in-place area. ☐ Assist in collecting accountability information (and/or headcounts), if requested. ☐ Control assembled personnel and follow the instructions of the LED.

APPENDIX E (cont)

<table>
<tr><th colspan="3">EMERGENCY ACTION TEAM CHECKLISTS</th></tr>
<tr><td>POWER FAILURE</td><td>TERMINATION</td><td>COMMENTS/NOTES</td></tr>
<tr><td rowspan="3">☐ Complete the actions specified in EAT “Initial Response” Checklist, as applicable.
☐ Instruct building occupants to remain calm, set equipment to “off,” secure classified material, and proceed to a lighted area.
☐ Verify that the OCC Duty Manager (702-295-0311) has been notified of the power failure.
☐ Follow the instructions of the LED and the appropriate EAT Checklist (evacuation or shelter-in-place) to implement protective actions, if necessary.</td><td rowspan="3">☐ Provide instructions to personnel (e.g., “all clear”) as directed by the LED.
☐ Remove “Building Evacuated-Do Not Enter” or “Shelter-in-Place-Do Not Exit” stickers from doors, if applicable.
☐ Complete applicable checklists and submit to the LED.
☐ Participate in the post-event briefing and identify strengths and areas for improvement.
☐ Sign the “In-House Training Attendance Roster,” FRM-0062 using RQ00027EX to verify participation as an ERO member in the emergency, drill, or exercise.</td><td></td></tr>
<tr><td>Name:

ERO Position:

Date of Event:

Building/Facility/Area/Work Location:</td></tr>
<tr><td><u>Directions</u>: Complete all applicable checklists and the above box, and provide them to the appropriate LED at the conclusion of the emergency, drill, or exercise.

For more detailed information, refer to CM-2120.001, “Emergency Services and Operations Support Emergency Preparedness and Response Manual.”</td></tr>
</table>

APPENDIX F

BUILDING/FACILITY/AREA/WORK LOCATION OCCUPANTS GUIDELINES		
FIRST-ON-SCENE AND INITIAL RESPONSE	**EVACUATION**	**SHELTER-IN-PLACE**
• Make initial notifications: - Alert nearby personnel. - Call 911 to request emergency assistance, if necessary. - Notify the Facility Manager (FM)/Facility Owner (FO)/Local Emergency Director (LED/Emergency Action Team [EAT]). - Call the Operations Coordination Center Duty Manager (702-295-0311) to initiate emergency and non-emergency notification and reporting. • Isolate the area and provide barriers, if safe. • Follow the specific instructions of the LED and/or EAT members. • Assist visitors in implementing protective actions. • Comply with steps in the applicable checklist (e.g., Evacuation, Shelter-in-Place, Power Failure, Bomb Threat, or Suspicious Package/Suspicious Mail).	• Complete the actions specified in "First-On-Scene and Initial Response" Guidelines, as applicable. • Remain calm and follow the instructions of the LED and/or EAT members. • Assist visitors in implementing protective actions. • Ensure classified material and vital records are secured. • Ensure safe shutdown of operations, time and conditions permitting. • Take personal possessions when leaving but do not delay to retrieve them. • Leave lights on and office doors open unless directed otherwise. • Walk quickly to the nearest exit. Do not use elevators. • Report to the evacuation assembly area and present yourself for accountability. • Follow the instructions of the LED and/or EAT members, remaining in the assembly area until given other instructions. • Refrain from smoking, eating, or drinking in the assembly area. • Refrain from moving personal or government vehicles unless directed by authorized personnel to do so.	• Complete the actions specified in "First-On-Scene and Initial Response" Guidelines, as applicable. • Remain calm and follow the instructions of the LED and/or EAT members. • Assist visitors in implementing protective actions. • Ensure classified material and vital records are secured. • Ensure safe shutdown of operations, time and conditions permitting. • Take personal possessions when leaving but do not delay to retrieve them. • Leave lights on and office doors open, unless directed otherwise. • Walk quickly to the designated shelter-in-place area, away from outside windows and doors, if applicable. • Report to the designated shelter-in-place area and present yourself for accountability. • Follow the directions of the LED and/or EAT members, remaining in the assembly area until given other instructions. • Refrain from smoking, eating, or drinking in the assembly area.

APPENDIX F (cont)

BUILDING/FACILITY/AREA/WORK LOCATION OCCUPANTS GUIDELINES		
POWER FAILURE	**TELEPHONE BOMB THREAT RECIPIENT**	**SUSPICIOUS PACKAGE OR SUSPICIOUS MAIL**
• Complete the actions specified in the "First-on-Scene and Initial Response" Guidelines. • Remain calm. • Set equipment to "off." • Assist visitors in implementing protective actions. • Ensure classified material and vital records are secured. • Take personal possessions when leaving but do not delay to retrieve them. • Proceed to the nearest lighted area. • Follow the instructions of the LED and EAT members, remaining in the lighted area until given other instructions. • Comply with steps in the applicable checklist (e.g., Evacuation or Shelter-in-Place), if required.	• Remain calm and gather as much information as possible, completing FRM-1705, "Telephone Bomb Threat Checklist." • Immediately call 911 when the caller hangs up. • Notify the FM/FO/LED/EAT members. • Notify the OCC Duty Manager at 702-295-0311. • Follow the directions of the FM/FO/LED/EAT. • Comply with steps in the applicable Guidelines (e.g., Evacuation or Shelter-in-Place), if required.	• Remain calm. • Refrain from going near the package/object. • Secure the area around the package/object, if possible, leave area as found, and avoid creating an air current. Note other suspicious objects. • Notify the FM/FO/LED/EAT immediately and be available for questioning. • Notify the OCC Duty Manager at 702-295-0311. • Follow the directions of the FM/FO/LED/EAT. • Comply with steps in the applicable Guidelines (e.g., Evacuation or Shelter-in-Place), if required.

APPENDIX G
Local Emergency Director/Emergency Coordinator Contact Information

Area 5 RWMC Local Emergency Director/Emergency Coordinator

Michael Millard

- Work: (702) 295-9643
-
- Pager: (702) 794-1787
-
-

Alternates

Jerry D. Freter

- Work: (702) 295-6808
-
- Pager: (702) 794-1829
-

APPENDIX H
Area 5 RWMC Emergency Equipment List

RWMC EMERGENCY EQUIPMENT Emergency equipment available for use in emergency response to Disposal Cell number 3:		
Equipment	**Location**	**Uses & Equipment**
Anti-contamination clothing	Building 5-31 Building 5-32	PPE
Respirators Full-face High-Efficiency Particulate Air	Building 5-31 Building 5-32	PPE
Air Samplers with Sample Heads and filters	Building 5-31 Building 5-32	Spill Response
Portable Radiological Instruments	Building 5-31 Building 5-32	Spill Response
Personnel Decontamination Kit (See RCT Inventory List)	Building 5-31 Building 5-32	Personnel Decon
READY Kit (See RCT Inventory List)	Building 5-31 Building 5-32	PPE
Stretcher - 1	P03U Sealand® (1)	First Aid
Fire Extinguishers	Building 5-7 Building 5-31 Equipment Shed 5-21 P03U Sealand® Building 5-6 Building 5-32 Building 5-33 Building 5-19 Building 5-18 Building Boneyard Building 5-21 Building RCT Sealand® extinguishers throughout disposal cells	Fire Suppression
First Aid Kit	Building 5-7 Building 5-31 Building 5-32 Building 5-33	First Aid
RCT Equipment	SIS Pinky (connex by VERB) VERB CAAB Buildings 5-7 / 5-33	All PPE Instruments All PPE, Respirators, some Instruments All PPE, Respirators and Instruments Limited PPE and Respirators

APPENDIX H (cont)

Eye Wash	Building 5-31 Building 5-32	First Aid
Emergency Shower	Building 5-31	First Aid & Decon
Evacuation Alarm	Building 5-7	Evacuation
Portable Radios	RWMS	Personnel Commo
Spill Response Kit (Misc spill response equip)	P03U Sealand® Northeast Corner of TRUPad	Spill Response

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

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

B.8.a Hazards in Off-Loading Operations

Specific precautions to be taken during off-loading operations include preventative measures and monitoring activities to safely manage LLMW and LLW. Generators will provide advanced notification of shipments to the RWMS to ensure that shipments are authorized and scheduled with the facility.

Precautions to be taken during off-loading operations to prevent releases to the environment or exposure to MWDU personnel include:

- Examination of required documents for each waste shipment to verify that all information is accurate and complete.
- Surveys of waste transport vehicles using appropriate portable radiation detection instruments and/or standard swipe survey techniques. Vehicles and trailers are also surveyed before being released from the RWMS.
- Swipe samples are collected and analyzed for radiological parameters from the exterior surface of selected containers.
- Container handling equipment used to prevent ruptured containers includes drum dolly, mobile crane, or forklift with drum lift attachments or slings. Ramps may also be used during off-loading and to conduct visual inspections of containers.
- During container handling operations, only required personnel will be allowed into the MWDU.

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

Design of the cell will prevent runoff from leaving the MWDU. Run-on is limited to the cell ramp and unloading areas. The entire RWMS facility is protected from run-on as described in B.1.b.2.

B.8.c Contamination of Water Supplies

Contamination of water supplies by the MWDU is highly unlikely since:

- There is no surface water near the MWDU.
- The average annual potential evapotranspiration rate is approximately 11 times the average annual precipitation rate at the NTS; leading to a net water deficit in surrounding soils.

- The depth from the land surface to the ground water in the uppermost aquifer is approximately 255 m (835 ft).
- Wastes containing free liquids are prohibited.
- The nearest drinking water well (Well 5b) is located approximately 6.5 km (4.0 mi) away from the RWMS.
- The RWMS inspection program is designed to quickly discover safety or environmental hazards. The emergency response plan/contingency plan is intended to facilitate rapid response and cleanup of releases.
- The leachate storage tank will have a secondary containment vault and underground piping will be double wall construction.

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

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

- Waste containers will be moved and placed in disposal configuration by equipment. Failed equipment can be replaced or activities can be delayed until the equipment is repaired.
- RWMS emergency communication equipment will be inspected monthly to ensure adequate inventory and proper operation. Hand-held radios are tested daily for proper function.
- Final design for operating the leachate collection system will include a back up system to remove leachate from the sumps.
- Normal operations will be limited to daylight hours.

B.8.e Undue Exposure of Personnel to Typical LLMW

Waste disposed at the MWDU will be containerized or encapsulated limiting the possibility of undue exposure of personnel. RWMS 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 assist in minimizing undue exposure, accidents, and injuries. RWMS personnel working with LLMW are trained and aware of potential hazards. Implementation of planning documents such as health and safety plans and radiological work permits further reduce potential employee exposures.

B.8.f Aisle Space

Aisle space will be maintained by designated travel routes and an access ramp that allows the unobstructed movement of personnel and fire protection/spill control/decontamination equipment to the MWDU during an emergency.

B.8.g Spills/Releases from the Tank or Tank Components

Spills or releases from the leachate storage tank will be contained in the tank’s secondary containment structure. The tank and secondary containment will be inspected as represented in Table 5 and corrective actions will be documented and tracked to completion.

B.8.g Releases to the Atmosphere

Releases to the atmosphere are minimized through the use of DOT approved packaging. All LLMW is packaged, shipped, handled, and disposed in DOT approved containers. Broken containers are not accepted for disposal. Additionally, transporters 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 will not be accepted for disposal at the MWDU.

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

Offsite generators transport LLMW to the RWMS on U.S. Highway 95 to the Mercury Highway entrance to the NTS. Major traffic flow into Area 5 is via the paved 5-01Road. Direct access off 5-01 Road to the RWMS 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/hr (45 mi/hr). Conventional stop and yield signs at major intersections are used to maintain traffic flow and control throughout the NTS. 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. Several oil and chip applications have been applied over the years. 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 definitely 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 inspection, continued maintenance, and reduced speed limits.

Within the RWMS, transport vehicles proceed through the gate adjacent to the Control Area Access Building 5-31 to Building 5-6 for real-time radiography (RTR) if necessary. Upon conclusion of RTR, waste containers are transported to the MWDU. Shipments not requiring RTR proceed directly to the MWDU.

Containers that fail RTR are moved to the verification hold area for disposition. Figure 11, Travel Routes within the RWMS, depicts the waste transportation routes through the RWMS access gate and into the MWDU.

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

Figure 11 Travel Routes within the RWMS

Reviewed and determined to be UNCLASSIFIED.
This review does not constitute clearance for public release.

Derivative Classifier: Richard Mullen Engr RM (Name/Organization)

Date: 3/25/09

FIGURE 11

TRAVEL ROUTES WITHIN THE RWMS

SCALE : 1" = 200'

1. MW CONTAINER TRANSPORT TRUCK ROUTE ALTERNATE 1
2. MW CONTAINER TRANSPORT TRUCK ROUTE ALTERNATE 2

LEGEND

- EXISTING PAVED ROAD
- EXISTING GRAVEL/DIRT ROAD
- EXISTING BUILDING OR STRUCTURE
- TEMPORARY BUILDING OR STRUCTURE
- COVERED PIT/TRENCH
- OPEN PIT/TRENCH
- EXISTING FENCE
- NEW FENCE

GRAPHIC SCALE

0 100 200 400 600 FEET

1" = 200'

GS

NO	DATE	REVISIONS	DRAWN	PREPARER	CHECKER	PROJ ENGR	APPROVER USER

NATIONAL NUCLEAR SECURITY ADMINISTRATION

NEVADA SITE OFFICE — LAS VEGAS, NEVADA

NEVADA TEST SITE — AREA 05

RWMS FIGURE SKETCHES

TRAVEL ROUTES WITHIN THE RWMS

DRAWN	PREPARER	CHECKER	PROJECT ENGINEER	APPROVER / USER
DATE	DATE	DATE	DATE	DATE

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

ENGINEERING NO. 09042

ORIGINAL SIGNATURES ON FILE

DRAWING NUMBER / WORK ORDER NUMBER: SK-09042-C-1011

REVISION 0

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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 NTS 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 12).

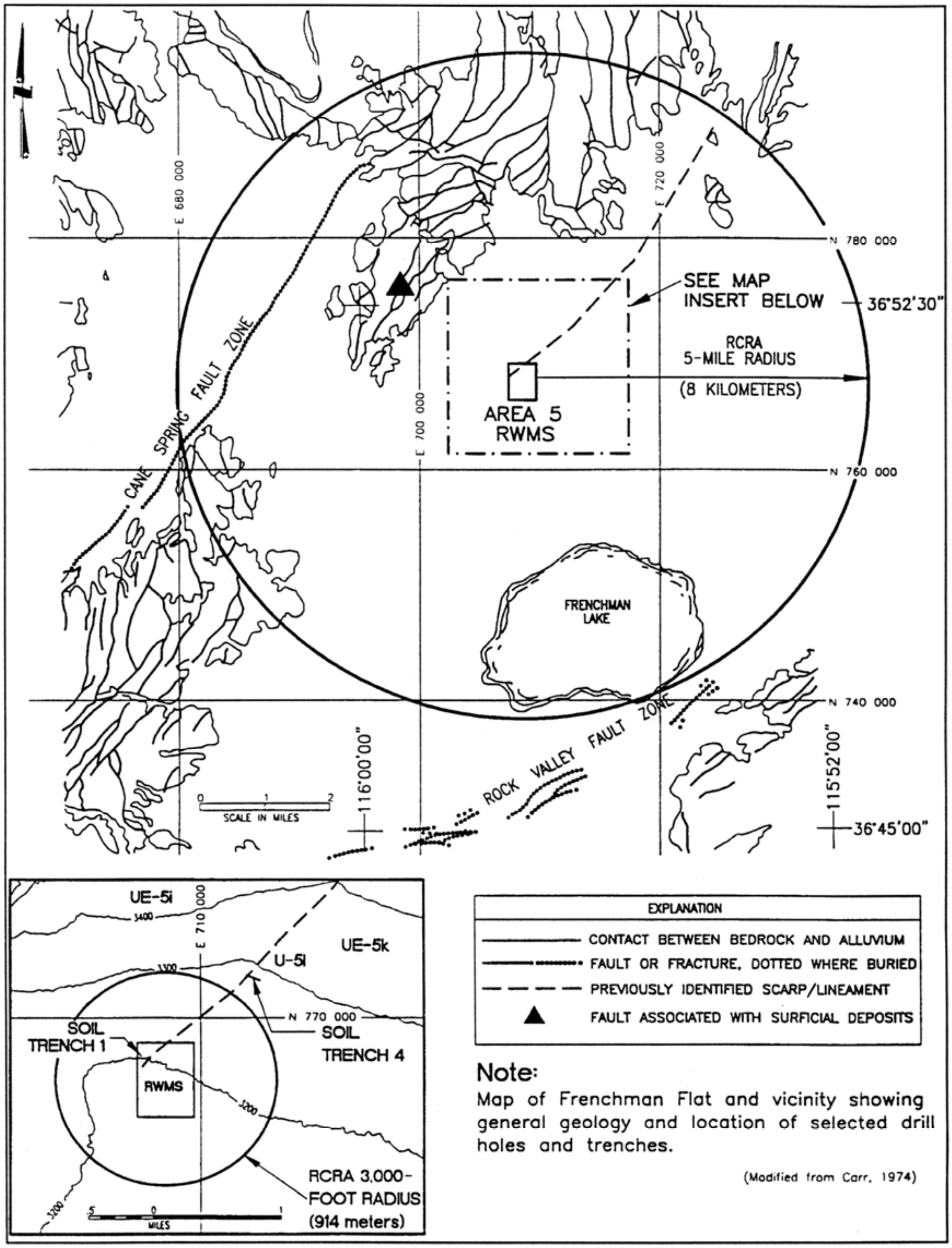


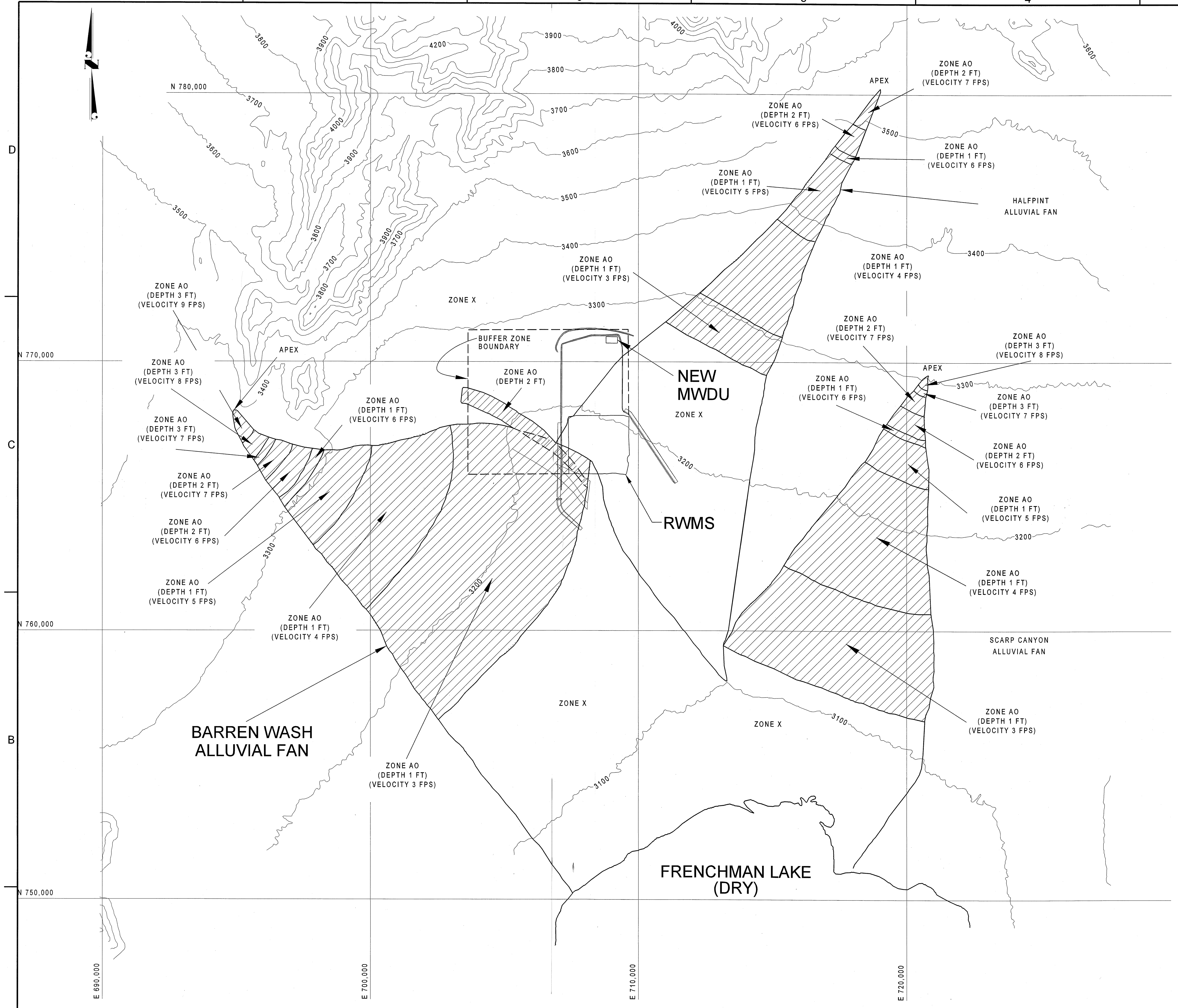
Figure 12 Map of Structural Pattern

The RWMS lies between two northeast-trending Quaternary fault zones: the Cane Spring fault zone, 6.5 km (4 mi) northwest of the RWMS; and the Rock Valley fault zone, 9.0 km (5.5 mi) south of the RWMS. A search of the University of Nevada-Reno Seismology Laboratory (www.seismo.unr.edu) database (1852 to 2005) for earthquakes in the Richter magnitudes greater than 4.0 occurring in the approximate southern half of the NTS shows 67 events. Thirty-three of the 67 recorded earthquakes are coincident with the date of an underground test (DOE, 1994). Seven additional earthquakes 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. Thirteen of the 67 earthquakes had Richter magnitudes between 5 and 6, inclusive; and two had Richter magnitudes greater than 6 (the largest earthquake had a magnitude of 6.2).

No surface-cutting or Holocene faults have been identified within 915 m (3,000 ft) of the RWMS (Raytheon Services Nevada, 1994). Activities used to identify and evaluate any potential surface-cutting faults included (1) detailed geomorphic mapping of waste disposal trench walls and pits at the RWMS, (2) video logging of one of the Greater Confinement Disposal boreholes, (3) lineament map preparation and associated field investigations, (4) trench excavations and mapping, (5) subsurface 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 13).

Figure 13 100-Year Flood Delineation



LEGEND

- ALLUVIAL FAN BOUNDARY
- BOUNDARY OF RADIOACTIVE WASTE MANAGEMENT SITE (RWMS)
- BOUNDARY OF AREA PROPOSED FOR RWMS EXPANSION
- 100-YEAR FLOOD ZONE OF SHALLOW CONCENTRATED FLOW
- 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 (.30M AND .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 (.30M AND .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 (.30M).

Reviewed and determined to be UNCLASSIFIED. This review does not constitute clearance for public release.

Derivative Classifier: Rulcaso Mcclow Exop RM (Name/Organization)

Date: 3/25/09

FIGURE 13

100-YEAR FLOOD ZONE DELINEATION

NO	DATE	REVISIONS	DRAWN	PREPARER	CHECKER	PROJ ENGR	APPROVER/USER

GS

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

NEVADA TEST SITE — AREA 05
RWMS FIGURE SKETCHES

100-YEAR FLOOD ZONE DELINEATION

DRAWN DATE | PREPARER DATE | CHECKER DATE | PROJECT ENGINEER DATE | APPROVER/USER DATE

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

ENGINEERING NO. 09042 — ORIGINAL SIGNATURES ON FILE

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Mapping of approximately 200 m (650 ft) of exposed walls in these trenches to a depth of 3 m (10 ft) did not identify any surface-cutting faults associated with either the scarp or apparent fault in the surface alluvium. Additionally, a basalt flow or sill was intersected beneath about 290 m (950 ft) of alluvium in drill holes UE-5i and UE-5k, located approximately 2 km (1.2 mi) north and northeast of the RWMS, respectively (Figure 12, Map of Structural Pattern). The numerical age of this basalt, presumably from a local center within or near Frenchman Flat, is 8.6 million years (B. Turrin [personal communication], August 1993). Occurrence of the basalt at a similar depth in these drill holes, which are 2 km (1.2 mi) apart and separated by this scarp, provides further evidence that this 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 RWMS in the longitudinal valley of the Massachusetts Mountains (Figure 12, Map of Structural Pattern). 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 RWMS **[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 RWMS. These investigations show that this lineament is not a surface-cutting fault or Holocene tectonic feature.

B.11.b Flood Plain

The MWDU is located outside the 100-year floodplain and is in compliance with **40 CFR 264.18(b)** and **270.14(b)(11)(iii)**. The southwest corner of the Area 5 RWMS falls within a 100-year floodplain as illustrated in Figure 13, 100-Year Flood Delineation. The RWMS is located in an area that is not subject to frequent flooding. The washes that drain toward the RWMS are normally dry and flow only 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 methodology. A flood study using FEMA methodology was completed and submitted to the NDEP in February 1993. *Flood Assessment at the Area 5 Radioactive Waste Management Site, DOE/Nevada Test Site, Nye County, Nevada* (Exhibit 3) evaluated the 100-year flood hazard.

The overall watershed that could impact the RWMS is approximately 365 km^2 (140 mi^2) (Figure 2, Topographic Features). This watershed was divided into 16 subbasins to best represent the hydrology of the study area. U.S. Geological Survey 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 sheetflow in lower parts of the fan.

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 these alluvial fans according to FEMA methodology. The results of the alluvial fan analyses are shown in Figure 13, 100-Year Flood Delineation.

FEMA designates alluvial fan flooding, shallow concentrated flow, and sheetflow 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 RWMS is within the 100-year flood hazard (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.

The HEC-2 model developed by the U.S. Army Corps of Engineers (COE) 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 0.30 m (1 ft) along the southwest corner of the RWMS, also placing this part of the RWMS in the 100-year flood hazard (Zone AO).

For the remaining subbasins that could impact the RWMS, flood hazard determinations were conducted assuming sheet-flow conditions. The analysis, using FEMA methodology for sheet-flow, concluded that these sheet-flow regions be designated as Zone X. FEMA defines Zone X as representing 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 within this zone. For this reason, flood hazard zone protection must be addressed.

Flow from the watersheds above the Area 5 RWMS is diverted by flood control structures located on three upstream sides of the RWMS. These structures have been engineered to maintain a run-on control system capable of preventing flow into the active portion of the Area 5 RWMS during peak discharge from a 25-year, 24-hour storm.

Exhibit 3, Flood Assessment at the Area 5 Radioactive Waste Management Site DOE/Nevada Test Site, Nye County, Nevada

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.

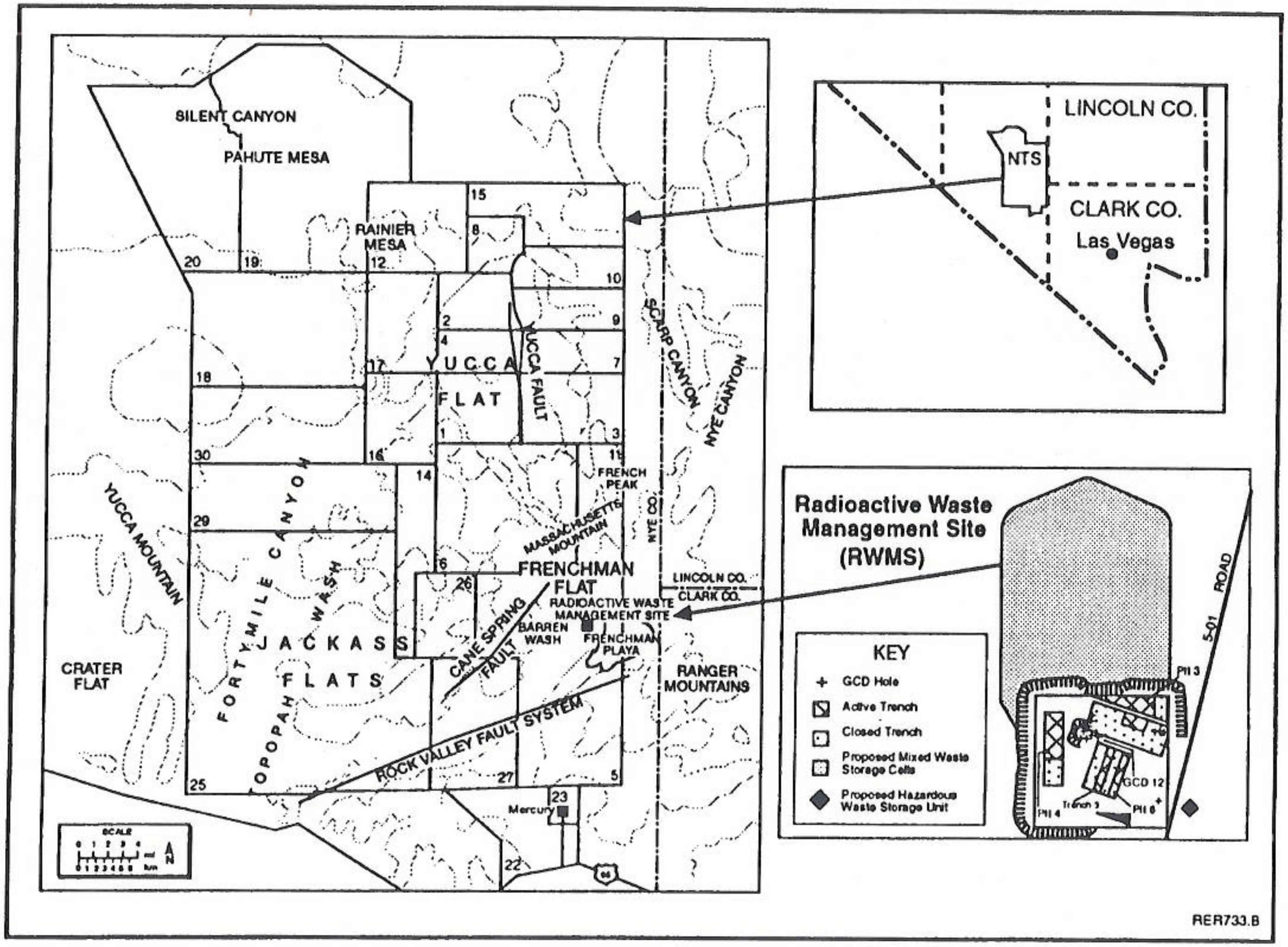


Figure 1. Location Map and Physiographic Features of the Nevada Test Site and the Area 5 Radioactive Waste Management Site

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).

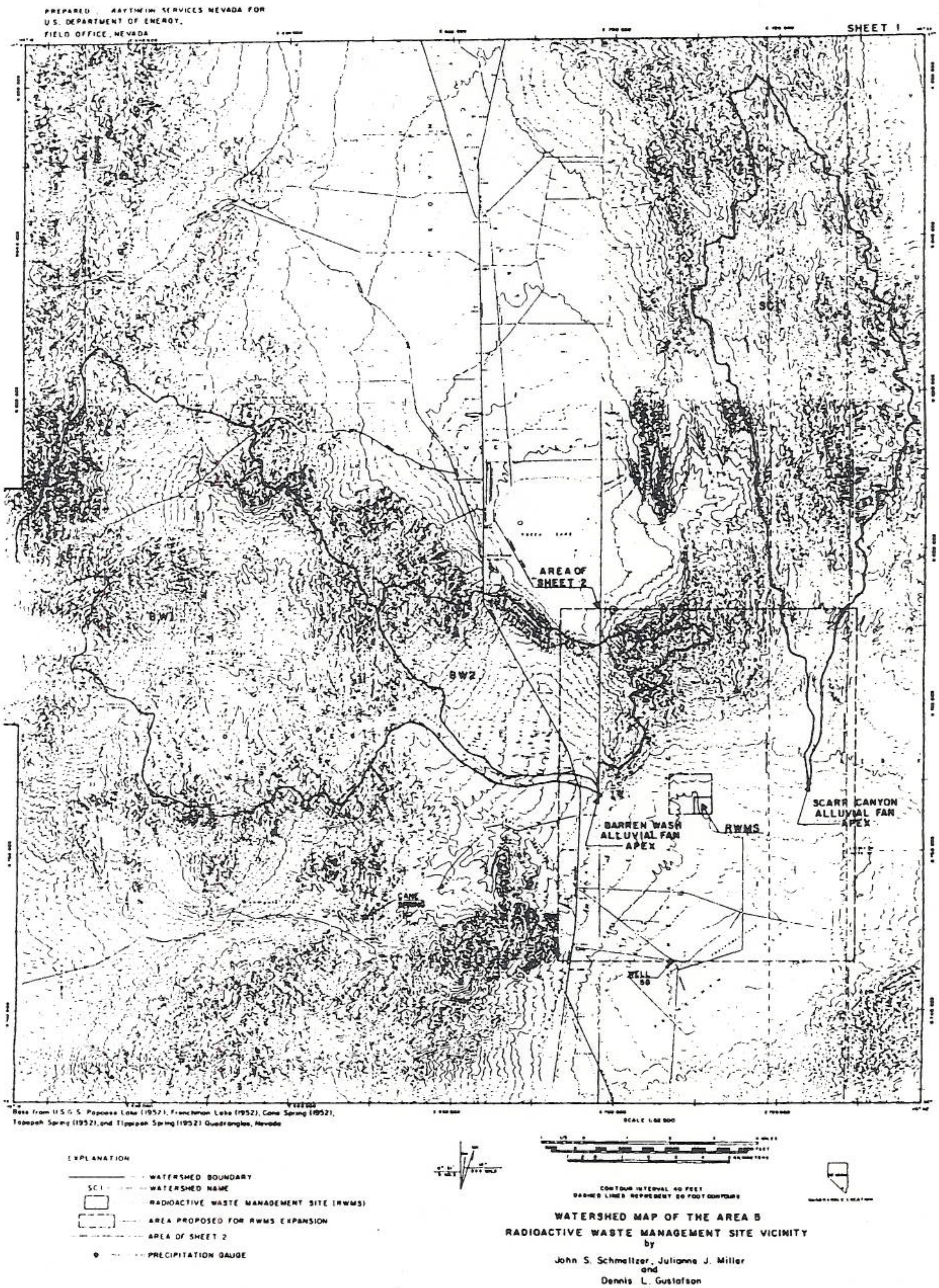
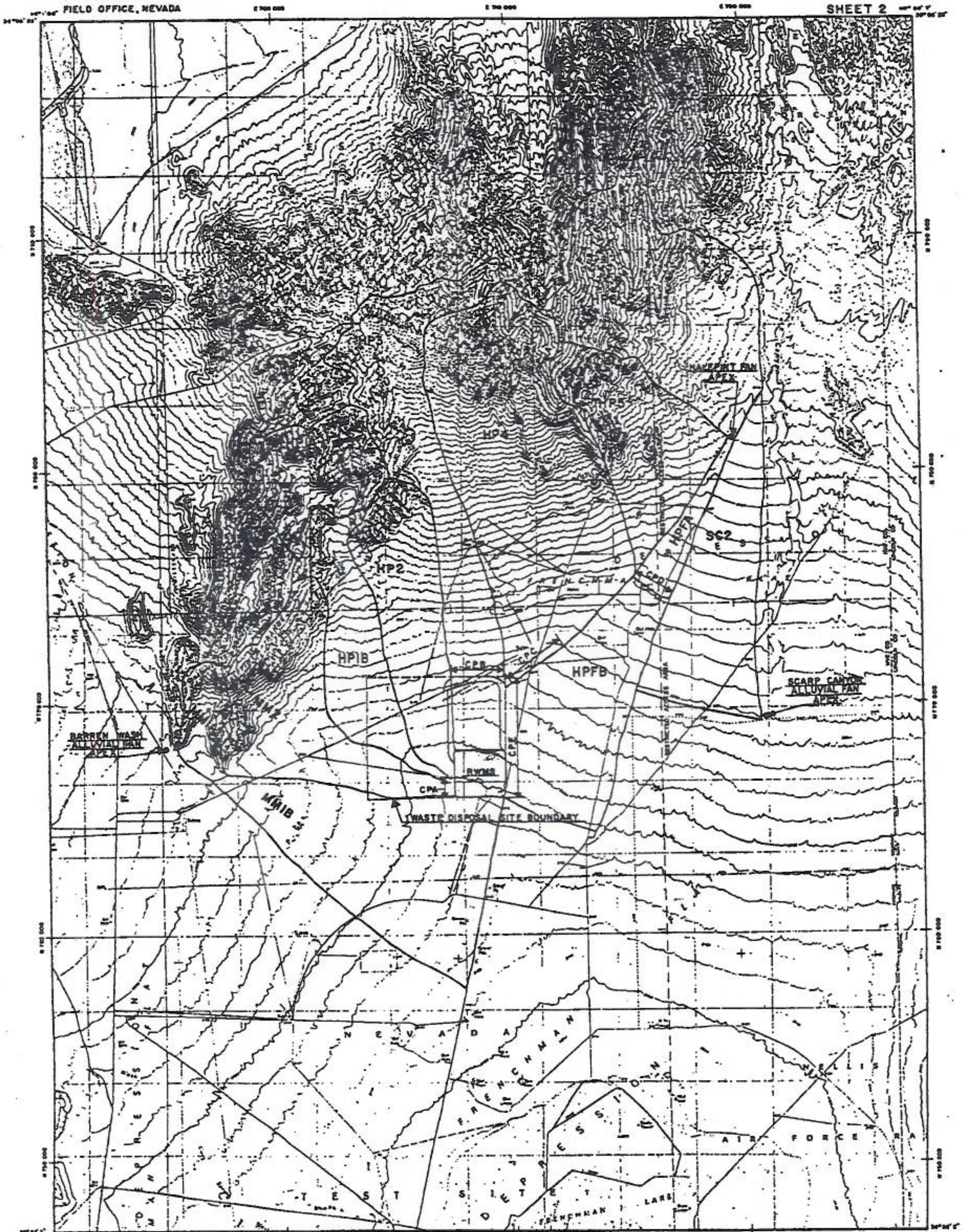


Figure 2. **Watershed Map of the Area 5 Radioactive Waste Management Site Vicinity (Sheet 1).** The overall watershed is divided into 16 subbasins; 13 are shown here, with the remainder shown on Figure 3 (Sheet 2).

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

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.

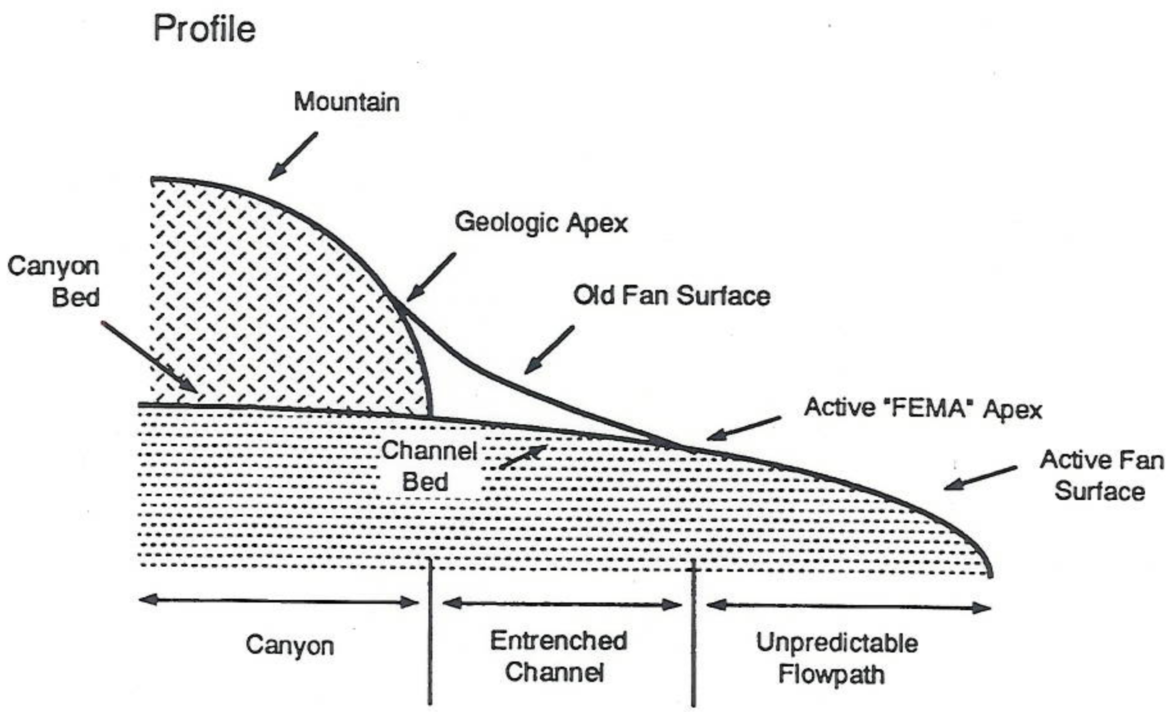


Figure 4. Idealized Alluvial Fan Profile. The geologic apex is the intersection of the mountain front and the piedmont plain. The active "FEMA" apex is the point below which the flow of the main channel becomes unpredictable.

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*.

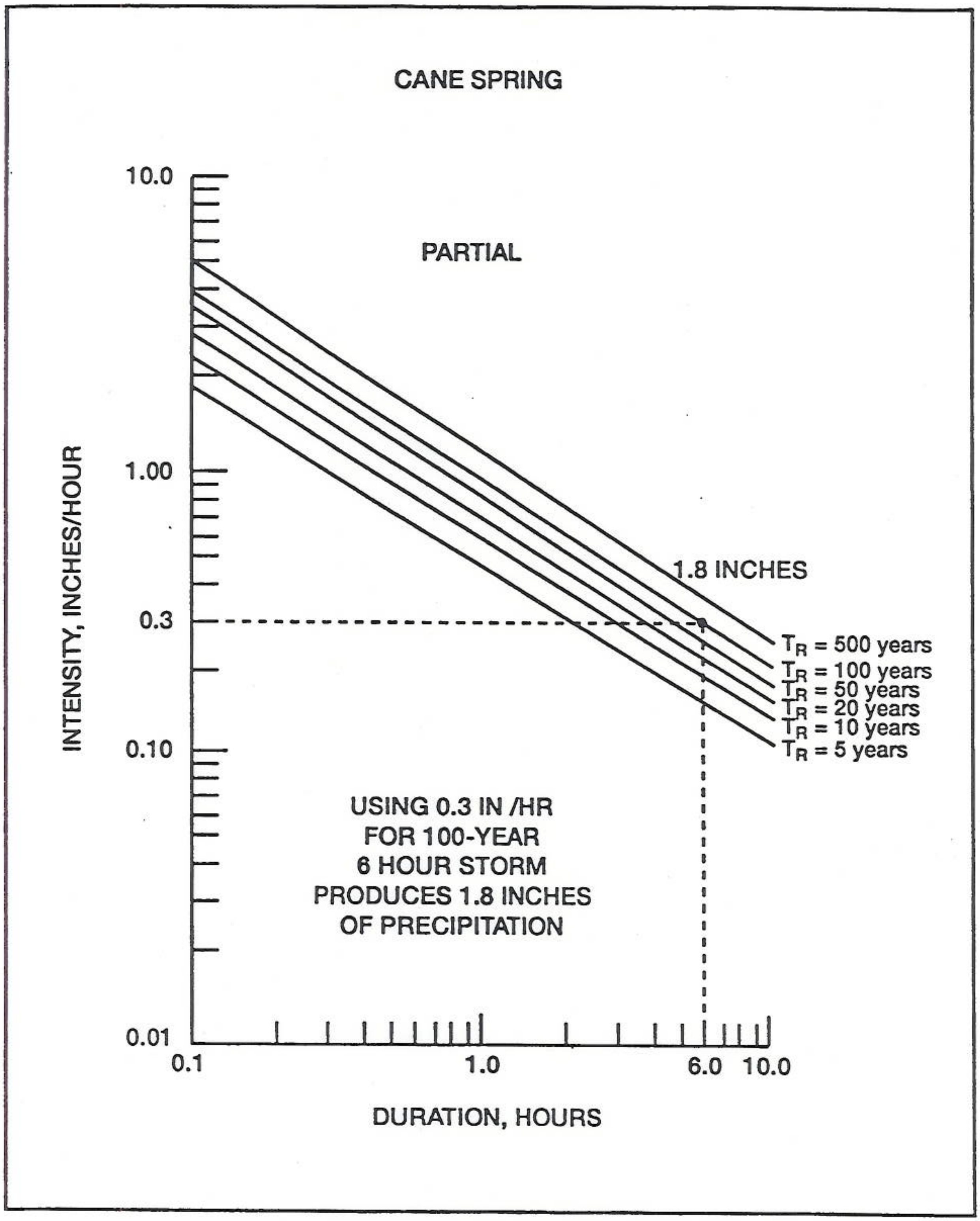


Figure 5. Intensity Duration Relationships for Various Return Periods, Cane Springs, Nevada Test Site, Nevada (modified from French, 1983). The 100-year, 6-hour point precipitation value of 1.6 inches compares well with the value from French, 1983.

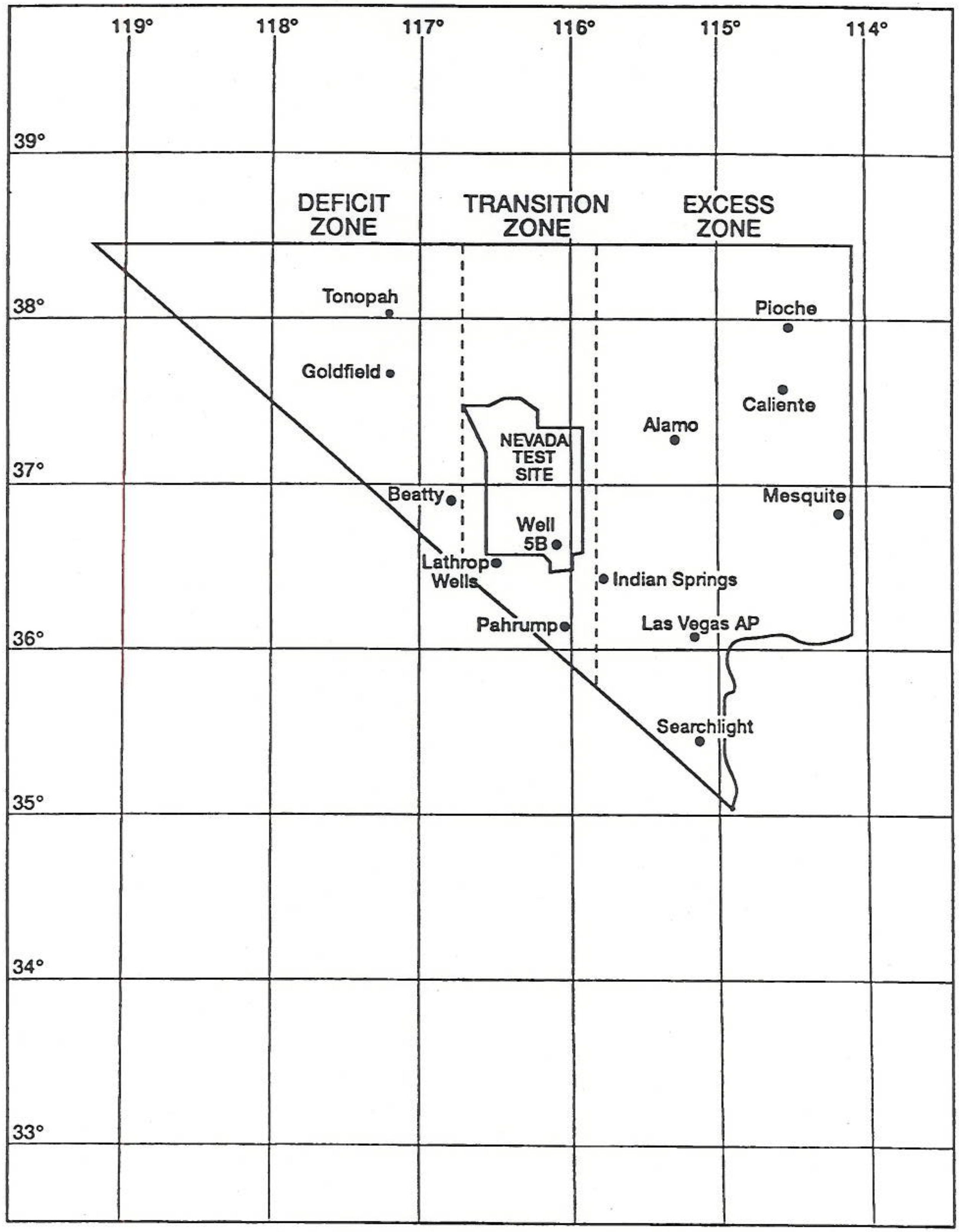


Figure 6. Hypothesized Zones of Precipitation in Southern Nevada (modified from French, 1983). The NTS is located in the transition zone of precipitation.

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)

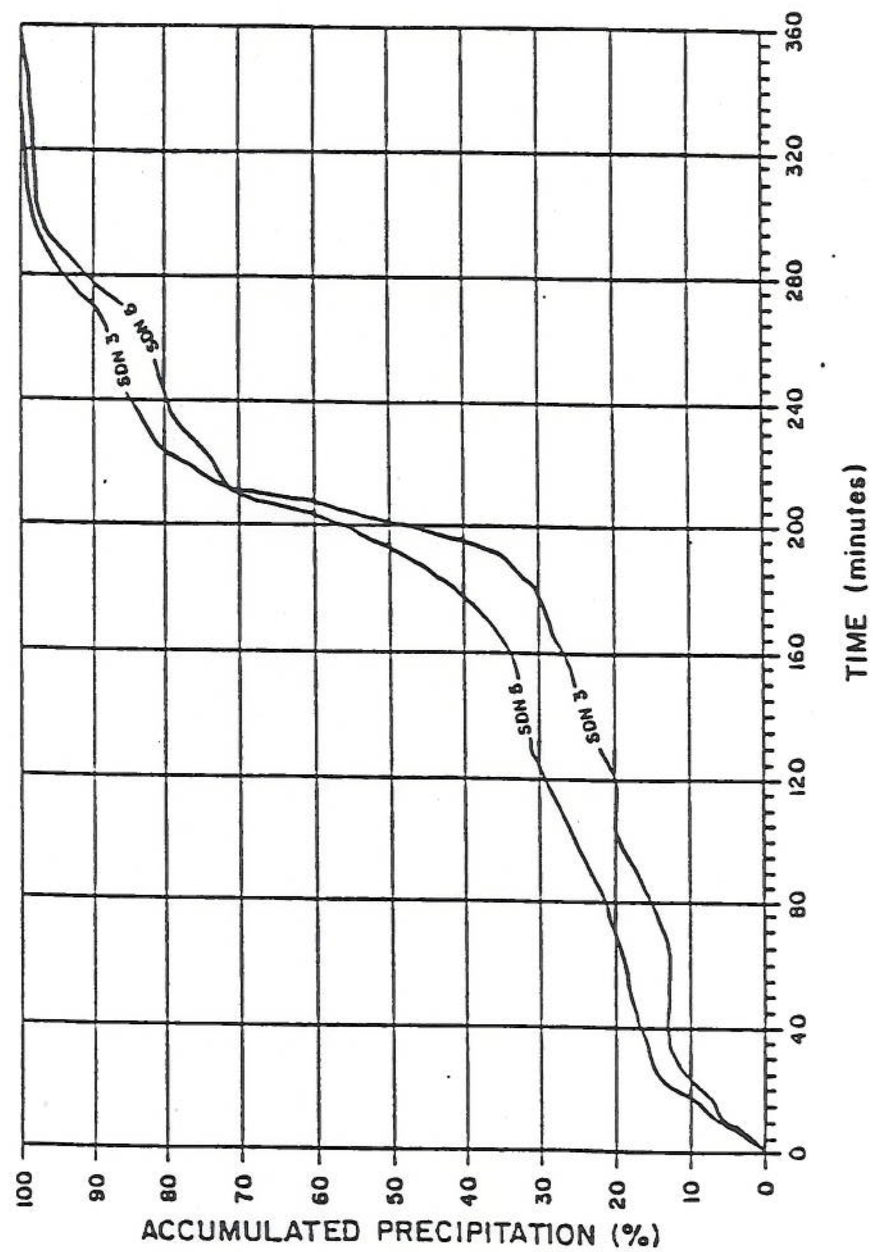
7.5-minute Topographic Quadrangles (USGS):

- 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:

SIX-HOUR DESIGN STORM DISTRIBUTIONS



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.

		Curve Numbers			
Watershed Name	Basin Area (mi^2)	AMC I	AMC II	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.

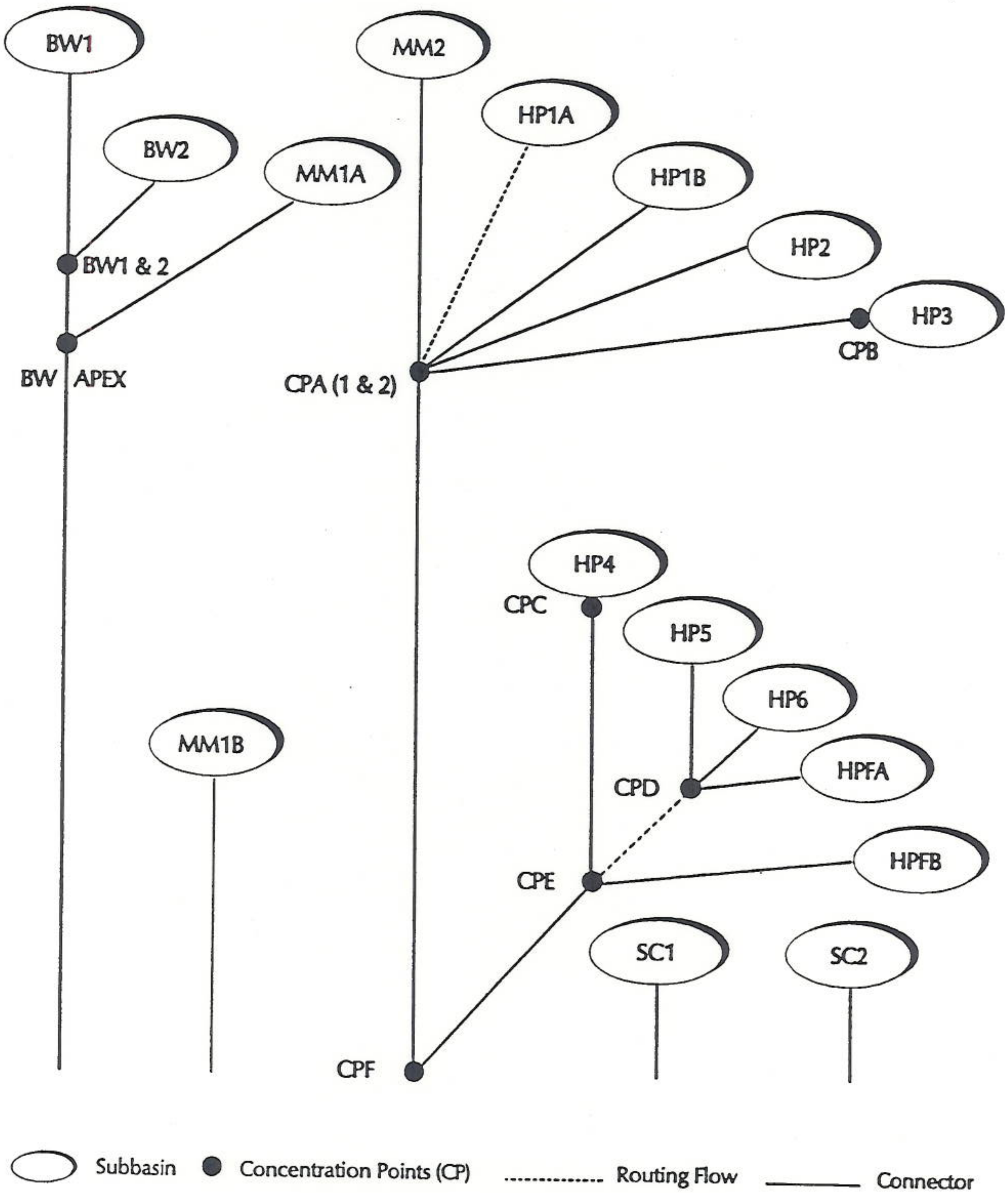


Figure 8. Schematic Diagram of Stream Network. This diagram shows how the 16 subbasins were combined in the HEC–1 models.

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

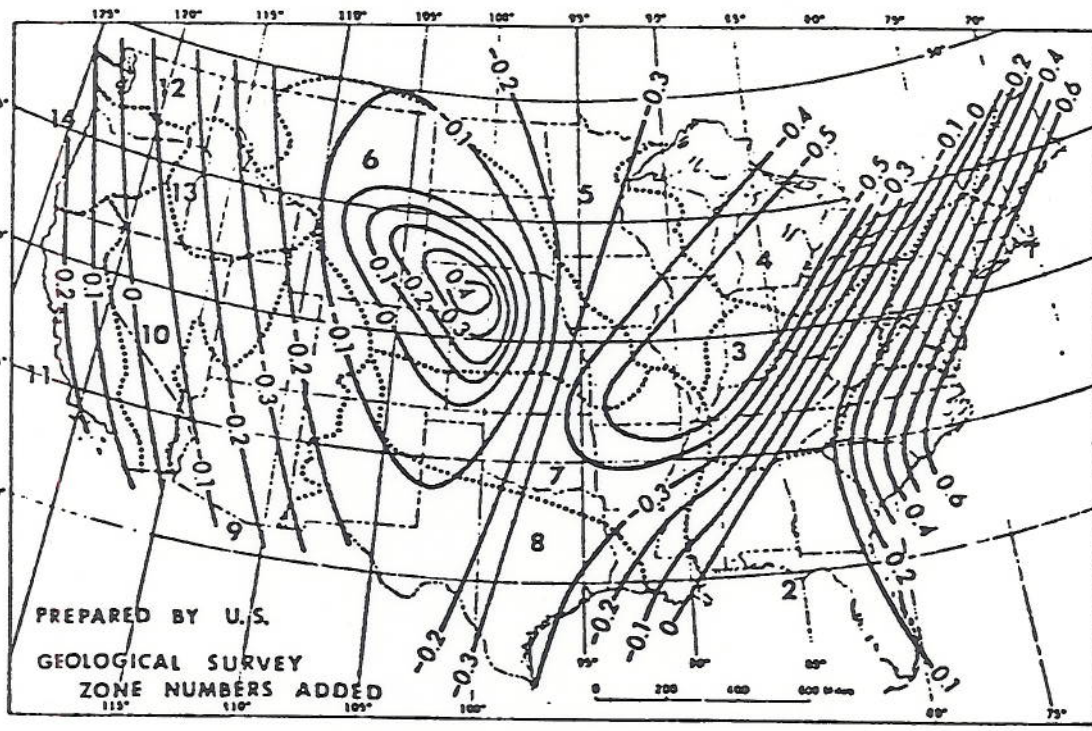


Figure 9. **Generalized U.S. Skew Coefficients (WRC [1981]).** The Nevada Test Site is located in an area with a zero skew coefficient value.

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.

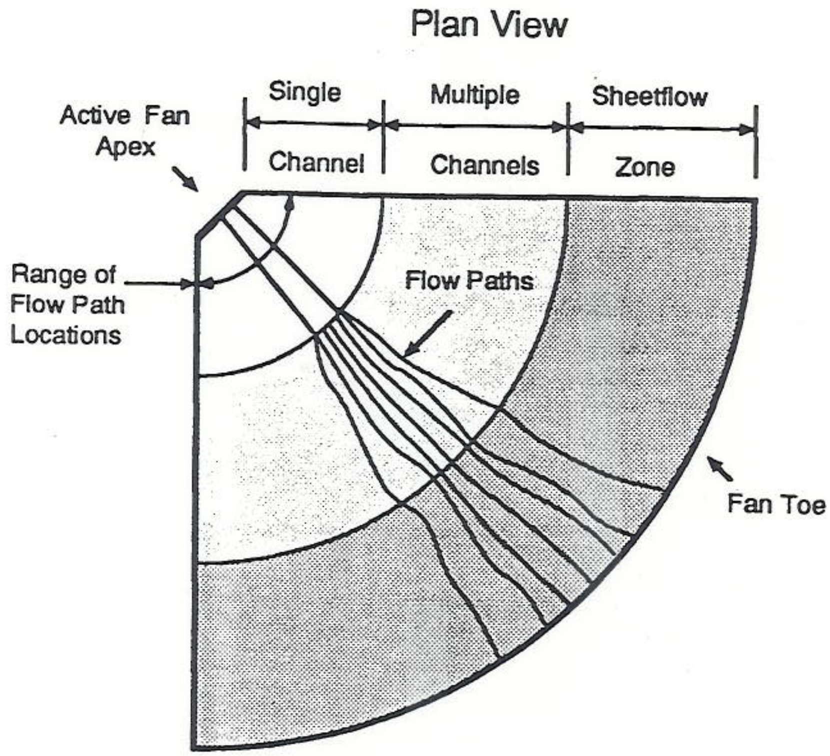


Figure 10. Alluvial Fan Plan View (modified from French, 1989). Plan view of an idealized alluvial fan showing the single channel, multiple channel, and sheetflow regions.

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

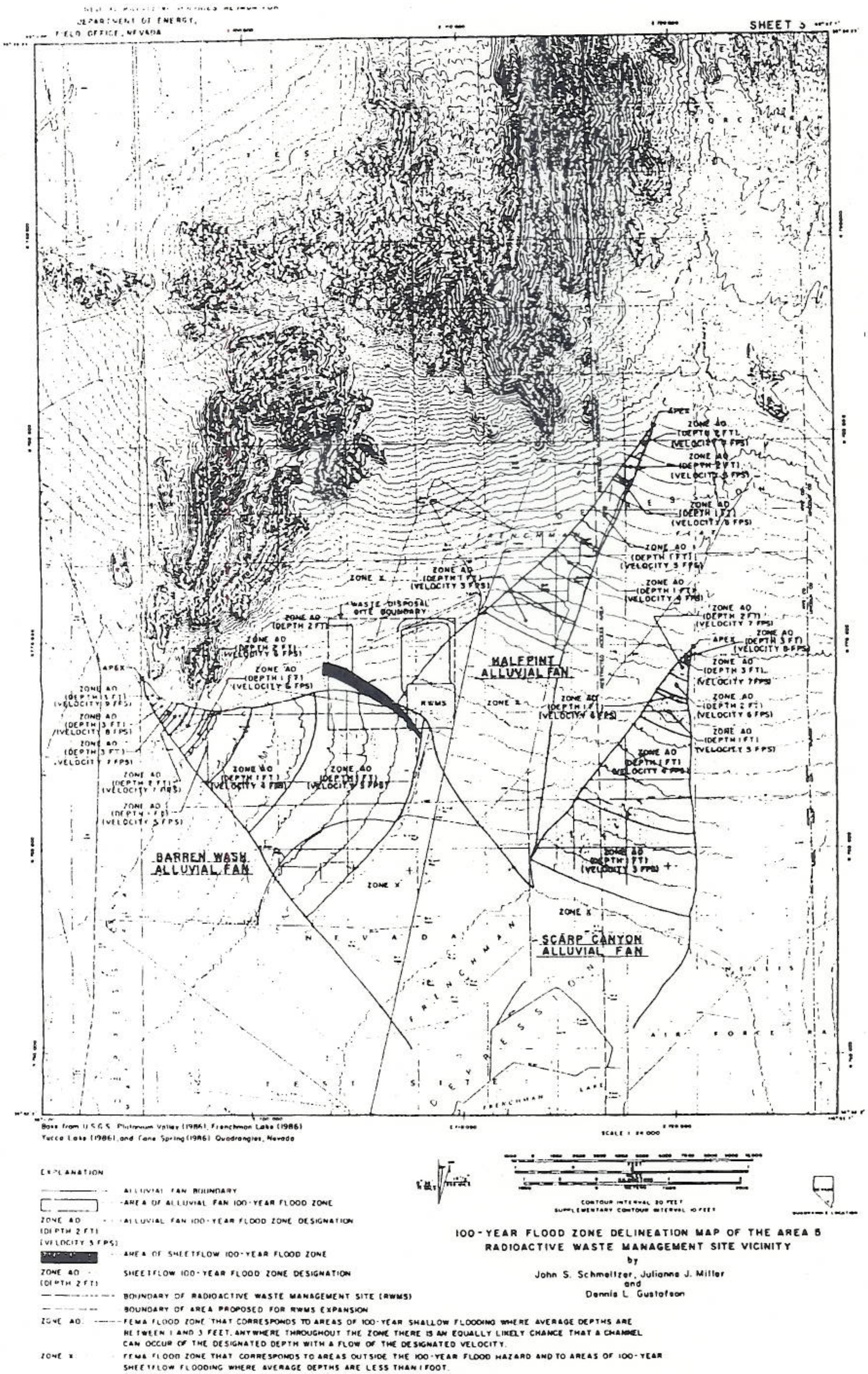


Figure 11. 100–Year Flood Zone Delineation Map of the Area 5 Radioactive Waste Management Site Vicinity (Sheet 3)

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.

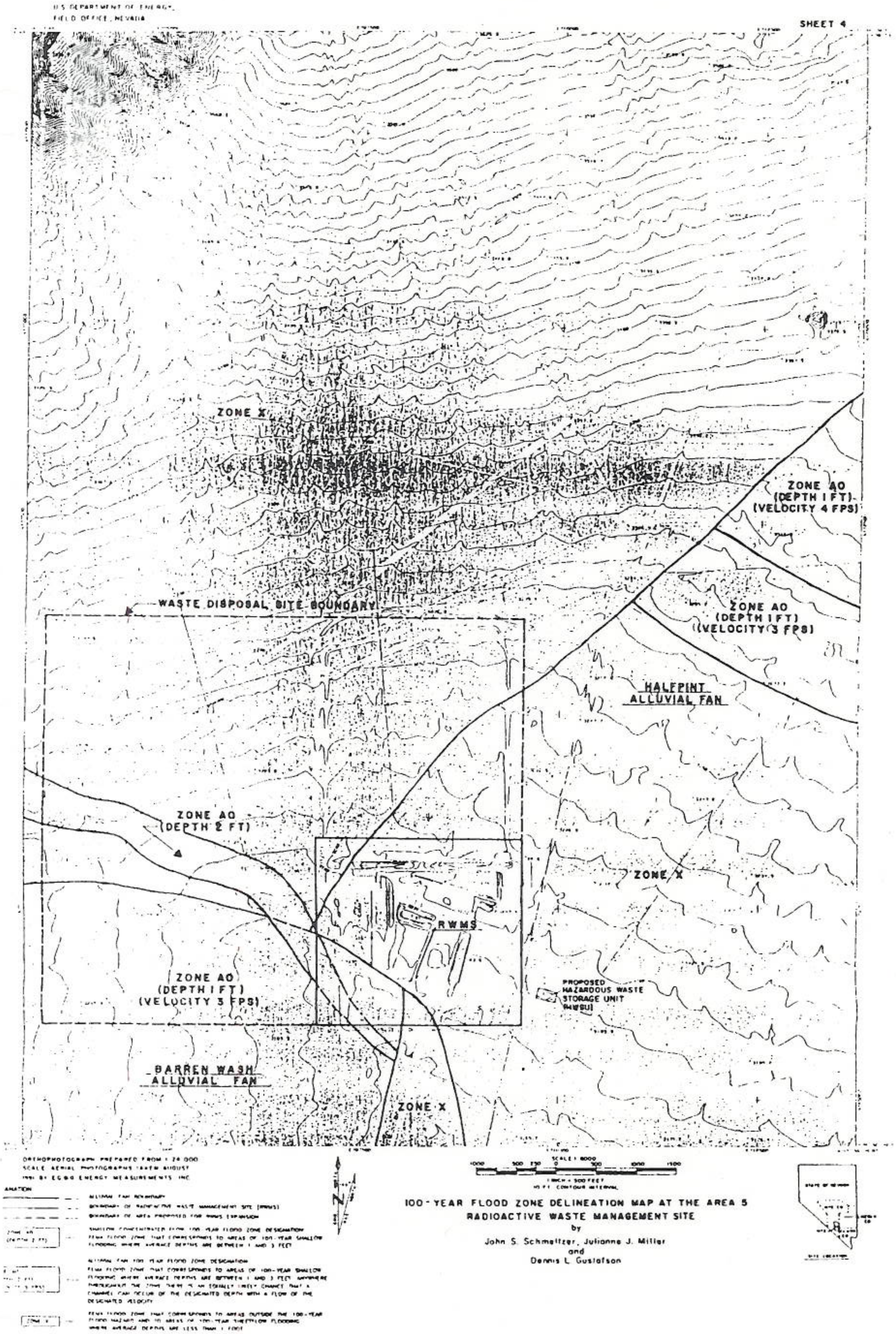


Figure 12. Orthophoto With Fans (Sheet 4)

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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*   HYDROLOGIC ENGINEERING CENTER       *
*         609 SECOND STREET             *
*     DAVIS, CALIFORNIA 95616           *
*         (916) 756-1104                *
*                                       *
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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

```
  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
```

```
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
```

```
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       .72       .36       .36
                     .18       .16       .12       .12       .12       .06       .10       .36       .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)

```
******************************************
*                                        *
*   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

```
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
```

```
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)   *
*          SEPTEMBER 1990               *
*            VERSION 4.0                *
*                                       *
* RUN DATE  01/29/1993  TIME  22:01:21  *
*                                       *
*****************************************
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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

```
ID     FLOOD ASSESSMENT FOR RWMS JOB #:51056           FILE: RWMSW.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 MAUAL (CCRFCD, 1990)
ID     CURVE NUMBER 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 10 TO ACCOUNT FOR MOISTER SOILS DURING THE 100-YR E
*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               90
UD      .31

KK      BW1
KM      Basin runoff calculation for Barren Wash 1
BA     60.5
LS               93
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     (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)    *            *  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)  *
*             SEPTEMBER 1990           *
*              VERSION 4.0             *
*                                      *
* RUN DATE  01/29/1993  TIME  22:03:06 *
*                                      *
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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: 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
```

```
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

 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

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

```
******************************************
*                                        *
*     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

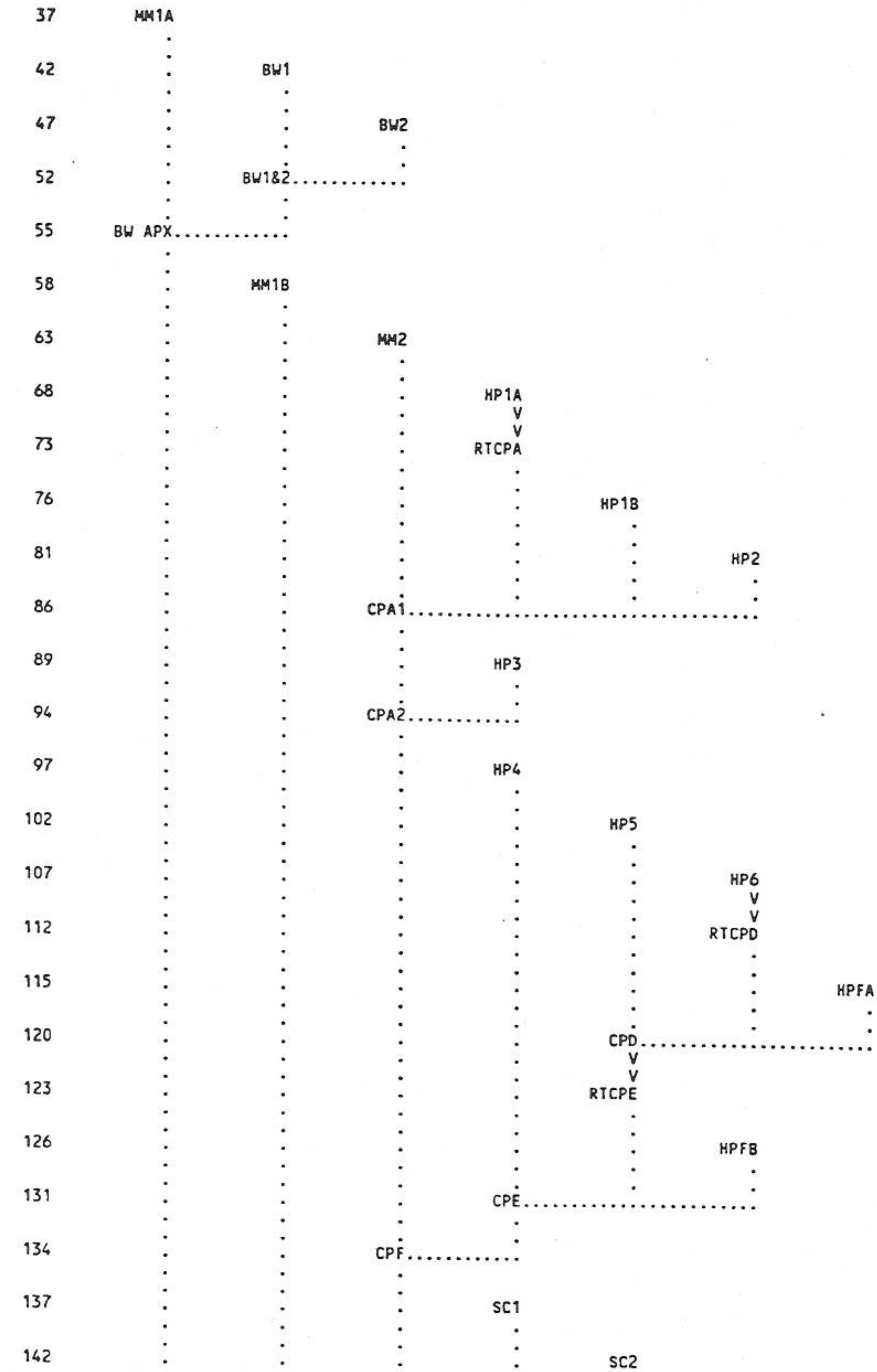
134     KK     CPF
135     KM    Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
136     HC      2

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 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)
SEPTEMBER 1990
VERSION 4.0

RUN DATE 01/29/1993 TIME 22:05:10

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 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	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)

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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  22:06:45 *                      *          (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: RWMS10C.DAT
   2         ID   10-YEAR 6-HOUR STORM 1.1 INCHES
   3         ID   POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
   4         ID   ADJUSTED RAINFALL PER CORRECTION FACTOR IN CLARK COUNTY MANUAL TABLE 501
   5         ID   DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
   6         ID   CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
   7         ID   CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
   8         ID   LAG TIMES DETEMINED 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    1.36     .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    1.32       1
  24         JD    1.17    9.99
             * CHANGED RAINFALL DISTRIBUTION ABOVE 10 SQ. MILES PER CLARK COUNTY MANUAL
  25         JD    1.17   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    1.07      20
  35         JD    1.01      30
  36         JD     .92      50
  37         JD     .82     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
```

```
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  *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    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)    *
*            SEPTEMBER 1990             *
*              VERSION 4.0              *
*                                       *
* RUN DATE  01/29/1993  TIME  22:08:57  *
*                                       *
*****************************************

*****************************************
*                                       *
*   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

ID    FLOOD ASSESSMENT FOR RWMS JOB #:51056          FILE: RWMS2.DAT
ID     2-YEAR 6-HOUR STORM 0.7 INCHES
ID    POINT RAINFALL FROM NOAA ATLAS 2 VOL VII (NO ADJUSTMENT NECESSARY)
ID    DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
ID    CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCFRCD, 1990)
ID    CURVE NUMBERS DETERMINED USING TABLE 602 IN CCFRCD, 1990
ID    LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCFRCD, 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     0.7     .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     .68       1
JD     .60    9.99
* CHANGED RAINFALL DISTRIBUTION ABOVE 10 SQ. MILES PER CLARK COUNTY MANUAL
JD     .60   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     .55      20
JD     .52      30
JD     .48      50
JD     .42     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
```

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  22:08:57  *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    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	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: $22.9512\ Q^{0.7454}$	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	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: $22.9512\ Q^{0.7454}$	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

__OCITY (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	$134.7735\ Q^{0.4869}$	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	$134.7735\ Q^{0.4869}$	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:		WIDTH (FT)
			Q	$134.7735\ Q^{0.4869}$	
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:		WIDTH (FT)
			Q	$134.7735\ Q^{0.4869}$	
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

'ELOCITY (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:		WIDTH (FT)
			Q	$10.2094\ Q^{0.8374}$	
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:		WIDTH (FT)
			Q	$10.2094\ Q^{0.8374}$	
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:		WIDTH (FT)
			Q	$6.2420\ Q^{1.0450}$	
0.5	0.3	49	0.23709	0.56316	2963
1.5	1.0	756	0.02605	0.15414	802

VELOCITY T/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY:		WIDTH (FT)
			Q	$6.2420\ Q^{1.0450}$	
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	$6.2420\ Q^{1.0450}$	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	$6.2420\ Q^{1.0450}$	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 T/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              *          * U.S. ARMY CORPS OF ENGINEERS        *
*                                           *          * HYDROLOGIC ENGINEERING CENTER       *
* Version   4.6.2;  May 1991                *          * 609 SECOND STREET, SUITE D          *
*                                           *          * DAVIS, CALIFORNIA 95616-4687        *
* RUN DATE    29JAN93    TIME    15:20:50   *          *        (916) 756-1104               *
*********************************************          ***************************************
```

```
X      X  XXXXXXX   XXXXX             XXXXX
X      X  X        X     X           X     X
X      X  X        X                       X
XXXXXXXX  XXXX     X         XXXXX    XXXXX
X      X  X        X                 X
X      X  X        X     X           X
X      X  XXXXXXX   XXXXX            XXXXXXX
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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

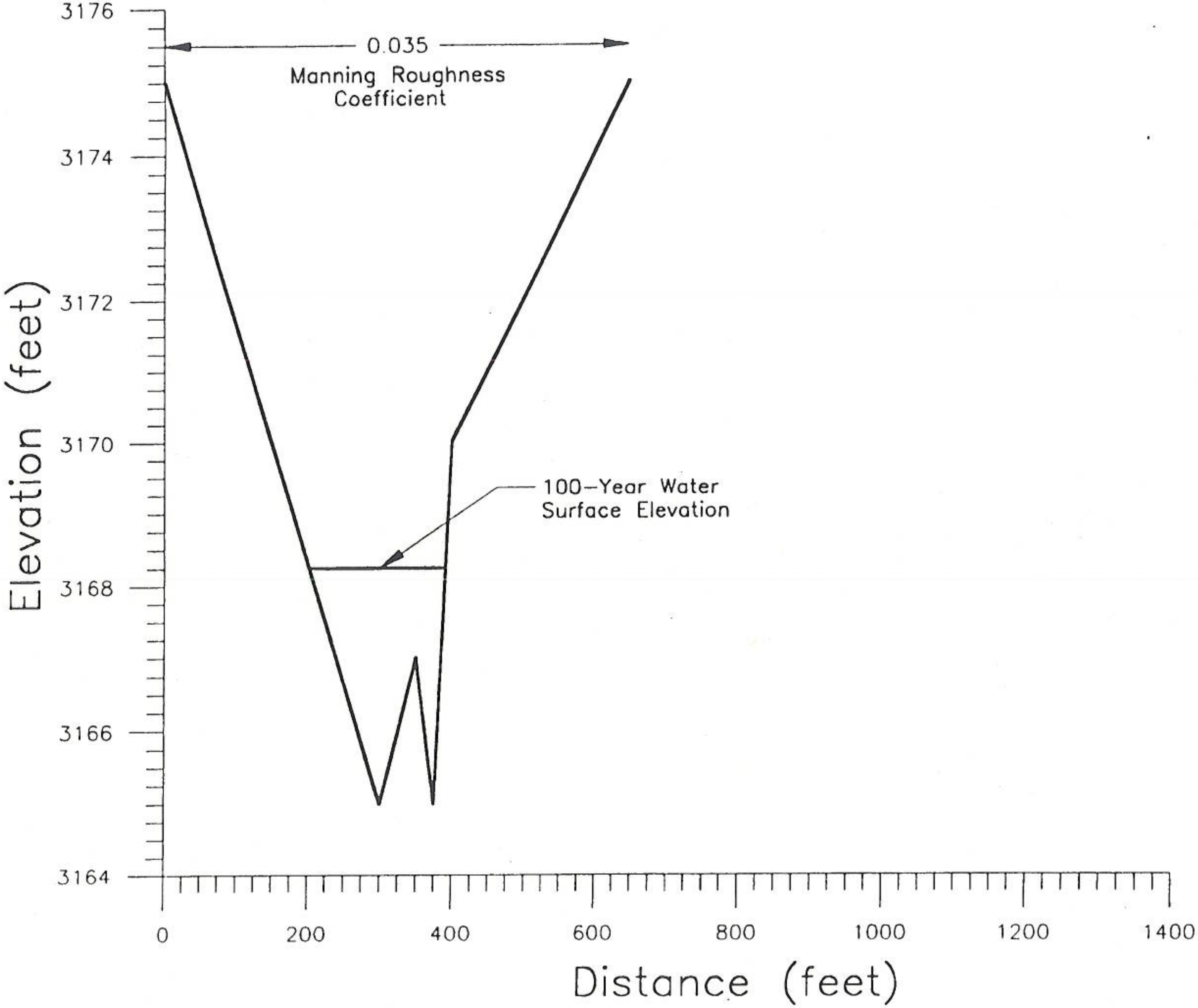
WARNING SECNO= 6.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

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

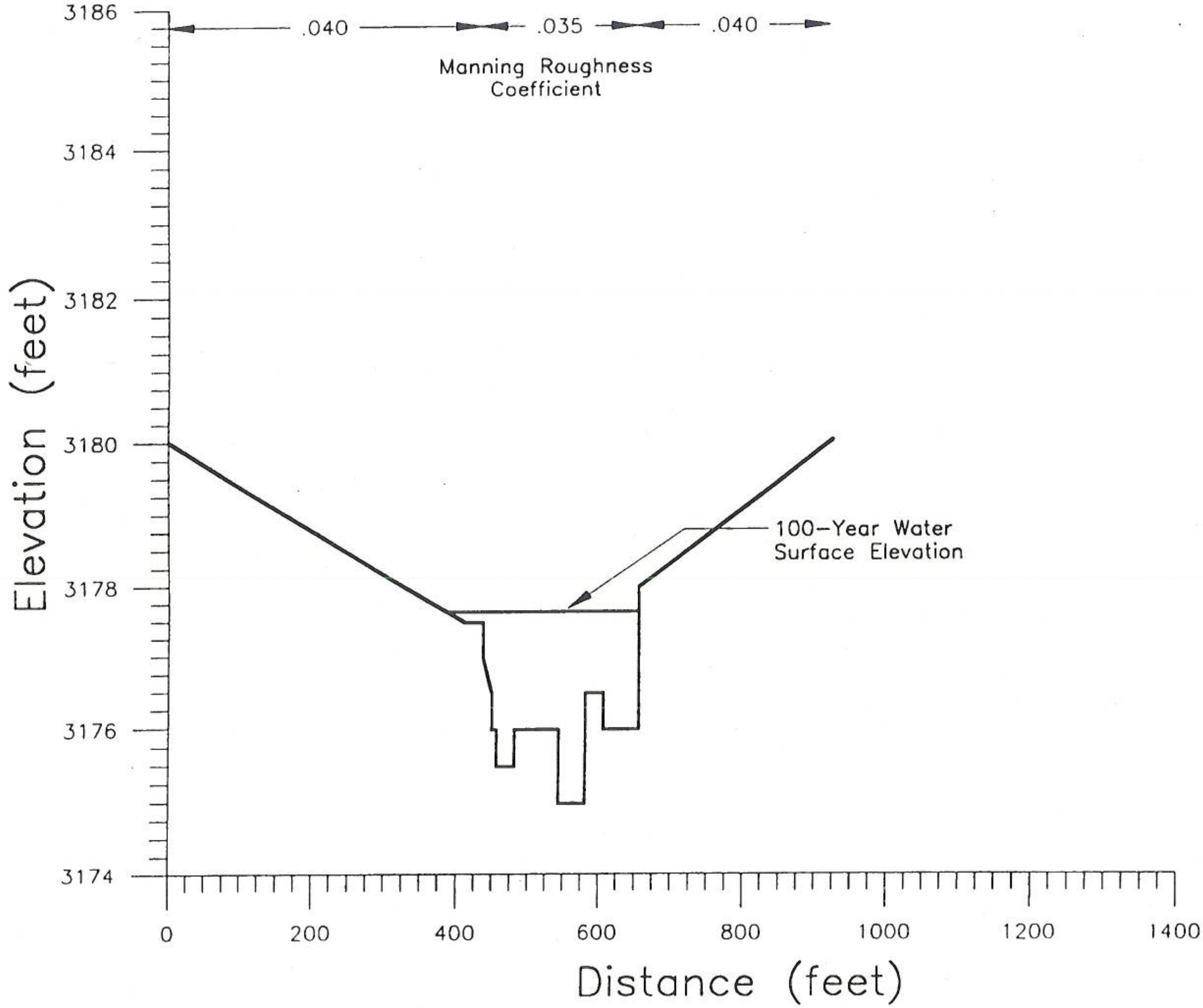
HEC-2 MODEL OUTPUT

CROSS SECTIONS

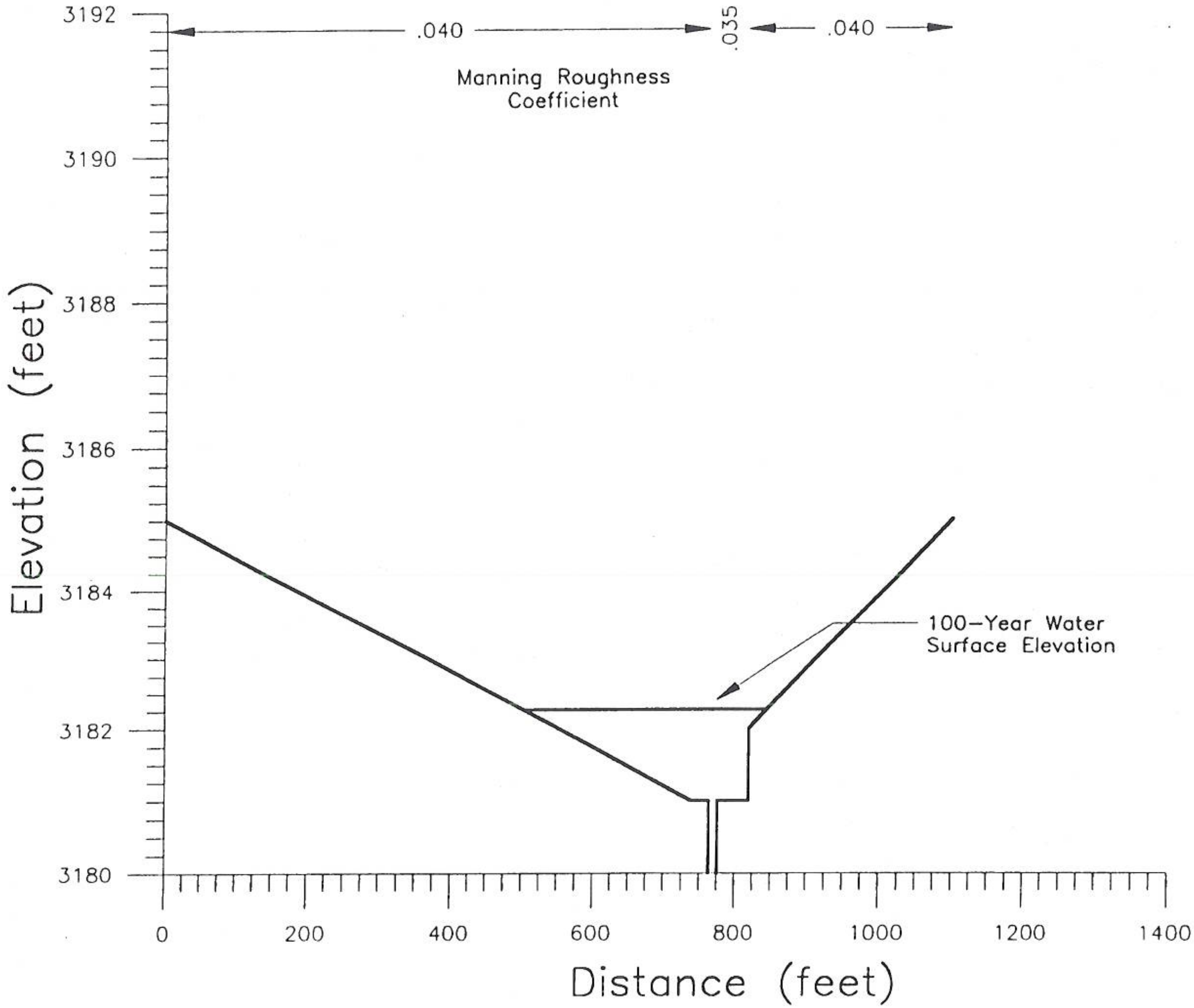
Cross-Section 1.000



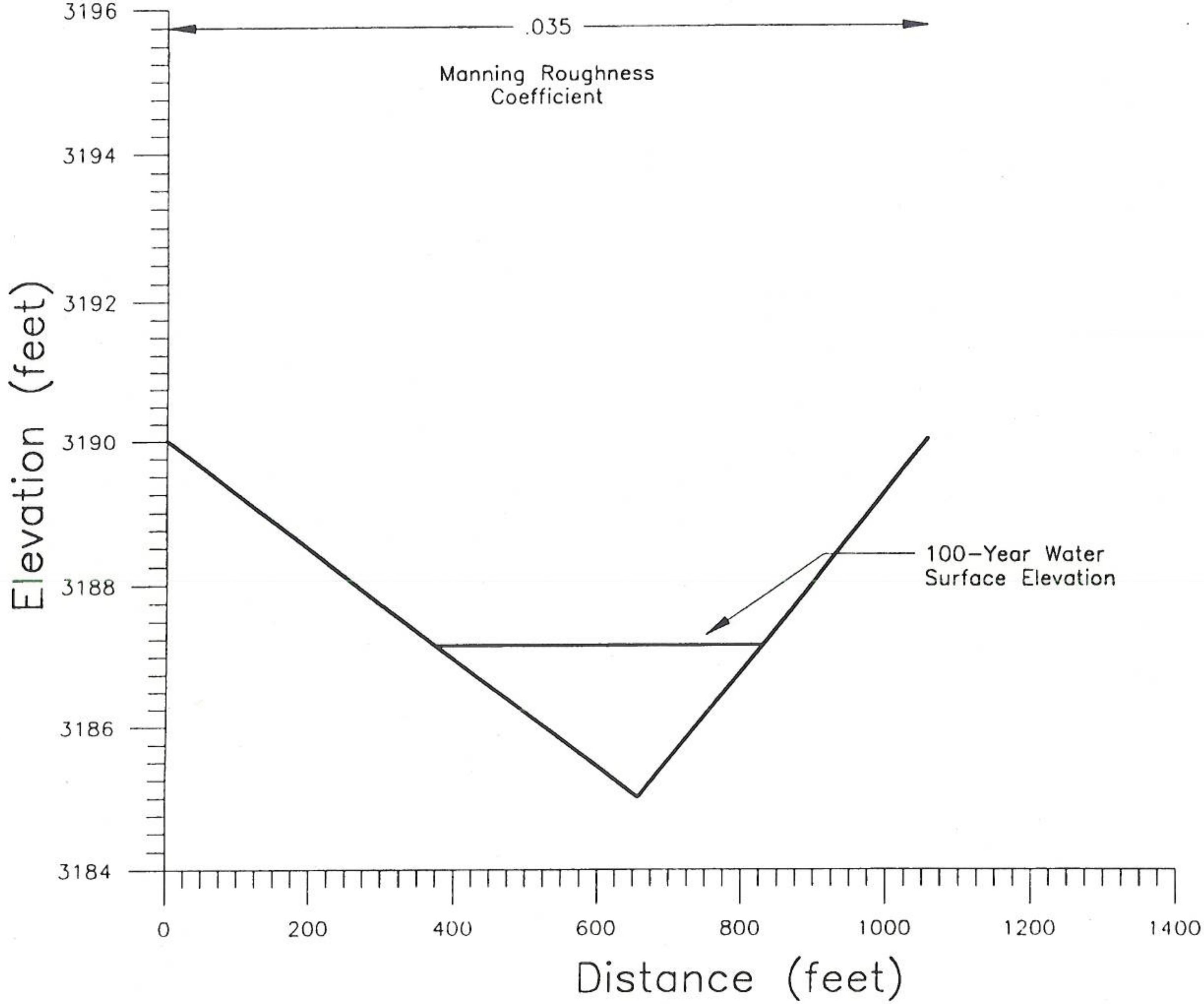
Cross-Section 2.000



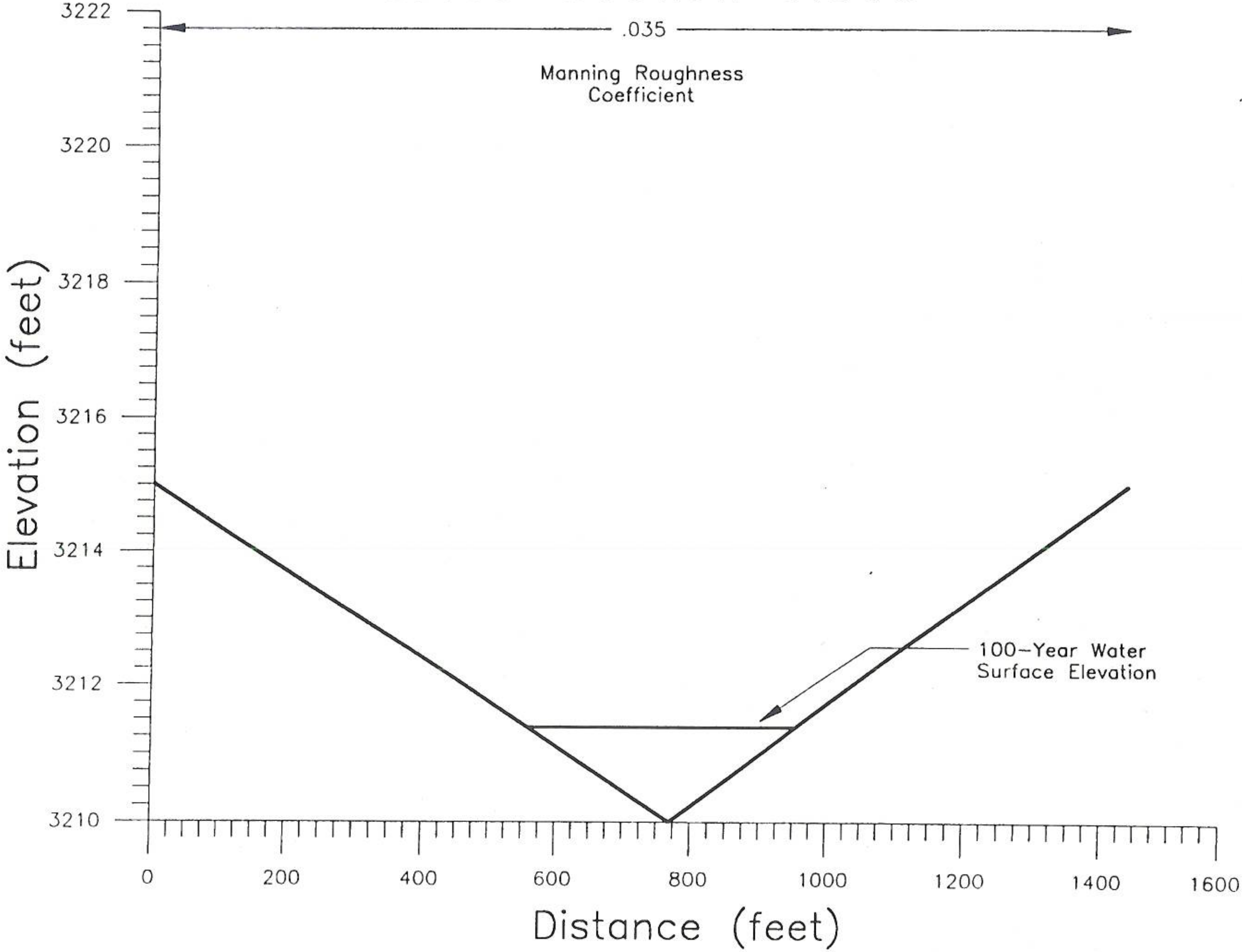
Cross–Section 3.000



Cross-Section 4.000



Cross-Section 5.000



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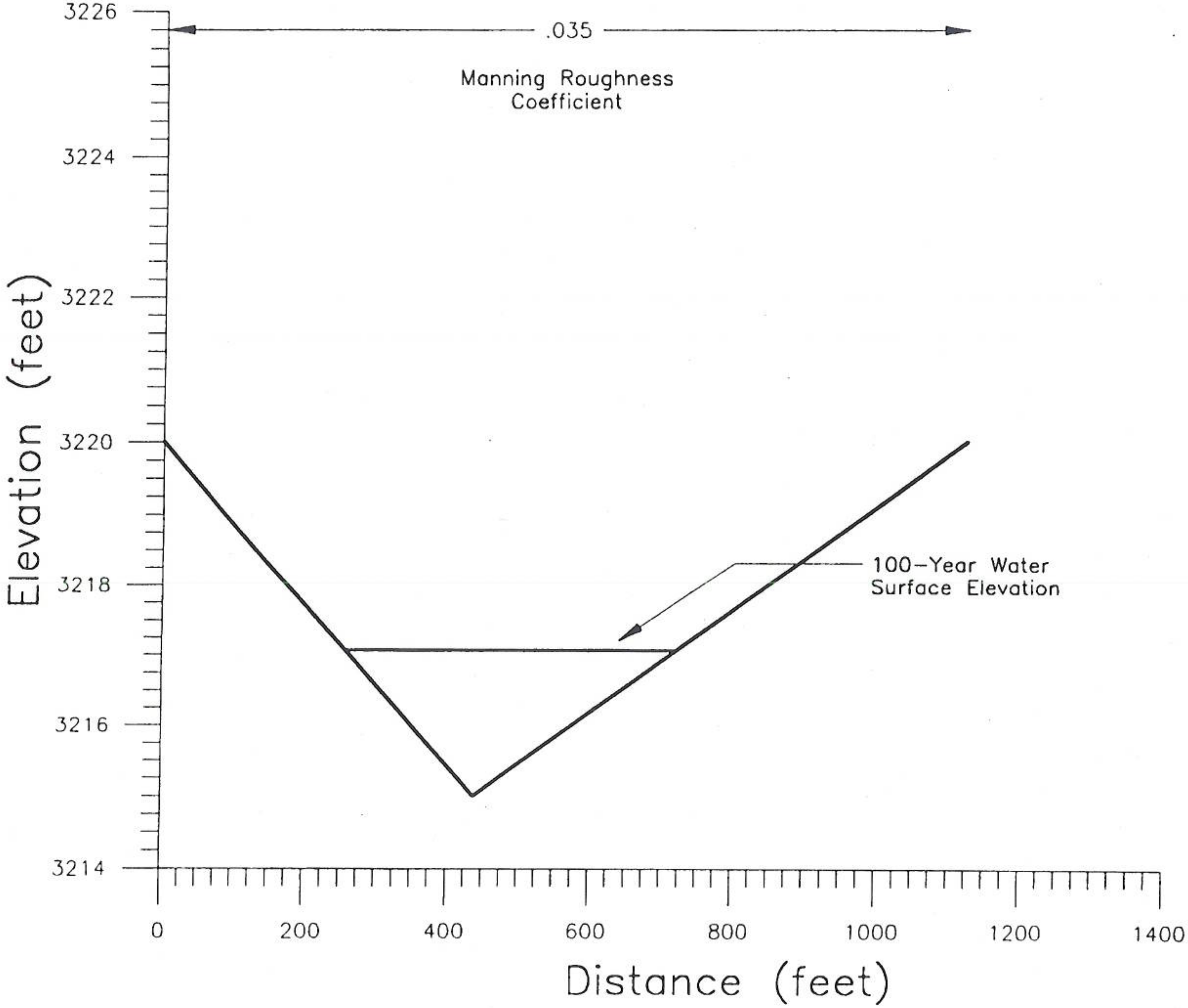

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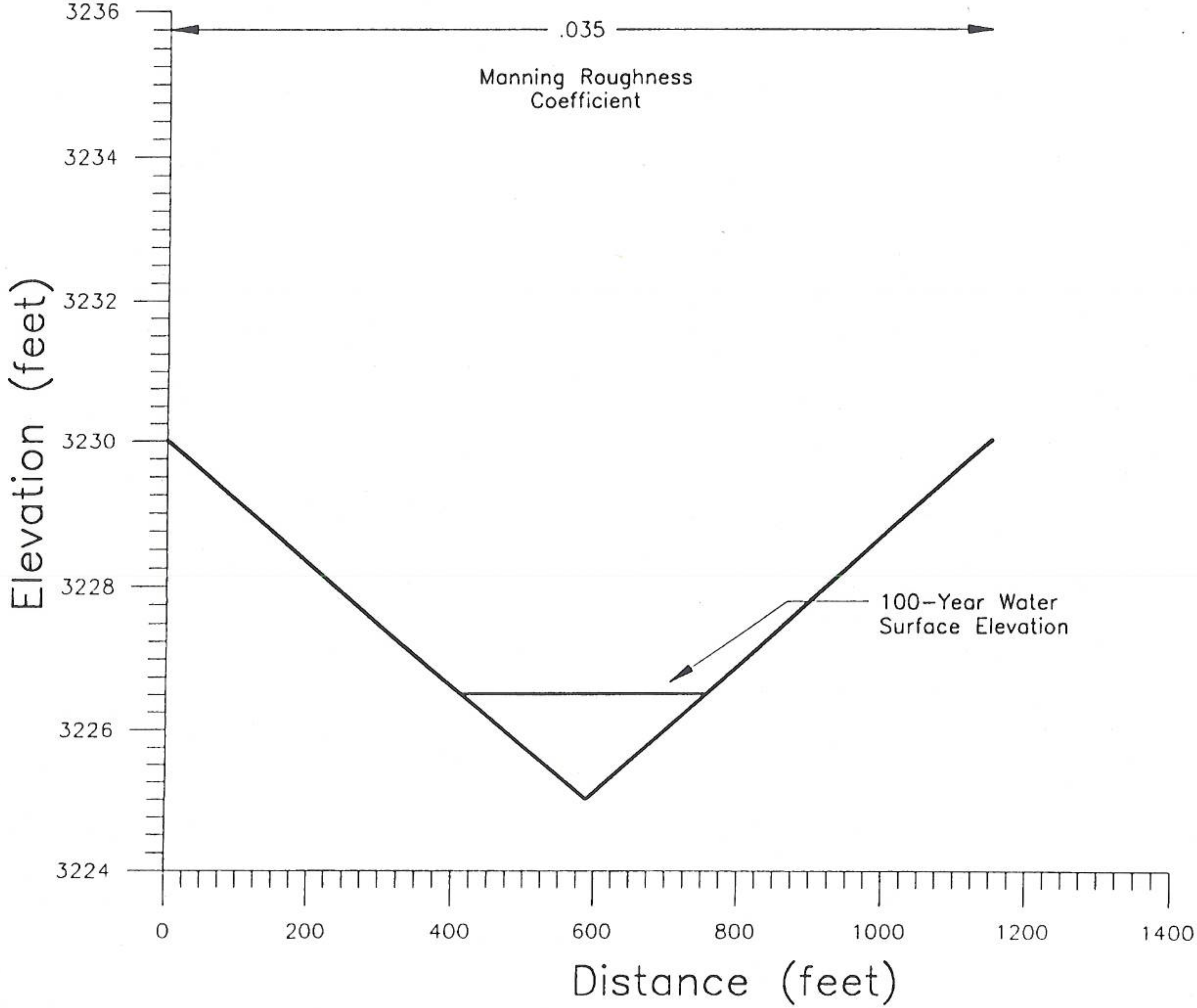

SHEETFLOW CALCULATIONS FOR THE NORTH SIDE OF THE AREA 5 RWMS

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:

$$Q=\frac{1.49}{n}d^{2/3}S^{1/2}dW$$

$$Q=\frac{1.49}{n}d^{5/3}S^{1/2}W$$

$$d=\frac{Qn}{(1.49S^{1/2}W)^{3/5}}$$

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:

$$Q=\frac{1.49}{n}d^{2/3}S^{1/2}dW$$

$$Q=\frac{1.49}{n}d^{5/3}S^{1/2}W$$

$$d=\frac{Qn}{(1.49S^{1/2}W)^{3/5}}$$

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

B.12 Training [40 CFR 270.14(b)(12)]

This section identifies the training requirements applicable to personnel assigned to perform duties at the MWDU.

B.12.a Radioactive Waste Management Program Training

The 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 Waste 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 that identify critical task assignments, entry level qualifications, and additional training needs. Qualification cards are prepared for all RWMC personnel that document completion of the assigned training program for their functional title. Annual reviews of training programs and qualification status for RWMS personnel are performed to ensure personnel training qualifications are current. Personnel qualification cards are maintained by the contractor's Training Department. Personnel training records are accessible at the RWMS via the contractor's training database. The Waste Operations supervisor also maintains a List of Qualified Individuals at the RWMS to ensure personnel training and qualification are current.

B.12.b RWMS Personnel [40 CFR 264.16(d)]

The information provided in Table 6, MWDU Training Matrix, includes functional title, required training for personnel assigned to perform work at the MWDU. Current functional titles and job descriptions are maintained in the Radioactive Waste Operations Training Records.

Table 6 MWDU Training Matrix

Functional Title	Outline of Required Training
RWO Waste Operations Manager (Qualification OQ00202)	Hazard Communication Hazardous Waste Site General Worker Basic RCRA and Hazardous Waste Manifest Hazardous Waste Site General Worker Refresher RCRA Refresher Radiation Worker II RWO Annual Refresher RWO General Employee Training
RWMS LLWO Supervisor (Qualification OQ00151)	Hazard Communication Hazardous Waste Site General Worker/Supervisor (8hr) Basic RCRA and Hazardous Waste Manifest Hazardous Waste Site General Worker Refresher RCRA Refresher Radiation Worker II RWO Annual Refresher RWO General Employee Training
RWO Waste Specialist (Qualification OQ00152)	Hazard Communication Hazardous Waste Site General Worker Basic RCRA and Hazardous Waste Manifest Hazardous Waste Site General Worker Refresher RCRA Refresher Respirator Fit Test Radiation Worker II RWO Annual Refresher RWO General Employee Training
Radiological Control Technician (Qualification OQ00123)	Hazard Communication Hazardous Waste Site General Worker Basic RCRA and Hazardous Waste Manifest Hazardous Waste Site General Worker Refresher RCRA Refresher Respirator Fit Test Radiation Control Technician Training RWO Annual Refresher RWO General Employee Training
Laborer (Qualification OQ00154)	Hazard Communication Hazardous Waste Site General Worker Hazardous Waste Site General Worker Refresher Respirator Fit Test RCRA for Craft(s) Radiation Worker II RWO Annual Refresher RWO General Employee Training
RWO RTR Operator (Qualification OQ00124	Hazard Communication Hazardous Waste Site General Worker Hazardous Waste Site General Worker Refresher RCRA Refresher Radiation Worker II RWO Annual Refresher RWO General Employee Training

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B.12.c Visitors

Untrained visitors are not permitted within the boundaries of the RWMS without an escort. Training requirements for visitors needing unescorted access are reviewed on a case-by-case basis by the RWMS Operational/Project Manager or designee. The amount of training required for an unescorted visitor depends upon the task the visitor is performing, the type of operations occurring at the RWMS, and whether exposure to wastes of hazardous constituents could occur.

Visitors may include inspectors, auditors, vendors, consultants, subcontractors, and treatment, storage, and disposal contractors. Other visitors can include personnel not assigned to perform normal day-to-day operations at the RWMS. Visitors receive a facility indoctrination briefing which, at a minimum, includes:

- Elements of the Contingency Plan and Emergency Procedures (alarms, evacuation routes, emergency equipment);
- Hazard communication information; and
- Hazard awareness and PPE [personal protective equipment] requirements.

Personnel not assigned to the RWMS who are performing work within the RWMS boundaries must receive approval from the RWMS Operational/Project Manager or designee. At minimum, these visitors must present credentials certifying that they have successfully completed Hazardous Waste General Site Worker Training/Refresher. These personnel also 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.

B.12.d Implementation and Documentation of the Training Program

All new employees must meet the training requirements within six months of employment and before working at the MWDU. The contractor’s Training Department and the Operations Manager will:

- Maintain, update, and revise the training program as necessary.
- Review regulations and operations/safety procedures to determine the adequate amount of training for each employee.
- Ensure that personnel conducting or administering the training have the proper credentials and certifications.
- Verify that the training program is documented and maintained in the MWDU personnel training records.
- Verify that former employee records are maintained for a minimum of three years from the date the employee is reassigned or terminated.
- Verify that employees are notified when specific training is required or due and that the training is received and successfully completed.
- Verify that employees have successfully completed the required training before working in an unsupervised capacity.

B.12.e Course Descriptions

- Hazard Communication **[29 CFR 1910.1200]** – This course provides the employee with an 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.

- Hazardous Waste Site General Worker/Annual Refresher **[29 CFR 1910.120, 40 CFR 264.16]** – Workers at a hazardous/mixed waste Treatment, Storage, and Disposal Facility are required to have a minimum of 40-hours of training with an 8-hour annual refresher. The training includes regulations, personal protective equipment, toxicology, basic chemistry, decontamination techniques, monitoring instruments, risk assessment/hazard evaluation, sampling methods and techniques, and emergency management.

- 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.

- Basic RCRA and Hazardous Waste Manifest/Annual Refresher **[40 CFR 260-268]** – This course discusses the Resource Conservation and Recovery Act regulations, how these apply to mixed waste handling and disposal, types of waste, how to identify hazardous waste, emergency response, and the Land Disposal Restrictions for hazardous waste. Hazardous waste manifest requirements are also covered.

- Radiation Worker II **[10 CFR 835.901]** – This course provides employees with 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. Refresher training (every two years) is required.

- RWO Annual Refresher **[40 CFR 264.16]** – This course provides employees with RCRA information for waste management activities (identification of hazardous and mixed waste, land disposal restrictions, uniform hazardous waste manifest, and emergency response actions).

- RWO General Employee Training (RWO GET) **[29 CFR 1910.120, 40 CFR 264.16] -** This course provides employees with information on RWO facilities as related to waste characterization, handling of classified waste, transuranic waste activities, mixed waste disposal, general work hazards and response to emergency/off-normal events.

- RCT Qualification Program **[10 CFR 835.103]** – This qualification program requires Radiological Control Technicians 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.

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 MWDU.
A description of the waste managed at this unit can be 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 MWDU. New information, technologies, or changes in performance monitoring may warrant an amendment to the closure and post-closure care plan.

A copy of this closure plan will be maintained in the MWDU Operating Record.

B.13.a Description of Closure [40 CFR 264.112(b)(4)]

B.13.a.1 MWDU (Landfill)

The MWDU (landfill) will be closed in-place with a native soil cover. The cover will be of adequate thickness to preclude the movement of moisture through the cover and into the waste zone. The final cover design and construction will meet the following performance standards:

- Provide long-term minimization or migration of liquid through the closed landfill.
- Function with minimum maintenance.
- Promote drainage and minimize erosion of the cover.
- Accommodate settling and subsidence.
- Have a permeability less than or equal to the permeability of any bottom liner system or natural sub-soils present.

After final closure, the cover will be maintained as necessary to correct the effects of settling, subsidence, or erosion. The leachate collection and removal system will be operated until leachate is no longer detected. The leak detection system will be maintained and monitored as required in **40 CFR 264.301(3)(iv) and (4)** and **264.303(c)**. Benchmarks will be surveyed, marked, and maintained to meet the requirements of **40 CFR 264.309**.

B.13.a.2 Leachate Collection Tank

The leachate collection tank will be clean closed. The tank and tank components will be dismantled and disposed in compliance with the regulations in effect at the time of closure.

Any residues from the decontamination of equipment, structures, and soil will be collected, containerized, characterized, and disposed in compliance with the regulations in effect at the time of closure.

B.13.b Performance Standards for the Final Closure Cover

B.13.b.1 Long Term Minimization and Migration of Liquids [40 CFR 264.310(a)(1)]

The performance of a non-vegetated and vegetated monolayer evapotranspiration (ET) closure cover over a 24-year period has been conservatively modeled by simulating flow of water through monolayer soil covers. The model used data collected from the existing non-vegetated operational cover on an LLMW interim status unit at the RWMS, interpreted data from two weighing lysimeters near the RWMS, and laboratory analyses of samples collected at the RWMS. Modeled drainage depths through a 2.4 m (8 ft) non-vegetated cover and vegetated cover was 1.02 cm/yr and zero respectively.

The final closure cover for the MWDU will be vegetated and nominally 2.4 m (8 ft) thick, thereby eliminating the possibility of migration of liquids through the cover to the waste zone. The cover may require the additional soils to allow for surface grading, drainage, and placement of native vegetation.

B.13.b.2 Function with Minimum Maintenance [40 CFR 264.310(a)(2)]

The closure cover will consist of a monolayer of native soil. The composition of the native soil and absence of layering will minimize maintenance **[40 CFR 264.111(a)]** and the need for repairs on the closure cover. Subsidence of the waste zone is expected after placement of the final closure cover. Subsidence occurrences will likely manifest themselves as depressions, shear fractures, or holes in the cover. All disruptions in the cover's surface will be repaired by adding native soil, grading, and re-vegetating as necessary. During the post-closure care period, monitoring of the cover structure will continue and actions taken to repair any problems will be noted in inspection documentation.

B.13.b.3 Promote Drainage and Minimize Erosion of the Cover [40 CFR 264.310(a(3)]

The closure cover will have a 1-2 percent slope to direct precipitation sheet flow to an adjacent drainage channel. The channel is designed to move water away from the unit. The low slope will allow the closure cover to drain, while minimizing erosion and surface scour. Visually observed intrusion of erosion will be repaired by adding soil, grading, and re-vegetation as necessary.

B.13.b.4 Accommodate Settling and Subsidence [40 CFR 264.310(a)(4)]

During the post-closure care period, any subsidence in the cover will be repaired. Following the post-closure care period, the cover will likely have differential subsidence and develop an uneven topography. The absence of layering in the cover will eliminate concerns with shearing of soils. Over time, low areas will fill in and the uneven topography will become increasingly subdued.

Potential settling was investigated within the RWMS and is discussed in the structural stability section of the performance assessment. The investigation considered factors such as the types of waste containers, the density of the containerized wastes, and the configuration of stacking. Maximum subsidence is conservatively estimated for a typical trench in the RWMS to be 1.5 to 4m (5 to 13 ft), expected to occur some time after the 100-year post closure of the RWMS in 2028. Much of the waste disposed is solidified and is in steel containers. Stacking of the containers will result in smaller spacing between containers, thereby reducing gaps and subsequently subsidence.

Subsidence observed in other operational covers at the RWMS closed disposal units has been either a small fissure or shallow depression, both of which were easily repaired by infilling with soil.

B.13.b.5 Have a Permeability Less Than or Equal to the Permeability of Any Bottom Liner System or Natural Sub-Soils Present [40 CFR 264.310(a)(5)]

The monolayer evapotranspiration cover proposed for the final closure cover seeks to meet this requirement with an alternative design. The native soil cover will have a greater permeability than the liner system on the floor of the disposal cell.

Layered closure covers are designed with a layer of natural or synthetic, low-permeability material to prohibit infiltration of moisture. The MWDU monolayer evapotranspiration cover allows moisture to infiltrate into the cover, be stored in the open pore spaces within the soil, and then be removed by evaporation and/or transpiration. The closure cover will achieve the same results as a standard layered closure cover design, where no moisture migration occurs through the closure cover to the waste zone.

Modeling of liquid migration through the closure cover has demonstrated equivalency to a standard closure cover. The cover inhibits infiltration of liquid beyond a given depth based on site data. This equivalency was accepted by NDEP for closure of Corrective Action Unit (CAU) 110 (U3ax/bl) at the Area 3 RWMS.

B.13.b.6 Coordination with Other Regulatory Standards

Disposal of LLW waste (including the LLW component of LLMW) at the RWMS is subject to requirements and performance objectives of DOE Order 435.1, *Radioactive Waste Management*, and the associated manual (DOE M 435.1-1) and guidance (DOE G 435.1-1). DOE Order 435.1 requires that a Disposal Authorization Statement be obtained for new or existing disposal facilities. A Disposal Authorization Statement for the RWMS was issued by DOE Headquarters in December 2000 and specifies that the disposal program shall be conducted according to the site Performance Assessment (PA).

B.13.c Financial Requirements [40 CFR 264.140(c)]

State and federal governments are exempt from the **40 CFR 264 Subpart H** requirements.

B.13.d Operational Activities and Schedule [40 CFR 264.112(b)(2)]

At the NTS, final closure of disposal units regulated under RCRA follow a sequence of closure activities that takes approximately two years to complete. Closure activities and schedule are shown in Table 7, MWDU Closure Activity Schedule.

1. **Preliminary Assessment.** Compile and summarize data in a report regarding the unit and surrounding area. Data are typically derived through onsite inspections, interviews, literature review, databases, historical records, manifests, waste profiles, maps, engineering drawings, photographs, and other media.

2. **Initial Planning.** Develop a conceptual model, identify data requirements and needs, and identify the approaches to acquiring and using needed data based on the preliminary assessment. NDEP is involved in the planning process and approves the results from this planning stage.

3. **Characterization Plan.** Develop a plan for acquiring data identified in initial planning. The characterization plan should include a field plan, a sampling and analysis plan, a health and safety plan, and any other sub-plans necessary to acquire data. NDEP reviews and approves the characterization plan.

4. **Characterization.** Conduct activities identified in the characterization plan.

5. **Characterization Report.** Present results of site characterization activities. NDEP reviews and approves the characterization report.

6. **Closure Plan.** Develop a plan to for closing the disposal unit based on results in the characterization report. The closure plan provides a summary description of the disposal unit, the physical setting, regulatory basis, the relationship of closure activities to other programs, assumptions, and the technical approach to closure. NDEP reviews and approves the closure plan.

7. **Closure Cover Construction.** Construct the final closure cover based on the closure plan.

8. **Closure Report.** Develop a report after construction of the final closure cover that discusses the process of construction and the as-built conditions of the closure cover. NDEP reviews and approves the closure report; approval of the report acknowledges final closure of the disposal unit.

9. **Post-Closure Monitoring and Maintenance.** Conduct post-closure monitoring and maintenance after completion of final closure. NDEP is involved in the determination of the post-closure schedule and frequency for monitoring and reporting.

B.13.e Facility Location and Description at Closure [40 CFR 264.112(b)(1)]

The MWDU will be located in the northeast corner of the existing RWMS, in a remote area of the southern NTS. Figures and text describing the unit and locating it in the RWMS are in Section B.1 of this permit application. The physical surface area of the MWDU will not be changed after closure. During closure, unused portions of the landfill will be filled with native soil or LLW (with NDEP approval). The final closure cover is discussed in Section B.13.b.

The leachate tank and ancillary equipment will be decontaminated, dismantled, and disposed as required.

B.13.f Final Waste Acceptance Date, Hazardous Waste Inventory [40 CFR 264.112(b)(3)]

The final waste acceptance date is unknown at this time. The closure process will begin within 30 days after the date that the MWDU receives the last known final volume of waste.
An estimate of the final inventory of hazardous wastes managed over the active life of the facility will be provided.

B.13.g Closure Schedule [40 CFR 264.112(b)(6)]

Table 7 depicts a closure activity schedule for the unit.

Table 7 MWDU 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.
Closure of the unit	Initiated 45 days after notification of closure and competed within 180 days of receiving the final volume of hazardous waste.
Certification of closure	Within 60 days after completion of closure activities.

B.13.h Amendment to Closure Plan [40 CFR 264.112(c)]

An amended closure plan will be submitted to NDEP for approval as a permit modification at least 60 days before the proposed change in facility design or operation or no later than 60 days after an unexpected event has occurred that affects the closure plan. However, if an unexpected event occurs during the partial or final closure period, NNSA/NSO 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.i Post-Closure Care [40 CFR 264.310(b)]

B.13.i.1 Post-Closure Care for MWDU Landfill

- The final closure cover integrity will be maintained and repaired as necessary to correct the effects of settling, subsidence, erosion, or any other events.
- The leachate collection and removal system will be operated until leachate is no longer detected.
- The leak detection system will be maintained and monitored. Pumpable liquids will be removed to minimize the head on the bottom liner.
- Groundwater monitoring will be conducted at permit established intervals and reported as described in Section C.
- Run-on and runoff control structures will be maintained to prevent erosion or damage to the final closure cover.
- Surveyed benchmarks will be maintained to ensure that the landfill location can be identified and facilitate the location of wastes placed in the MWDU. A survey plat will be provided to NDEP indicating the location and dimensions of the MWDU.

B.13.i.2 Post-Closure Care for Leachate Collection Tank [40 CFR 264.197]

The leachate collection tank will be clean closed; therefore, no post-closure care is planned. Impacted soils (if applicable) will be managed and disposed according to regulations in effect at the time of closure.

B.14 Post-Closure Notices [40 CFR 270.14(b)(14)]

Closed hazardous waste disposal units on the NTS are noted in NDEP Permit NEV HW0021 (November 2005), Part VII. A description of the closure/post closure requirements are noted in Volume 1 of the Permit Application for NEV HW0021.

Closure of hazardous waste management sites on the NTS is carried out through the Federal Facilities Agreement and Consent Order (FFACO). The FFACO is an agreement between the state of Nevada, U.S. Department of Defense (DoD), and the U.S. Department of Energy Legacy Management and NNSA/NSO. The process requires that use restrictions (UR) shall always be instituted on sites where contamination above regulatory limits is being closed-in-place. Two types of UR are established in the FFACO, administrative and standard. Administrative URs differ from the standard 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 the 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 DOE Facility Information Management System, the FFACO database, the DOE CAU/CAS files, and in the U.S. Air Force Geographical Information System.

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)**.

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)**.

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)**.

B.19 Topographic Map [40 CFR 270.14(b)(19)]

B.19.a MWDU Topographic Maps and Facility Location

Figure 6, RWMS Overall Location Map, with 1.5 m (5 ft) contour intervals, with a scale of 2.5 cm (1 inch [in]) equal to 61 m (200 ft) illustrate the MWDU boundaries and extend a distance of 305 m (1,000 ft) outside the unit boundaries. This figure shows access roads, gates, existing facilities, wells, drainage, and flood control structures. Figure 14 illustrates the existing LLW disposal units in the "expansion area" and the proposed location of the MWDU.

Figure 14 Existing LLW Disposal Units and Proposed Location of MWDU

Reviewed and determined to be UNCLASSIFIED. This review does not constitute clearance for public release.

Derivative Classifier: Robert Morton Engr. (Name/Organization)

Date: 3/25/09

FIGURE 14

EXISTING LLW DISPOSAL UNITS & PROPOSED LOCATION OF MWDU

SCALE : 1" = 200'

GRAPHIC SCALE

0 100 200 400 600 FEET

1" = 200'

GS

NO	DATE	REVISIONS	DRAWN	PREPARER	CHECKER	PROJ ENGR	APPROVER/USER

NATIONAL NUCLEAR SECURITY ADMINISTRATION

NEVADA SITE OFFICE — LAS VEGAS, NEVADA

NEVADA TEST SITE — AREA 05

RWMS FIGURE SKETCHES

EXISTING LLW DISPOSAL UNITS & PROPOSED LOCATION OF MWDU

DRAWN	PREPARER	CHECKER	PROJECT ENGINEER	APPROVER / USER
DATE	DATE	DATE	DATE	DATE

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

ENGINEERING NO. 09042

ORIGINAL SIGNATURES ON FILE

DRAWING NUMBER / WORK ORDER NUMBER: SK-09042-C-1014

REVISION 0

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The center of the RWMS is located at N 768650.25 and E 706476.40. The center of the MWDU is located at approximately N 770840 and E 708820 (based on Nevada State Plane Grid – Central Zone, North American Datum, 1983).

B.19.b Land Use

Several Public Land Orders withdrew land from the public domain to establish the NTS. Public Land Order 805, issued in 1952, withdrew the land where the MWDU is located. Since then, NTS land has been used for national defense and energy related testing and research and waste management activities. The NTS is not open to public entry for any purpose (e.g., agriculture, mining, homestead, or recreation). Because of the nature of land use at the NTS over the last 58 years, there are no plans to return the area to public use. Certain 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; transuranic waste characterization, repackaging, and storage; controlled hazardous materials spill testing; and hazardous waste storage. An NTS land use map is provided in Figure 3, NTS Land Use Map.

B.19.c Wind Rose

Wind speed and direction are provided in Figure 15, Wind Rose for RWMS. Winds in this area are generally from the southwest, with wind velocities varying from 0-20 m/second (s). However, there is 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.

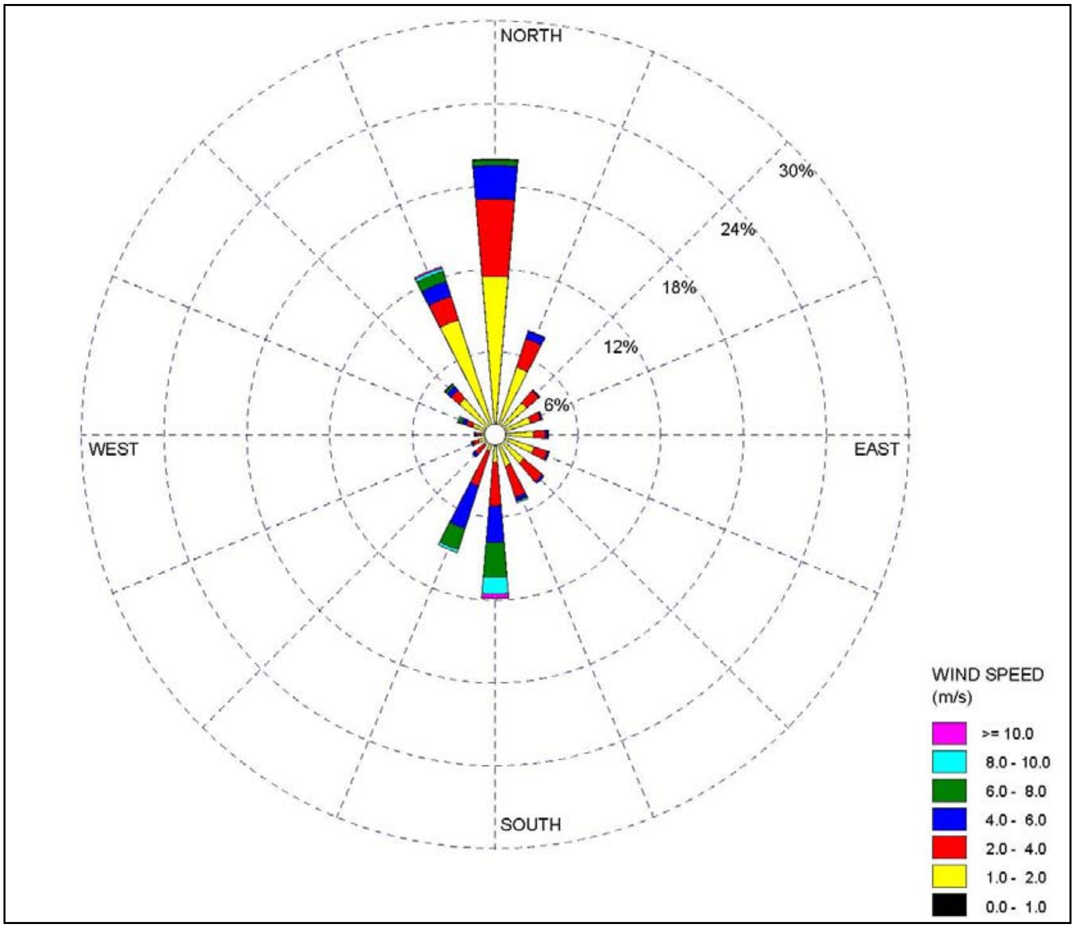


Figure 15 Wind Rose Diagram for the Area 5 RWMS Meteorology Station

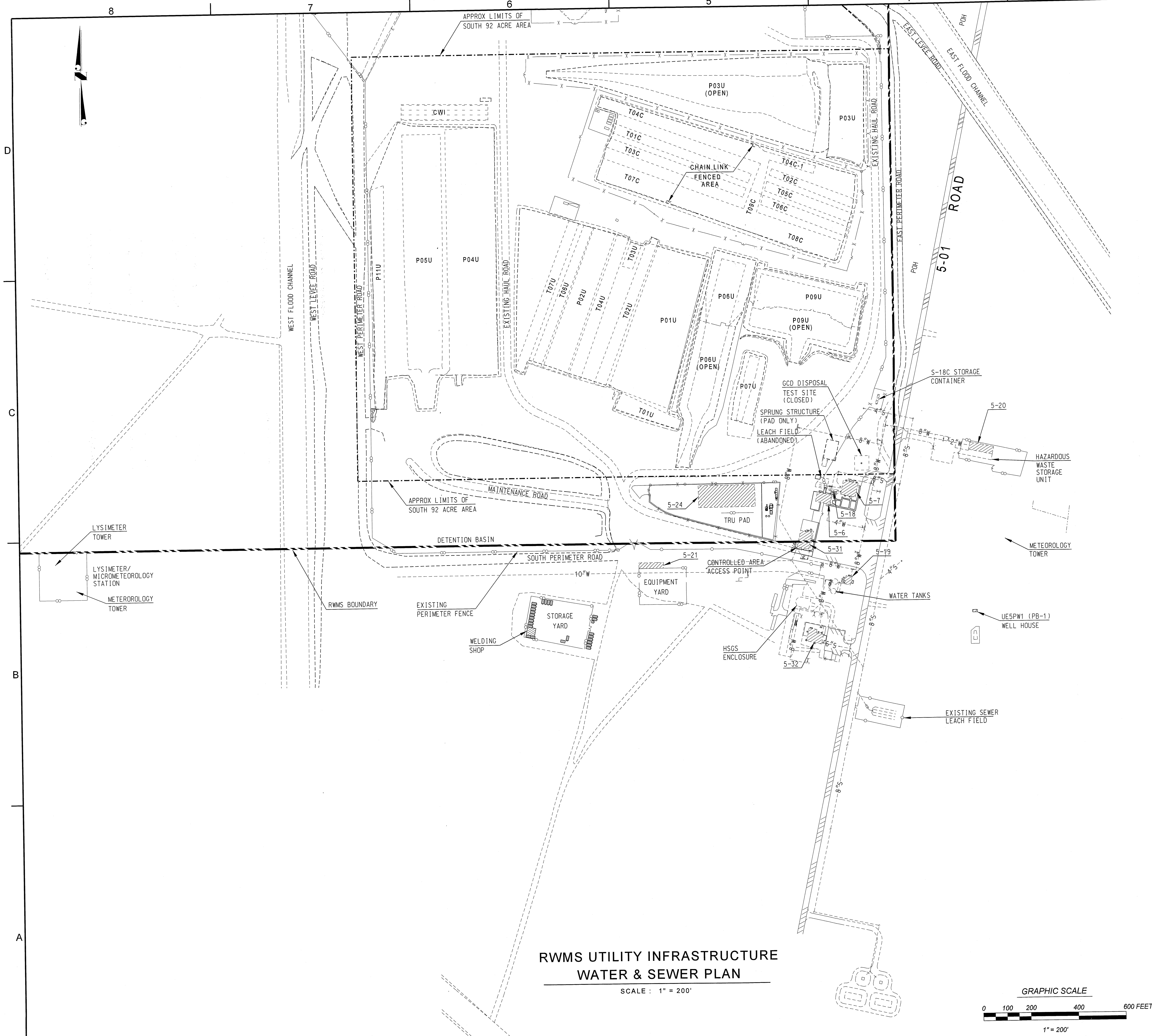
B.19.d Well Locations

Figure 6 (RWMS Overall Location Map) is a topographic map with 6.1 m (20 ft) contour intervals showing the MWDU location and the surrounding area, including nearby well locations.

B.19.e Utility Characteristics

Utilities at the RWMS are shown in Figures 16 through 18.

Figure 16 Water and Sewer Plan



RWMS UTILITY INFRASTRUCTURE WATER & SEWER PLAN

SCALE : 1" = 200'

FIGURE 16

Reviewed and determined to be UNCLASSIFIED. This review does not constitute clearance for public release.

Derivative Classifier: Richard Morton Engr (Name/Organization)

Date: 3/25/09

NO	DATE	REVISIONS	DRAWN	PREPARER	CHECKER	PROJ ENGR	APPROVER/ USER

GS

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

NEVADA TEST SITE — AREA 05
RWMS FIGURE SKETCHES

RWMS UTILITY INFRASTRUCTURE
WATER & SEWER PLAN

DRAWN	PREPARER	CHECKER	PROJECT ENGINEER	APPROVER / USER
DATE	DATE	DATE	DATE	DATE

National Security Technologies LLC — Vision • Service • Partnership — NEVADA OPERATIONS — P.O. BOX 98521 LAS VEGAS, NV 89193-8521

ENGINEERING NO. 09042 — ORIGINAL SIGNATURES ON FILE

DRAWING NUMBER / WORK ORDER NUMBER: SK-09042-C-1016

REVISION 0

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Figure 17 Electrical and Communications Plan-South

NOT AVAILABLE FOR PUBLIC VIEWING

Figure 18 Electrical and Communications Plan-North

NOT AVAILABLE FOR PUBLIC VIEWING

(1) Potable Water, Wastewater, and Fire Protection

The potable and fire protection water system for the RWMS is served by Public Water System Permit NY-0360-12NTNC. Domestic wastewater from RWMS office buildings is discharged to a permitted septic system (NY-1083) located south of the RWMS.

RWMS fire alarm pull boxes are located in Buildings 5-6, 5-7, and 5-31. Personnel working in the MWDU have access to hand held/vehicle radio and cell phone communications.

Emergency response is discussed in Section B.7.

(2) Power System

Offsite electrical power is supplied to the NTS 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 RWMS through an overhead power line.

A diesel generator provides emergency power to the RWMS buildings when necessary.

(3) Storm Water Drainage

The storm drainage system designed to protect the RWMS from run-on and runoff is depicted in Figure 6.

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/NSO will maintain a written operating record. Because the MWDU is located in a remote area, portions of the operating record are maintained at the RWMS, Mercury, or North Las Vegas Facility for convenience. NDEP inspections of the current operating record (for Pit 3, MWDU) acknowledge this separation as functional and compliant with regulatory requirements.

The operating record will include:

- A description and quantity of each hazardous waste received/disposed and the date of disposal.
- Location and quantity of each hazardous waste within the disposal cell (B.20.a.7) cross referenced to specific manifest document numbers.
- Records and results of waste analyses and waste determinations.
- Summary reports and details of all incidents that require implementing the contingency plan.
- Records and results of inspections for the last three years.
- Monitoring, testing, or analytical data and corrective actions resulting from a release from the proposed MWDU.
- Record of written notice from NNSA/NSO to generators indicating that NNSA/NSO has all the necessary permits for and will accept the waste the generator is shipping.

B.20.a.2 Generator Process

The following outlines the procedure for shipping LLMW to the NTS:

- Waste generators and the waste profile must be approved according to the current revision of the Nevada Test Site Waste Acceptance Criteria (NTSWAC) and the Waste Analysis Plan (Section B.3) before waste shipment. An initial waste verification rate per waste stream is developed and approved by NNSA/NSO.

- A U.S. Environmental Protection Agency (EPA) Uniform Hazardous Waste Manifest **(40CFR 264.71)**, appropriate LDR certification or notification **(40 CFR 268.7)**, and a "Package Storage and Disposal Request" form are required for each waste shipment. Waste transport must be according to state, federal, and DOE requirements. Applicable state requirements include those of the state in which the shipment originates, states the waste is transported through, and the state of Nevada. The package number and the waste stream number are entered on the "Package Shipment and Disposal Request" form.

- The NTS receives and verifies waste containers Monday through Thursday, unless otherwise coordinated in advance.

- The transporter must provide the necessary paperwork for initial review at Gate 100, the entrance to the NTS. If the transporter does not have an NTS badge, a temporary badge will be issued at the gate after checking the driver's identification. A map to the RWMS is also available at the gate.

- The transporter delivers the waste shipment to the RWMS for processing and off-loading.

B.20.a.3 Waste Receipt, Survey, and Shipping Records

- When the shipment arrives at the RWMS, the driver parks and signs in at Building 5-7, completes the route survey, and submits applicable shipping documents. RWMS personnel perform a completeness review of the generator's shipping documents which may include:

  - Uniform Hazardous Waste Manifest,
  - LDR documents, and
  - Original Package Storage and Disposal Request.

- Flat bed trailers – vehicle and load are surveyed for radiological contamination and transport integrity before entering the controlled area.

- Closed transport vehicles (vans) – vehicles are surveyed for radiological contamination and van integrity.

- Upon approval from RWMS personnel, the transporter is escorted into the Controlled Area by proceeding th~~o~~rough the gate adjacent to the Controlled Area Access Building (Building 5-31).

- For containers requiring Real Time Radiography (RTR), the transporter is escorted to the RTR in Building 5-6. Figure 11, Travel Routes within the RWMS, depicts the waste transportation routes within the RWMS.

- RWMS 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 MWDU.

- At Building 5-6, only required containers are unloaded for RTR verification. The RTR system has the capability to perform RTR on three 55-gallon drums, or one typical waste box at a time. Only the specified quantity of waste requiring RTR will be removed from the transport vehicle. After RTR has been completed, accepted containers are reloaded on the transport vehicle and the transporter is escorted to the MWDU.

- Containers, markings, and labels are inspected and compared with the associated manifests. Paper work review and inspection requirements are documented on a shipment checklist. The waste manifests, LDR Notices, 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 completed and all containers accepted, RWMS personnel will commence placing the waste containers in the disposal configuration.

- Radiological surveys of the truck bed and tires are performed before releasing the waste transport vehicles from the RWMS.

B.20.a.4 Discrepancies

- If a discrepancy is detected at any time during the paperwork or inspection process, the discrepancy will be categorized dependent upon the level of severity of the condition. Waste containers will remain on the transporter vehicle until the noncompliant condition has been resolved.

- If one of the containers in the original sample set fails RTR, a second sample set of equal quantity will be 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 RWAP.

- If a discrepancy requires several days to resolve, the containers will be placed in the verification hold area, Wastes in this area shall meet the requirements in **40 CFR 264.170 to178**, inclusive.

- If the discrepancy cannot be resolved, all waste packages associated with the noncompliant shipment will be returned to a generator-specified facility and required discrepancy notifications are made.

- Manifesting of partial or full loads that are rejected by NNSA/NSO will be carried out as required in **40 CFR 264.72**.

B.20.a.5 Waste Segregation within the MWDU [40 CFR 264.312 and 264.313]

Meeting LDR requirements and adherence to the Waste Analysis Plan eliminates the acceptance of incompatible, corrosive, reactive, or ignitable wastes. Therefore, segregation of wastes in the MWDU is not necessary.

B.20.a.6 Prohibited Waste [40 CFR 264.314 and 264.317]

Wastes containing free liquids or with EPA waste codes F020, F021, F022, F023, F026, and F027 are not accepted for disposal at the MWDU. Other prohibited waste codes include D001, D002, and D003.

B.20.a.7 Waste Placement, Surveying, and Recordkeeping [40 CFR 264.309]

Waste placement is documented using the NTS container stacking coordinate system. Based on the availability and configuration of packages, waste will be stacked in stair-step configuration in an attempt to maintain a face angle of 1:1. Tiered stacking may be used as necessary to accommodate irregular containers. All waste containers placed in the MWDU shall be at least 90 percent full as required in **40 CFR 264.315**.

The following sequence for waste placement will be followed at the MWDU:

1. Record the location coordinates of each container.
2. Stack waste containers.
3. Place and maintain operational cover over the filled portion of the cell, excluding the active face.
4. Maintain access/haul roads traffic surfaces, shoulders, berms, and drainage.
5. File hard copy records and enter waste coordinates into the database.

B.20.a.8 Wind Dispersal

All wastes will be containerized, thereby eliminating the possibility of wind dispersal of wastes. In addition, an operational cover will be maintained as the cell is filled, with only the active face left uncovered.

B.20.a.9 Leachate Collection and Management

The MWDU leachate collection system will consist of two leachate collection layers, one located above the primary liner and one between the primary and secondary liner. Liquids will be collected in sumps and pumped via riser to the surface.

Liquids collected from the primary liner will be analyzed for **40 CFR 261.24, Table 1** parameters. If the liquid does not exceed the concentration limits in this Table, the liquid will be managed as waste water.

Liquids collected from the secondary liner will be managed as F039 waste, and will meet applicable treatment standards in **40 CFR 268** for disposal. Sampling and analytical parameters for disposal of leachate will be predicated by RCRA constituents accepted for disposal at the MWDU.

Design considerations for the leachate collection system are discussed in B.1.b.1, Disposal Unit Design.

The action leakage rate for the landfill will be determined by the final design parameters **[40 CFR 264.302]**. RWMS personnel inspecting and monitoring the leak detection system will record the amount of liquids removed from the sump during the unit's active life and closure period. During post closure, amounts of liquids will be monitored and recorded at least monthly, or as dictated by levels of leachate in the sump **[40 CFR 264.303(c)(1 & 2)]**.

B.20.b Other Federal Laws [40 CFR 270.3]

Other federal laws that apply to operations and discharges from the RWMS include:

- *National Historic Preservation Act* – Within the boundaries of the RWMS, waste disposal activities will not create adverse effects to properties listed or eligible for listing on the National Register of Historic Places.

- *Endangered Species Act* – Waste disposal activities at the RWMS are not likely to jeopardize the continued existence of any endangered or threatened species or adversely affect its critical habitat.

- *Clean Air Act* – Fugitive dust emissions from activities at the RWMS are regulated by air quality permit AP9711-0549.01 (NTS Class II Air Quality Operating Permit) issued by the state of Nevada.

- *Clean Air Act* (National Emissions Standards for Hazardous Air Pollutants) - Air monitoring for radionuclide emissions is conducted from two monitoring stations at the RWMS. Results confirm that emissions are below reporting limits for radionuclide emissions.

B.20.c Exposure Information Report [40 CFR 270.10(j)]

This exposure information report has been prepared using the Permit Applicants' Guidance Manual for Exposure Information under RCRA 3019 (EPA, July 3, 1985). Other sections of this permit application address measures used to limit exposure to employees and the general public (Section B.1 General Information Requirements, Section B.4 Security, Section B.5 Inspection Schedule, Section B.7 Contingency Plan, Section B.8 Prevention Procedures, Structures, and Equipment, Section B.10 Traffic, Section B.11 Facility Location, Section B.12 Training Programs, Section B.13 Closure/Post-Closure Plans, Section B.14 Post-Closure Notices, Section B.20 Additional Information, Section C.1 Protection of Groundwater, Section F.1 Information Requirements for Tank Systems).

B.20.c.1 General Information

Exposure to the general public and employees from releases of hazardous waste and hazardous constituents during normal operations are mitigated as follows:

- Low-level LLMW s are transported to and from the MWDU using qualified transporters who are DOT certified and have an EPA identification number identifying the transporter as a shipper of hazardous waste. In addition, waste packages meet DOT packaging requirements.

- Public access to the NTS is strictly controlled. Members of the public who visit the RWMS or non-RWMS assigned personnel who do work at the RWMS must meet access/training requirements. Non-assigned personnel and visitors are escorted at all times. An armed security force patrols the NTS 24 hours a day, 7 days a week.

- Unauthorized Entry Prohibited signs are posted along the RWMS perimeter and at the gate to the MWDU. All traffic entering the RWMS, enters through a single controlled access gate.

- Personal protective equipment commonly used at the MWDU includes safety shoes, safety glasses, and hardhats.

- Employee qualifications for workers at the RWMS include site-specific training for RCRA compliance as well as radiation worker/technician.

- Emergency procedures detail actions to be taken in emergencies. The NTS onsite response organizations include fire department, Nye County Sheriff, and medical department. Emergency equipment is located at the RWMS and at the MWDU to deal with spills/releases.

- A 1.2 m (4 ft) thick operational cover is maintained at the MWDU during normal operations. The operational cover limits exposure of the waste to wind, precipitation, and human contact.

(1) Existing Risk Assessment Reports and Information

The Contingency Plan and Emergency Procedure discuss detailed personnel procedures used to respond to emergencies, as well as personnel protective procedures to prevent exposure and environmental hazards. Section B.8 contains detailed information relative to the protection of human health, safety, and the environment.

The NTS, and thus the MWDU, is a federal facility that is exempt from financial or insurance requirements.

(2) Land Use and Zoning

The MWDU is located in the southern portion of the NTS and is surrounded for a radius in excess of 6.5 km (4 mi) by federally owned land. Access to the NTS is monitored and restricted. Further, the NTS is patrolled by armed security and the Nye County Sherriff's Department.

This land is not anticipated to be returned to the private sector in the future. The public land order that withdrew land for the NTS does not allow cattle grazing or mineral mining near the RWMS. No economic or demographic pressures are expected to affect the use of the RWMS. A land use map of the NTS is provided in Figure 3.

(3) Aerial Photograph

Figure 4 provides an aerial photograph of the RWMS.

(4) Waste Analysis Data

LLMW that are accepted at the MWDU for disposal are identified in Section B.2. The hazardous constituents in the LLMW streams are also characterized, to the extent possible, as described in this section.

(5) Annual Waste Volume and Treatment Process

Treatment of LLMW is not performed at the MWDU. Hazardous and/or mixed wastes generated at the NTS are:

- Treated at the RCRA permitted Explosives Ordnance Disposal Unit;
- Transported to an offsite permitted treatment facility;
- Treated onsite in a 90-day accumulation area in an accumulation tank or container;
- Treated onsite under a treatability study;
- Treated onsite under a RCRA Corrective Action Plan;
- Treated under the generator treatment plan for those wastes that fall out of TRU Project and into the jurisdiction of the Mutual Consent Agreement, or
- Treated under the Mutual Consent Agreement according to the Generator Treatment Protocol.

Mixed wastes received at the MWDU from offsite are already treated, if required, and containerized according to applicable requirements set forth in the NTSWAC (Section B.3).

(6) Federal, State, or Local Environmental and Health Inspection of Compliance Records

The MWDU is subject to annual inspections performed by NDEP.

B.20.d Groundwater Pathway

(1) Groundwater Uses within 4.9 km (Three Miles (4.9 km) of the MWDU

There are three groundwater monitoring wells (active), one withdrawal well (active), and three other wells (inactive) within 4.9 km (3 mi) of the RWMS (Figure 6, 20-Foot Contour Map and RWMS Overall Site Plan). None of these wells supply potable water and there is no use of local groundwater for domestic, commercial, or agricultural purposes. The closest well supplying potable water is approximately 6.5 km (4 mi) south of the MWDU. The aquifers used by the wells are separated by volcanic confining units from the underlying regional carbonate aquifer considered to be part of the Ash Meadows groundwater system.

Monitoring wells RNM-1, RMN-2, and RMN-2S, completed in the valley-fill alluvial aquifer, were used for radionuclide migration studies. Well 5c, completed in the tuff aquitard underlying the valley-fill aquifer, supplies non-potable water for construction activities. In addition, three other wells were used to characterize the RWMS.

(2) Regional Map of Groundwater Recharge and Discharge

A regional map showing directions of groundwater flow and discharge areas is provided in Figure 19 (Regional Groundwater Flow Directions). This is also discussed in Section C and pictorially presented in Figure 19.

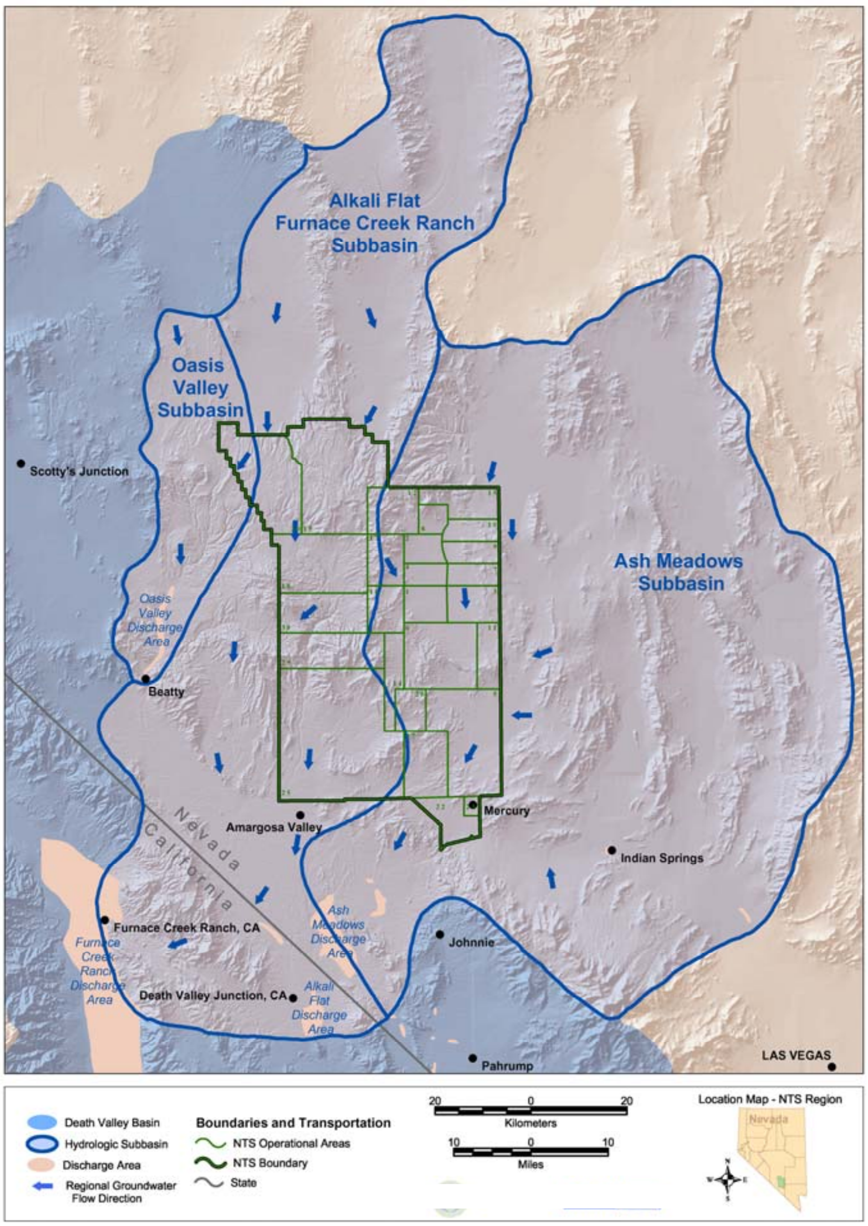

Figure 19 Regional Groundwater Flow Directions

(3) Net Precipitation

The RWMS site is arid, with an average annual rainfall of 12.5 cm (4.9 in) based on data collected at Well 5b from 1963 through 2007.

(4) Well Data Indicating a Release of Pollutants

Water from supply wells and other monitoring wells near the RWMS are sampled to evaluate the possibility of any movement of radioactive contaminants. Results of all sampling efforts to date have indicated no contaminant migration has occurred. An interim status RCRA groundwater monitoring program has indicated that contamination has not occurred as a result of LLMW disposal, which has been ongoing since 1987 at the RWMS.

(5) Food Chain Contamination

There is no known pathway of contamination within the food chain that would result from a release at the MWDU. There is no commercially produced food on or near the NTS.

B.20.e Surface Water Pathway

(1) Surface Water Uses within Three Miles (4.9 km) of the MWDU

There are no perennial sources of surface water in the vicinity of the RWMS. The only natural surface water within 4.9 km (3 mi) of the RWMS is Frenchman Lake, a playa at the bottom of the closed hydrographic basin. Ephemeral streams convey runoff to the playa, where it may stand for a few days or weeks as a lake before evaporating. The playa is dry throughout most of the year.

(2) Velocities of Streams and Rivers

There are no perennial streams or rivers within the Frenchmen Flat Basin. The RWMS is located on coalescing alluvial fans, where flow events are ephemeral. A flood assessment for the RWMS (Figure 13, 100-Year Flood Delineation) shows flow velocities on the alluvial fans to be 1 m per second or less during a flood event.

(3) Surface Water Quality and Monitoring

Due to the absence of perennial surface waters, no surface water monitoring is performed within the Frenchman Flat Basin.

B.20.f Air Pathway

(1) Air Monitoring Data and Current Monitoring System

Monitoring of air particulates for plutonium, americium, gross alpha, gross beta, and gamma radioactivity and monitoring of atmospheric moisture for tritium is conducted around the RWMS to meet National Emissions Standards for Hazardous Air Pollutants (NESHAP) requirements and to demonstrate <25 millirem (mrem) limit specified by DOE O 435.1. However, no sampling is performed specifically for RCRA hazardous constituents. Atmospheric radioactivity has never been greater than 3 percent of the value that would result in a 25 mrem dose to someone residing at the Area 5 RWMS.

(2) Population

There are no residents living within 6.5 km (4 mi) of the RWMS. The nearest population centers are Amargosa Valley, approximately 45 km (28 mi) away and Indian Springs, 39 km (24 mi).

B.20.g Subsurface Gas Pathway

(1) Disposal of Municipal Type Waste

Municipal waste has never been accepted for disposal at the RWMS. No methane gas is expected to be generated from within the LLMW disposed at the MWDU.

(2) Location of Underground Conduits

Figures 20 through 22 illustrate the existing and planned underground conduits for electrical, water, and sewer lines in the vicinity of the MWDU and the RWMS.

(3) Monitoring and/or Control Mechanisms for Subsurface Gas Releases

There is no system planned to continually monitor for non-radiological subsurface gas releases. Due to the absence of municipal-type waste, no methane gas is expected to be generated from within the LLMW disposed at the MWDU.

(4) Description of Known Releases

There is no evidence that past disposal of LLMW at existing RWMS cells has ever released hazardous subsurface gases.

B.20.h Contaminated Soil Pathway

(1) Areas of Soil Contamination

A soil sampling project was started at the RWMS in 1979 to determine the effect of waste management operation on the levels of tritium, ^{137}Cs, and ^{239}Pu in the surface soils. Sampling was not performed to determine the presence or concentrations of RCRA pollutants. The 1979 soil sampling results have been used as reference points for comparison with data obtained in subsequent years. All soil sampling conducted to date indicates that there have been no statistically significant increases in radioactive contaminant levels.

(2) Releases that Resulted in Soil Contamination

There have been no known releases at the proposed site for the MWDU that have resulted in soil contamination from radioactive or hazardous constituents.

B.20.i Transportation Information

All transportation information is provided in Section B.10. Transporters handling either incoming or exiting shipments are DOT certified and have assigned EPA identification numbers. NTS maintains onsite first responder personnel through the NTS Fire Department.

B.20.j Management Practices Information

There have been no occupational illnesses or claims of injury from ongoing LLMW disposal activities at the RWMS.

B.20.k Exposure Potential of the MWDU

The following section summarizes the exposure potential to hazardous constituents from the MWDU disposal activities.

(1) Groundwater Pathway

The MWDU is approximately 255 m (835 ft) above the uppermost aquifer. Contaminants must migrate through the unsaturated zone before contacting the groundwater. Based on RWMS characterization studies, the exposure potential for humans via the groundwater is very low.

The climate at the RWMS is characterized by low precipitation and high evapotranspiration. A water balance study was initiated at the RWMS to characterize the movement of water within the near surface. An objective of the program is to quantify water available for deep drainage, which could interact with buried waste and recharge the uppermost aquifer. Data collected from this study provide direct evidence of the effectiveness of evaporation processes within the operational cover to remove infiltrated water from the near surface alluvium. The data to date indicate that recharge is zero due to high evapotranspiration in the near surface. Under existing conditions, the near surface alluvium is effectively disconnected from the uppermost aquifer because water movement is directed toward the land surface. Evidence of this upward flow is provided by water potential and environmental tracer data obtained from the RWMS characterization projects. Environmental tracer studies have confirmed that there has been no movement of surface water to the alluvial aquifer for thousands of years. Because water is not moving through the alluvium to the water table, liquid phase contaminant migration to the groundwater is highly unlikely.

If natural processes at the ground surface and near surface vadose zone did not prevent downward liquid migration, the thickness and dryness of the unsaturated alluvium results in excessive liquid phase travel times to the uppermost aquifer. Monte Carlo simulations of travel time, based on data from characterization studies, indicate that there is a 95 percent probability that the unretarded travel time is between 32,000 and 102,000 years.

Groundwater elevation measurements beneath the RWMS indicate that the water table is essentially horizontal. These data show that the horizontal potential gradient is too weak to produce groundwater movement of any significance under the current conditions.

The alluvial aquifer is weakly connected to the carbonate aquifer. The groundwater flow pathway is downward through the alluvial aquifer to the underlying volcanic aquifer and confining unit. It then travels into the regional carbonate aquifer, then south and southwest laterally to wells or springs located offsite. Because the volcanic confining unit is very resistant to flow, it is the dominant barrier to contaminant migration.

Based on the factors described above and that there are no domestic, commercial, or agricultural uses of the groundwater in the vicinity of the RWMS, there is minimal potential for human exposure to contaminants from groundwater.

(2) Surface Water Pathway

The only surface water body within 4.9 km (3 mi) of the RWMS is a playa lake (Frenchman Lake), which is usually dry, except during rain events. There are no domestic, commercial, or agricultural uses of this water and thus no possibility for human exposure, other than occupational exposures, in the unlikely event of surface water contamination.

(3) Air Pathway

Waste is required to be encapsulated and/or containerized. The waste acceptance container requirements will minimize the possibility of an airborne release of LLMW. The future operational cover will be a minimum of 1.2 m (4 ft). The RWMS is located in an unpopulated remote area and, if a release were to occur, the only human exposure possible would be to workers at the site.

(4) Subsurface Gas Release

There are no significant methanogenic waste forms present in the MWDU. Data has been presented from LLW landfills which show the microbial degradation of cellulose materials (paper, wood packaging, and laboratory trash associated with LLW) results in negligible gas production of methane and carbon dioxide. The RWMS is located in an unpopulated remote area and, if a release were to occur, the only human exposure possible would be to workers at the site.

(5) Soil Release

There is no evidence to indicate that soil contamination has occurred related to operating the MWDU. Spills of LLMW are unlikely to contaminate soil because only non-liquid containerized wastes will be accepted for disposal. In the event of a spill of LLMW, any affected soil will be placed in containers and managed as LLMW. The potential for human exposure resulting from the dispersal of contaminated soil is low due to the sparse population in the vicinity. Because no crops are grown in the area, food chain contamination also is extremely unlikely.

(6) Transportation Related Releases

The only method of transporting LLMW to the RWMS is by vehicle. All shipments are made according to applicable DOT, EPA, and NNSA/NSO requirements. Drivers are encouraged to refrain from unnecessary stops until the waste shipment is delivered to the NTS. The Contingency Plan and Emergency Procedures (Exhibit 2) contain emergency response procedures that will be implemented in the event of any accidental spill of LLMW onsite. For transportation-related accidents in the Las Vegas area, the City of Las Vegas and Clark County or Nye County emergency response organizations will respond.

(7) Potential for Human Exposure from Worker Management Practices

There have been no recorded injuries, accidents, or illnesses resulting in exposures related to operating the current (P03U) MWDU. The Contingency Plan and Emergency Procedures (Exhibit B2) describe emergency response activities. The plan calls for immediate action whenever necessary and provides for investigation into releases and initiation of corrective actions. Procedures to prevent hazards are described in Section B.8. In addition, all employees at the RWMS are required to complete the training program described in Section B.12.

Based on existing NNSA/NSO and contractor operating procedures and quality assurance programs, the potential for offsite migration and public exposure resulting from releases from the MWDU is extremely remote.

B.22 Summary of Pre-Application Meeting [40 CFR 124.31 and 40 CFR 270.14(b]

This section provides a summary of the pre-application public meeting and the published notice of the meeting. The meeting was held at the Bob Rudd Community Center in Pahrump, Nevada, on Wednesday, September 2, 2009, from 1730 to 1930 hours.

The meeting was held to inform the public of proposed hazardous waste management activities, provide information on the design and purpose of the unit, diagram travel corridors used by transporters, and allow the public to comment on the proposed permit.

Exhibit 4 contains the following information:

- Meeting notice and published newspaper article
- Posters representing public information disseminated at the meeting
- Attendees sign in sheet
- Record of public comments

Exhibit 4, Pre-Application Public Meeting and Notice

National Nuclear Security Administration

Nevada Site Office News

News Media Contacts:
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For Immediate Release:
August 26, 2009

U.S. Department of Energy Hosts Open House on the Proposed Construction of New Mixed Low-Level Radioactive Waste Disposal Cell at the Nevada Test Site

U.S. Department of Energy (DOE), National Nuclear Security Administration representatives will hold an open house meeting on Wednesday, September 2, 2009, regarding the upcoming submittal of an application to the State of Nevada for a Resource Conservation and Recovery Act (RCRA) Part B permit to construct and operate a new mixed low-level radioactive waste disposal cell in Area 5 of the Nevada Test Site.

The open house will be held from 5:30 pm to 7:30 pm at the Bob Rudd Community Center, located at 150 North Highway 160 in Pahrump.

Subject matter experts will discuss the proposed plans and provide background information. Members of the public are encouraged to attend, ask questions, and provide comments related to the proposed mixed low-level radioactive waste disposal cell.

Mixed low-level radioactive waste is low-level radioactive waste with a RCRA hazardous waste component. The hazardous component of the waste contains material that is toxic, corrosive, reactive, ignitable, or specifically identified by the U.S. Environmental Protection Agency (EPA) as "hazardous."

Members of the public requiring special access to participate in the meeting are encouraged to contact the DOE at least 72 hours prior to the meeting.

NSO-09-08 **-30-**

On Wednesday, September 2, 2009, U.S. Department of Energy (DOE) National Nuclear Security Administration representatives will hold an open house meeting from 5:30pm – 7:30pm at the Bob Rudd Community Center located at 150 North Highway 160, Pahrump, NV 89060 regarding the upcoming submittal of an application to the State of Nevada for a Resource Conservation and Recovery Act (RCRA) Part B permit. This permit will allow the DOE to construct a new disposal cell and dispose mixed low-level radioactive waste in Area 5 of the Nevada Test Site. Members of the public are encouraged to attend, ask questions, and provide comments related to mixed low-level radioactive waste disposal at the Nevada Test Site. Mixed low-level radioactive waste is low-level radioactive waste with a RCRA hazardous waste component. These wastes are considered hazardous because they are toxic, corrosive, reactive, ignitable, or specifically identified by the U.S. Environmental Protection Agency (EPA) as "hazardous." People requiring special access to participate in the meeting are encouraged to contact the DOE at least 72 hours prior to the meeting.

For further information contact:

U.S. Department of Energy
National Nuclear Security Administration
Nevada Site Office
Office of Public Affairs
P.O. Box 98518
Las Vegas, NV 89193-8518
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http://www.nv.doe.gov

Nevada Test Site
Resource Conservation and Recovery Act (RCRA) Permit Submittal Process

Permit Application

The U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office (NSO) plans to submit a RCRA Part B permit application to the State of Nevada Division of Environmental Protection (NDEP) to construct a new mixed low-level radioactive waste disposal cell at the Nevada Test Site (NTS) Area 5 Radioactive Waste Management Site. Public comments are encouraged and will be included in the permit application if received by September 15, 2009. Comments received after this date should be forwarded to NDEP for consideration.

Application Review

- NDEP has 180 days to review and comment
- NDEP reviews the application for:
  - Completeness
  - Regulatory compliance
  - Environmental impact
- NSO must satisfactorily resolve all comments

Permit Issuance

- NDEP prepares the draft permit upon review completion
- Permit published for 45-day public review and comment
- NDEP addresses public comments
- NDEP issues final permit or denies the application
- Disposal facility constructed and operations begin

Permit Compliance

- NDEP required to conduct periodic inspections
- NSO required to correct inspection deficiencies/violations
- NDEP may modify, revoke, or terminate permit with just cause
- Permit renewal required every five years

What is RCRA?

RCRA is a federal law regulating the management of hazardous waste from generation to disposal. RCRA applies to all private, public, and governmental entities.

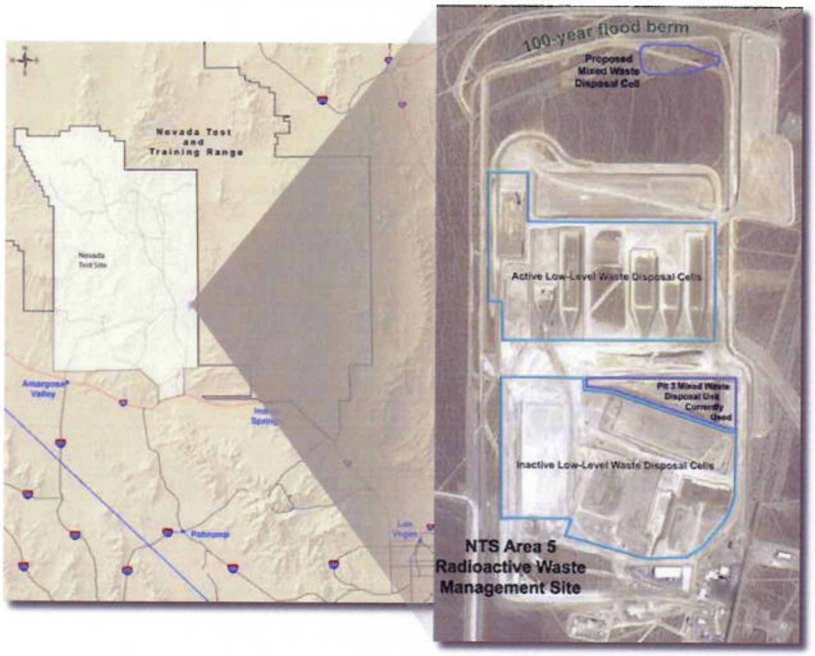
The existing RCRA Part B Permit requires a percentage of mixed low-level waste disposed at the NTS be visually examined using x-ray technology

Once mixed low-level waste packages are unloaded, a radiological survey is conducted on all truck trailers prior to release from the NTS

Nevada Test Site

Proposed Mixed Low-Level Waste Disposal Cell Design

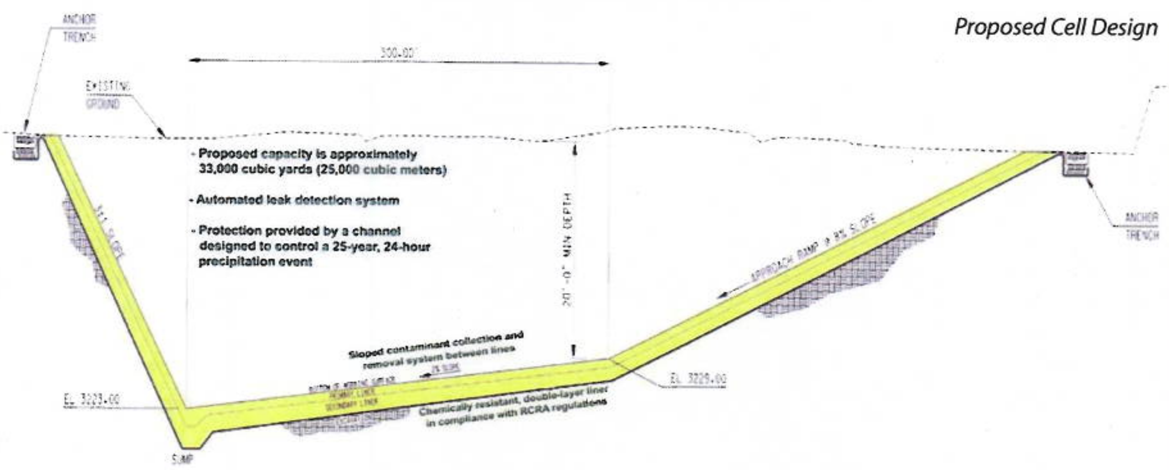
The U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office plans to submit a permit application to the State of Nevada for approval to construct a new mixed low-level waste disposal cell at the Nevada Test Site Area 5 Radioactive Waste Management Site.



Disposal Facility Environmental Conditions

- Depth to groundwater is approximately 770 feet
- Average annual rainfall is four to six inches
- Evaporation exceeds rainfall by 12 times

Proposed Cell Design



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National Nuclear Security Administration

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Mixed Low-Level Radioactive Waste Disposal at the Nevada Test Site

- Mixed waste contains both a hazardous and a low-level radioactive waste component
- Hazardous waste is toxic, corrosive, reactive, ignitable, or specifically identified by the U.S. Environmental Protection Agency as "hazardous"

Mixed low-level waste disposal in the existing "Pit 3" at the Nevada Test Site

Existing mixed low-level waste disposal cell, Pit 3, at the Nevada Test Site Area 5 Radioactive Waste Management Site

- An existing mixed low-level waste disposal cell, Pit 3, is located in Area 5 of the Nevada Test Site
  - Waste is generated by U.S. Department of Energy environmental cleanup activities across the United States
- Pit 3 operates under a Resource Conservation and Recovery Act Part B Permit
  - Disposal is limited to no more than 20,000 cubic meters
  - Closure of the existing cell is required by December 2010

- All waste shipped to the Nevada Test Site must comply with strict U.S. Department of Transportation regulations
- Mixed waste acceptance, packaging, and disposal is conducted in accordance with stringent Nevada Test Site Waste Acceptance Criteria
- All waste is tagged, scanned, and positioned in Nevada Test Site disposal cells using a grid system

Mixed low-level waste packages disposed in Pit 3

Nevada Test Site Area 5 Radioactive Waste Management Site

The U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office plans to submit a permit application to the State of Nevada for approval to construct a new mixed low-level waste disposal cell at the Nevada Test Site Area 5 Radioactive Waste Management Site.

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Nevada Test Site
Projected Mixed Low-Level Waste Generators and Disposal Volumes

Waste Generators

Mixed low-level waste disposed at the Nevada Test Site is generated by environmental cleanup activities at U.S. Department of Energy and U.S. Department of Defense facilities across the United States. These generators must successfully demonstrate that every waste shipment complies with Nevada Test Site Waste Acceptance Criteria before approval is granted for transportation and disposal at the Area 5 Radioactive Waste Management Site.

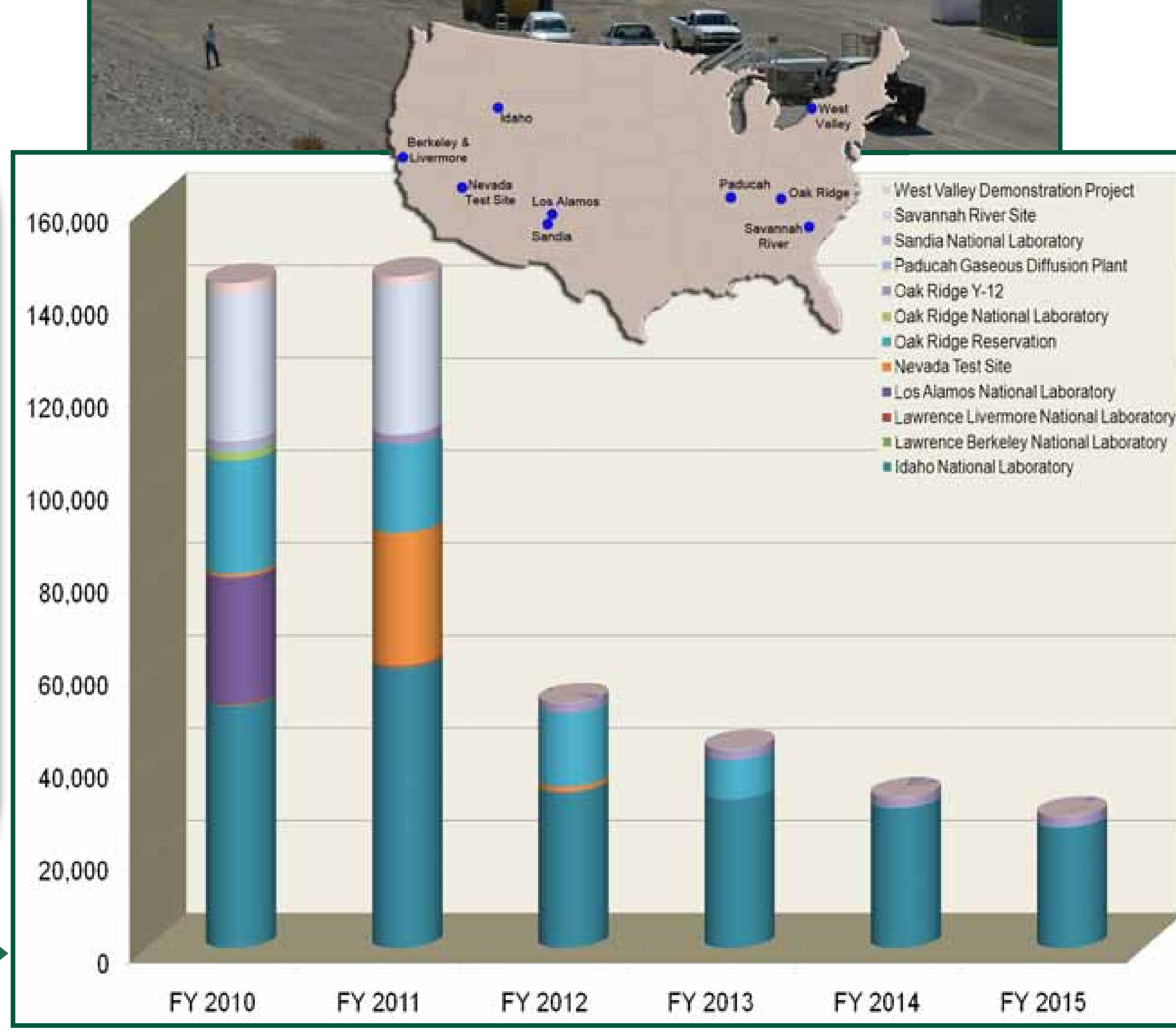
American Recovery and Reinvestment Act (ARRA) of 2009

Many of the generators approved to ship low-level and mixed low-level waste to the Nevada Test Site have received funding through the ARRA to accelerate and conduct additional cleanup activities which, in turn, generates additional waste, some of which will be disposed at the Nevada Test Site.

Containerized mixed low-level waste generated by environmental cleanup activities is transported to the Nevada Test Site via trucks

Volume Projections

- Generators are required quarterly to update volume forecasts for the current fiscal year to ensure the availability of adequate resources for waste disposal operations at the Nevada Test Site
- Annually, generators are required to provide volume forecasts for the five years beyond the current fiscal year
- Generators provide separate volume forecasts for waste generated and disposed using ARRA funding



Total mixed low-level waste volumes projected in cubic feet per fiscal year (FY)

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Transporting Mixed Low-Level Radioactive Waste to the Nevada Test Site

All mixed waste must be transported in compliance with U.S. Department of Transportation regulations and U.S. Environmental Protection Agency requirements

Fiscal year 2008 transportation routes to the Nevada Test Site

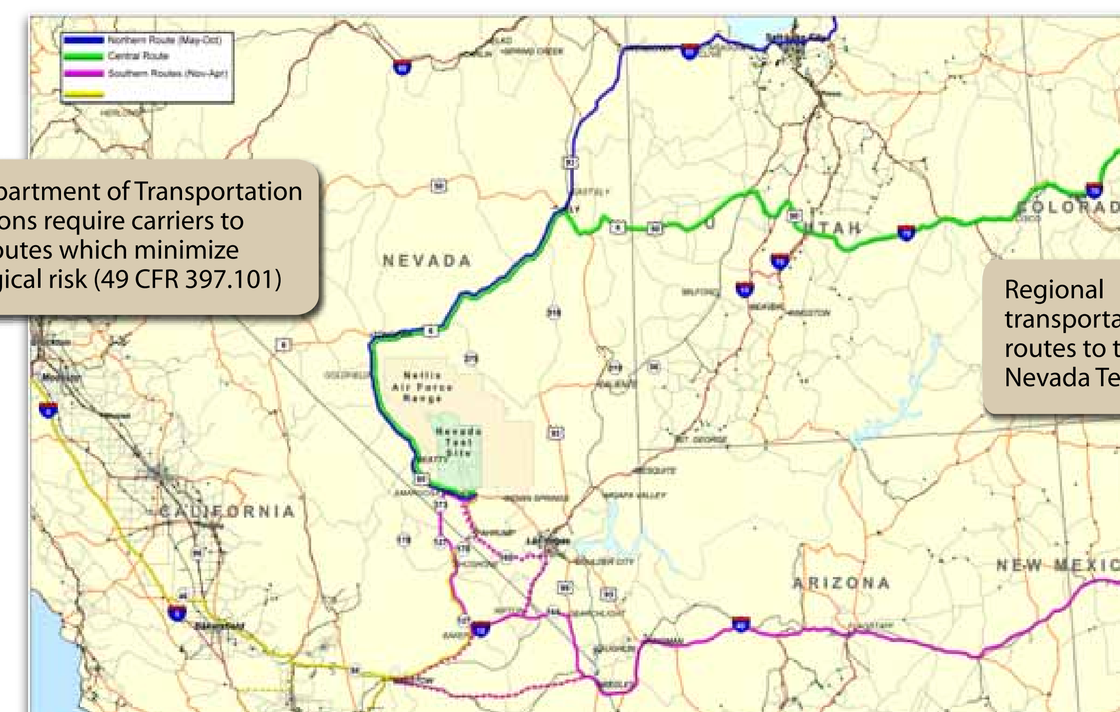
Waste generators are responsible for ensuring that waste is packaged in a safe and compliant manner (49 CFR 173.401)

Radiological surveys are conducted on mixed waste shipments upon arrival and departure at the Area 5 Radioactive Waste Management Site (49 CFR 173.443)

Waste generators are required to select motor carriers who have been reviewed by the DOE Motor Carrier Evaluation Program (DOE O 460.2A)

Shipments of mixed waste to the Nevada Test Site display the appropriate placards (49 CFR 172.500)

U.S. Department of Transportation regulations require carriers to select routes which minimize radiological risk (49 CFR 397.101)



Regional transportation routes to the Nevada Test Site

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National Nuclear Security Administration

RCRA PERMIT APPLICATION
SUBMITTAL OPEN HOUSE

WEDNESDAY, SEPTEMBER 2, 2009
BOB RUUD COMMUNITY CENTER, PAHRUMP, NEVADA

MR. SELDEN: TYLER SELDEN. THE QUESTION I'VE GOT IS HOW MUCH LOW-LEVEL NUCLEAR WASTE IS PRODUCED HERE IN NEVADA, AND HOW MUCH ACTUALLY COMES FROM OUTSIDE OF NEVADA THAT WOULD BE STORED IN THIS PARTICULAR NUCLEAR CELL.

-OOO-

MS. ROSE: MY NAME IS MERLYNN ROSE. I'M A CITIZEN OF THE UNITED STATES. AND I'M JUST CURIOUS IF THEY'RE GOING TO BE ASKING THE WESTERN SHOSHONE ABOUT -- IF THEY AGREED FOR THE WASTE TO BE MOVED TO THIS NEW SITE. AND IF THEY RECEIVED THEIR APPROVAL, BEING THAT IT IS ON A SOVEREIGN NATION KNOWN AS NEWE SOGOBIA SOVEREIGN NATION AS NOTED BY THE UNITED NATIONS. SO BASICALLY, I JUST WANT TO KNOW IF THEY HAVE THEIR APPROVAL. THANK YOU.

-OOO-

MS. MEGAN RICE:

MR. VIGALE: LOUIS VIGALE.

MS. RICE: MEGAN RICE.

MR. VIGALE: WE'RE WITH NEVADA DESERT EXPERIENCE.

MS. RICE: IT'S OUR GROUP IN LAS VEGAS.

MS. RICE: MY FIRST REACTION REALLY IS THAT I'VE BEEN HEARTENED BY THE FACT THAT IN THE REGULATORY, THE

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REPORTING SERVICES

OVERALL PLANNING THAT THE FINAL STAGE SEEMS TO BE MOVING TOWARD CLOSURE. AND SO THAT MEANS THAT WE HAVE HOPE THAT THERE WOULD BE A DEFINITE EFFORT TO MAKE THAT POSSIBLE BY THE DEPARTMENT OF ENERGY, WHICH IS WHAT WE'RE SPEAKING TO, RIGHT?

THE DEPARTMENT OF ENERGY WOULD BE TAKING PRACTICAL PLANNING STEPS AND STAGES TO NOT JUST HAVE TO CONTINUE CLEANING UP FOREVER AS SOON AS POSSIBLE, IT WON'T BE NECESSARY TO BE CONDUCTING THESE TOXIC WASTE MIXED LOW-LEVEL WHATEVER, HAVE TO CARRY THEM INTO ANYWHERE FROM ANYWHERE IN THE COUNTRY. HOPEFULLY, THE DEPARTMENT OF ENERGY BUILDS AND IT'S DOING THAT'S ALLOWING THIS TO HAPPEN AND HELPING IT TO HAPPEN IN STATES WHERE THE ENVIRONMENTAL BENEFITS THE COUNTRY AND THE PLANET WITH THE DEFINITE STEPS TO WORK TOWARDS THE TIME WHEN IT WON'T BE NECESSARY TO CARRY MORE WASTE.

MR. VAGALE: WELL, MY CONCERNS ARE THAT ONE, IS THE DANGER OF THE WASTE. ONE IS QUESTION OF TRANSPORTATION. AND I APPRECIATE THAT, YOU KNOW, THE EFFORTS THAT HAVE BEEN MADE AND HAVE BEEN EXPLAINED TO US TO GUARD THE SAFETY IF THE TRUCKS DON'T GO THROUGH LAS VEGAS. BUT IT POINTED OUT TO US THAT ONE DID TURN OVER RIGHT OUT HERE AT WHERE 160 COMES INTO I-15, RIGHT IN THIS AREA. FORTUNATELY, NOTHING SPILLED OR GOT LOOSE. BUT PEOPLE, THE VERY FACT THAT THEY SAY FORTUNATELY IT WASN'T,

WELL, THAT MEANS IT'S POSSIBLE IT COULD HAVE.

THEY BYPASS LAS VEGAS, BUT PEOPLE LIVE IN THOSE OTHER PLACES, LIKE PAHRUMP. SO THEY ONLY COME THROUGH PAHRUMP, NOT LAS VEGAS. I DON'T KNOW IF YOU LIVE IN PAHRUMP, BUT YOU MIGHT, YOU KNOW, YOU'RE CONCERNED ABOUT IT AS SOMEBODY LIVING IN LAS VEGAS AND PARTICULARLY PEOPLE WHO HAVE CHILDREN, ET CETERA.

BUT THE OTHER THING THAT CONCERNS ME IS THAT RADIOACTIVITY HAS HALF-LIVES OF THOUSANDS OF YEARS. AND WHAT HAPPENS AFTER THEY -- THEY HAVE PROTECTIVE SYSTEMS, BUT THEY'RE DESIGNED FOR, LIKE, 25 YEARS TO MONITOR THE WATER, THE LAND, THE SEEPAGE INTO THE -- TOWARDS THE WATER TABLES AND THEY'RE 750 FEET DOWN. BUT OVER HUNDREDS OF YEARS AND MAYBE THOUSANDS OF YEARS, THERE WILL BE LIFE ON THIS PLANET AND WHAT WILL HAPPEN IF SOMEBODY DECIDES, AS FOR EXAMPLE, ARIZONA, THEY FIND THAT IT'S VERY ENVIRONMENTALLY FRIENDLY TO HAVE A SCHOOL UNDERGROUND, UNDER DIRT, UNDER THE DIRT, YOU KNOW, FOR THE COOLING AND HEATING AND SO FORTH. AND WHAT IF THAT IS AREA THAT THEY DON'T KNOW ANYMORE THAT A HUNDRED YEARS BEFORE, 200, 500 YEARS BEFORE WAS RADIOACTIVITY AND IT'S STILL RADIOACTIVE?

THERE IS EVIDENCE, AS I UNDERSTAND IT, THAT RADIOACTIVITY FROM THE TESTING ERA HAS GONE INTO THE WATER TABLES AND HAS BEEN ENCOUNTERED IN DEATH VALLEY IN THE

RIVERS THERE, EVEN AFFECTING THE FISH. THEY SHOW SIGNS OF MUTATION MUCH LARGER THAN USUAL, ET CETERA. WHAT WILL THIS LEAKAGE FROM THIS -- WHERE THERE EVENTUALLY BE THE -- EVENTUALLY THERE WILL BE AND WILL THEY EVENTUALLY GET DOWN TO THE TABLES? NOW THERE'S DONE A LOT OF EFFORT, SPENT A LOT OF MONEY TO MONITOR OVER 25 YEARS. BUT WHAT ABOUT 250 YEARS OR EVEN 2500? WE DON'T KNOW IF IT'LL STILL BE DANGEROUS.

SO I THINK IT'S OUR POSITION THAT WE SHOULDN'T BE PRODUCING THIS KIND OF WASTE, ESPECIALLY FOR MILITARY PURPOSES. THE LIVES OF PEOPLE THAT ARE AFFECTED BY NUCLEAR WEAPONS OR JUST WEAPONS WITH DEPLETED URANIUM OR WHATEVER IT IS THAT THEY'RE USING THIS -- THAT THIS WASTE COMES FROM IS A DANGER TO PEOPLE LIVING TODAY, THEY'RE OUR FRIENDS OR FOES. AND WE JUST DON'T KNOW THE EFFECT ON PEOPLE IN THE FUTURE.

SO WE BASICALLY -- OPENING MORE WASTE STORAGES ENCOURAGES MORE PRODUCTION OF NUCLEAR WASTE AND MORE HAZARD TO PEOPLE TODAY AND IN THE FUTURE.

-OOO-

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2

From: susan singer
Sent: Tuesday, September 15, 2009 7:44 AM
To: RCRA
Subject: Opposing RCRA Part B permit application

I strongly oppose approving the RCRA Part B permit to construct a new mixed low-level radioactive waste disposal cell at the NTS Area 5. Iff approved it would mean trucks that carry this waste would travel our highways, emitting gamma and neutrons. Living within spitting distance of a highway, it is unacceptable that anyone be subjected to unknown risk created by the transport of even "low-level" radioactive waste. This permit application seems an end run around the Yucca Mountain funding halt.

Susan Singer

From: Wili Vegas
Sent: Tuesday, September 15, 2009 2:15 PM
To: RCRA
Subject: oppose RCRA part B permit app. @NTS Area 5

To whom it may concern: i oppose nuclear materials being transported thru public roadways, unfortunately this happens everyday...Specifically i oppose RCRA part B permit application at Nevada Test Site Area 5, also i oppose BLM oversite elimination of same area...I speak for the next SEVEN GENERATIONS...WILLIAM FRAGOSA

From: Andrew Kishner
Sent: Tuesday, September 15, 2009 1:54 PM
To: RCRA
Subject: Comments re: RCRA Part B Application

To the attention of Mr. Ken Small,

I am opposed to the idea of constructing, and the granting of a RCRA Part B permit for, a new mixed low-level radioactive waste disposal cell at the NTS Area 5. Scores of citizens residing in central Nevada have already experienced dangerously high whole-body radiological doses from U.S. nuclear weapons testing fallout from the Nevada Test Site. The transportation routes traveled by semi trucks from waste generators across the U.S. to this proposed cell will mostly converge on central Nevada's routes, which wind through main streets and near children-filled schools and day care centers. These trucks emit radiation in the form of gamma and neutron rays - allowed by DOT standards - that leak from the caskets to the world outside the truck's walls. What is the total, cumulative person-rems that will be attributed to the population exposure from trucking waste to this new disposal cell when it is finally filled (more than 15 feet high and a football field in area)? Using the National Research Council's rule of thumb (an average of *800 cancer* deaths are expected per *1 million person-rem* of exposure), how many non-fatal cancers and fatal cancers will this new disposal cell be responsible for?

I am also opposed to DOE Environmental Management's scheme for the relinquishment of the 700 acres underlying the proposed disposal cell and 're-withdrawing' the land away from the public's caretaker of these lands, the BLM. I am opposed to this plot to forever deny the public the right to have those 700 acres back for its own use. The NTS is no longer being used for the original intent of the existing Public Orders for land withdrawal and never is it mentioned in any of the Public Orders for permanent waste disposal facilities. Never did the public approve anything other than 'weapons testing.' Contamination of these lands has made large tracts of the NTS 'not suitable for public use' but that doesn't and shouldn't give EM an excuse to remove the public's access to that land forever. Contamination of these lands from weapons testing warrants the clean-up and return of these lands to the BLM. If they can't be cleaned up because it isn't feasible, for whatever reason, then they at least shouldn't be more contaminated with radioactive waste and reassigned permanently for non-public use.

Sincerely,
Andrew Kishner

RCRA Open House – Pahrump, NV – 9/2/2009

First Name	Last Name
Bob	Gamble
Mary Ellen	Giampaoli
George	Glidden
Cash	Jaszezak
James	Lopez
Megan	Rice
Jacob	Sanders
Tyler	Selden
Fr. Louis	Vitale
Michael	Voegele
Joseph	Ziegle
Merlynn	Rose

Note: 31 people were in attendance but these were the only individuals who signed in.

C.1 MWDU Groundwater Protection *[40 CFR 270.14(c)]*

C.1.a Groundwater Monitoring Data

Currently groundwater monitoring at the RWMS is conducted for LLMW disposal unit P03U (Pit 3), an interim status unit identified in NDEP Permit NEV HW0021. The groundwater monitoring program consists of three wells located in the uppermost aquifer (alluvial aquifer). These three wells have been sampled since 1993 and results formally reported to NDEP since 1997. To date no hazardous waste constituents have been detected, the monitoring parameters set by NDEP have not been exceeded, and background values have been established for groundwater in the uppermost aquifer.

C.1.b Groundwater Monitoring Program

Exhibit 5 is a copy of the NTS 2008 Data Report: Groundwater Monitoring Program Area 5 RWMS (DOE/NV/25946-619, January 2009). The report also includes a data summary of monitored parameters since program inception.

Groundwater monitoring is conducted at three wells as a RCRA requirement for Pit 3. Water levels in each well are measured every three months and water samples are collected every six months. Water samples are analyzed for indicators of contamination (pH, specific conductance, total organic carbon, total organic halides, PCBs, and tritium) and general water chemistry parameters (calcium, magnesium, potassium, sodium, iron, manganese, bicarbonate, sulfate, chloride, and fluoride).

Semi-annual monitoring data collected and reported for the three current monitoring wells have established that:

- There has been no measurable impact on the quality of the uppermost aquifer as a result of disposal activities in Area 5;
- There has been no statistically significant change in the background concentrations of monitoring limits **[40 CFR 264.90(3)]**;
- Based on groundwater elevations, the aquifer under the Area 5 RWMS is essentially flat;
- The general direction of groundwater flow in the uppermost aquifer is from north to south;
- The calculated flow velocity in the uppermost aquifer is approximately 0.1 meters (m) per year;
- The flat groundwater table elevations make local groundwater flow mapping difficult. The groundwater table elevations measured in Area 5 are relatively flat (water table elevation between PW3 and Well 5b [6.5 km south] [4 mi] is approximately 1 m [3.3 ft]). This condition makes determination of local flow direction difficult to model.

C.1.c Detection Monitoring Program

Exhibit 5 contains information required in **40 CFR 264.98** including:

- A proposed list of indicator parameters including pH, specific conductance, total organic carbon, total organic halides, and tritium and general water chemistry parameters (calcium, magnesium, potassium, sodium, iron, manganese, bicarbonate, sulfate, chloride, and fluoride). These measurements can provide a reliable indication of the presence of hazardous constituents in the groundwater.
- The proposed groundwater monitoring system.
- Investigation levels for the indicator parameters.

C.2 Hydrologic Conditions at the Area 5 RWMS

Extensive site characterization, environmental monitoring, and flow and transport modeling have been performed for the Area 5 RWMS over the past several decades to assess facility performance. These are discussed in detail in the Performance Assessment Report for the Area 5 RWMS (Shott, et al., 1998) and summarized in the draft data quality objective document for CAU 111. The Performance Assessment implements the conceptual site model, which indicates that release pathways are upward to the land surface with negligible infiltration below the root zone. Important transport processes are the rapid release of volatile compounds to the cover and the atmosphere and slow accumulation of particulates in the cover by the coupled processes of liquid phase advection/diffusion in deep cover layers and animal burrowing/plant uptake in the near surface.

The hydrologic conditions at the Area 5 RWMS as measured and predicted include:

- Groundwater depth is approximately 255 m (835 ft) [Well UE5PW-1 at 236 m (774 ft), Well UE5PW-2 at 256 m (841 ft), and Well UE5PW-3 at 272 m (891 ft)].
- The water table is extremely flat (gradient of approximately 1E-4 m/m) with flow velocities of approximately 0.1 m per year.
- The travel time for infiltrated water from the top of the downward flow region to the water table far exceeds the required isolation periods for hazardous waste and low-level radioactive waste. Estimated travel time exceeds tens of thousands of years.
- Below the rooting zone, moisture flux (liquid and vapor) is upward from approximately 3 m to 40 m, no flux from 40 m to 90 m, and downward to water table below 90 m.

Supporting evidence for negligible infiltration below the root zone includes:

- Thick (240 m), dry (approximately 8 percent volumetric water content) vadose zone indicates very low hydraulic conductivity and very long travel times to the saturated zone.
- Estimated age of soil-pore water, based on chlorine-36 and stable isotope profiles, far exceeds measured age of groundwater.
- The water potential profile above 40 m indicates upward movement of water.
- Stable isotope ratios ($^{18}O/^{16}O$, D/H) indicate deep profile soil-pore water entered the system under a cooler, wetter climate.
- Fourteen years of weighing lysimeter data shows no discharge below 2 m.
- Reference evapotranspiration calculated from meteorological data is approximately 11.6 times precipitation.

C.2.e Continuation of Existing Groundwater Monitoring

NNSA/NSO will continue to monitor the three existing wells for current parameters associated with the groundwater monitoring program. Annual reporting will follow format and content established between DOE and NDEP in a letter dated August 12, 1997.

Exhibit 5, Nevada Test Site 2008 Data Report: Groundwater Monitoring Program Area 5 Radioactive Waste Management Site

DOE/NV/25946--619

National Security Technologies LLC
Vision • Service • Partnership

NEVADA TEST SITE

2008 DATA REPORT: GROUNDWATER MONITORING PROGRAM AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE

January 2009

Prepared for:

U.S. Department of Energy
National Nuclear Security Administration
Nevada Site Office

Prepared by:

National Security Technologies, LLC
Las Vegas, Nevada

DISCLAIMER

DOE/NV/25946--619

NEVADA TEST SITE

2008 DATA REPORT: GROUNDWATER MONITORING PROGRAM AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE

January 2009

Prepared for:

U.S. Department of Energy
National Nuclear Security Administration
Nevada Site Office

Prepared by:

National Security Technologies, LLC
Las Vegas, Nevada

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LIST OF ACRONYMS AND ABBREVIATIONS

AMSL	above mean sea level
BN	Bechtel Nevada
°C	degrees Celsius
Ca	calcium
CFR	Code of Federal Regulations
Cl	chloride
cm	centimeter
cm/yr	centimeter per year
DOE	U.S. Department of Energy
E	Easting
°F	degrees Fahrenheit
F	fluoride
Fe	iron
ft	feet
GW	groundwater
HCO_3	bicarbonate
IL	investigation level
in.	inch
in./year	inch per year
K	potassium
L	liter
LCA	lower carbonate aquifer
m	meter
m/m	meter change in water level elevation per meter change in gradient direction
m^3/m^3	void space volume (cubic meter) per total aquifer volume (cubic meter)
MDC	minimum detectable concentration
MDL	method detection limit
Mg	magnesium
mg/L	milligram per liter
mmhos/cm	millimhos per centimeter
Mn	manganese
N	Northing
Na	sodium
NDEP	Nevada Division of Environmental Protection
NSTec	National Security Technologies, LLC
NTS	Nevada Test Site
pCi/L	picoCurie per liter
RCRA	Resource Conservation and Recovery Act
REECo	Reynolds Electrical and Engineering Company, Inc.
RWMS	Radioactive Waste Management Site
SC	specific conductance
SiO_2	silicate
SO_4	sulfate
TOC	total organic carbon
TOX	total organic halides
µg/L	microgram per liter

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EXECUTIVE SUMMARY

This report is a compilation of the groundwater sampling results from the Area 5 Radioactive Waste Management Site (RWMS) including calendar year 2008 results. Each of the three Pilot Wells was sampled on March 11, 2008, and September 10, 2008. These wells were sampled for the following indicators of contamination: pH, specific conductance, total organic carbon, total organic halides, and tritium. Indicators of general water chemistry (cations and anions) were also monitored. Results from all samples collected in 2008 were within the limits established by agreement with the Nevada Division of Environmental Protection for each analyte. These data indicate that there has been no measurable impact to the uppermost aquifer from the Area 5 RWMS.

There were no significant changes in measured groundwater parameters compared to previous years.

Other information in the report includes an updated Cumulative Chronology for the Area 5 RWMS Groundwater Monitoring Program and a brief description of the site hydrogeology.

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This report is a compilation of the groundwater sampling results from three monitoring wells located near the Area 5 Radioactive Waste Management Site (RWMS) at the Nevada Test Site (NTS), Nye County, Nevada, for calendar year 2008. The NTS is an approximately 3,561 square kilometer (1,375 square mile) restricted-access federal installation located approximately 105 kilometers (65 miles) northwest of Las Vegas, Nevada (Figure 1-1). Pilot wells UE5PW-1, UE5PW-2, and UE5PW-3 are used to monitor the groundwater at the Area 5 RWMS (Figure 1-2). In addition to groundwater monitoring results, this report includes information regarding site hydrogeology, well construction, sample collection, and meteorological data measured at the Area 5 RWMS.

The disposal of low-level radioactive waste and mixed low-level radioactive waste at the Area 5 RWMS is regulated by U.S. Department of Energy (DOE) Order 435.1, “Radioactive Waste Management” (DOE, 2001). The disposal of mixed low-level radioactive waste is also regulated by the State of Nevada under the Resource Conservation and Recovery Act (RCRA) regulation Title 40 Code of Federal Regulations (CFR) Part 265, “Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities” (CFR, 1999). The format of this report was requested by the Nevada Division of Environmental Protection (NDEP) in a letter dated August 12, 1997. The appearance and arrangement of this document have been modified slightly since that date to provide additional information and to facilitate the readability of the document. The objective of this report is to satisfy any Area 5 RWMS reporting agreements between DOE and NDEP.

1.2 SITE HYDROGEOLOGY

The Area 5 RWMS is located in northern Frenchman Flat in the southeast portion of the NTS. Frenchman Flat is a topographically closed basin. Erosion of surrounding mountains has resulted in accumulation of thick, unsaturated, alluvial deposits above volcanic rocks within the basin (Bright et al., 2001). Alluvial and volcanic aquifers are present beneath the Area 5 RWMS and are believed to extend throughout much of the Frenchman Flat basin (Bechtel Nevada [BN], 2005). In this south-central portion of the NTS, a moderately thick volcanic confining unit, consisting of altered volcanic rocks, separates the shallow alluvial and volcanic aquifers from the underlying regional lower carbonate aquifer (LCA) (BN, 2005; Laczniak et al., 1996).

Sodium-bicarbonate type water comes from the three monitoring wells (UE5PW-1, UE5PW-2, and UE5PW-3). This type of water is common in the upper aquifers in Frenchman Flat. UE5PW-1 and UE5PW-2 are completed in the alluvial aquifer and UE5PW-3 is completed in the volcanic aquifer. Similar groundwater chemistry and water-table elevations in UE5PW-1, UE5PW-2, and UE5PW-3 indicate that the alluvial and volcanic aquifers are locally connected near the Area 5 RWMS.

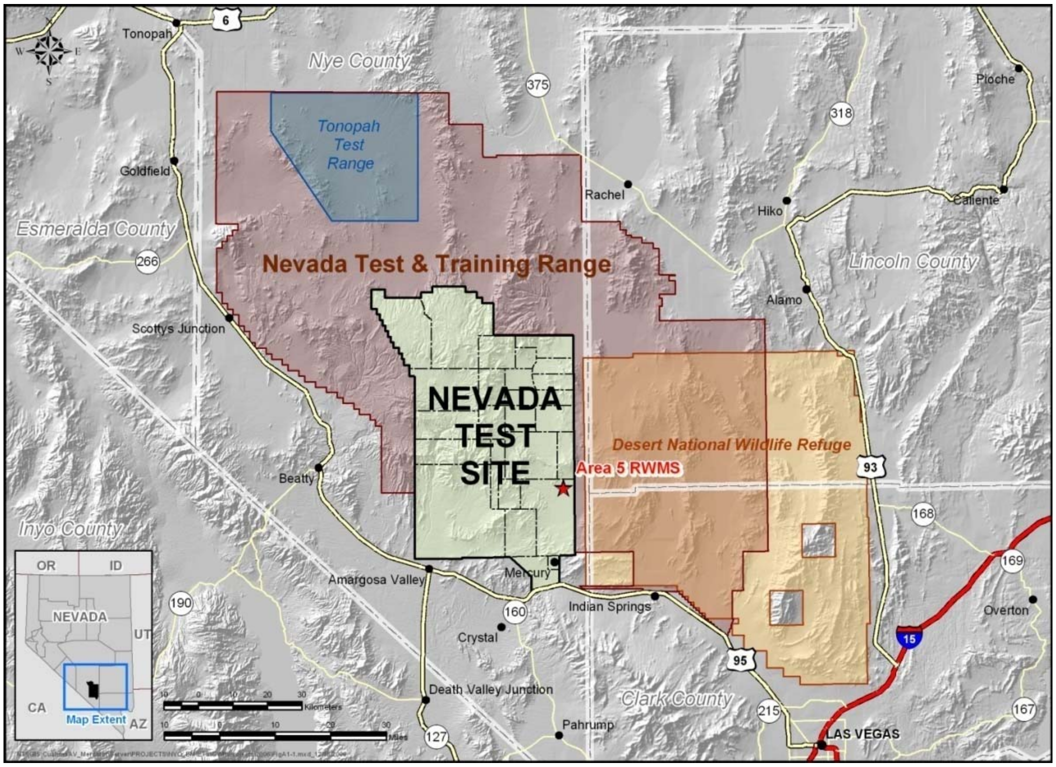

Figure 1-1 Location of the Area 5 RWMS and Nevada Test Site within Nevada

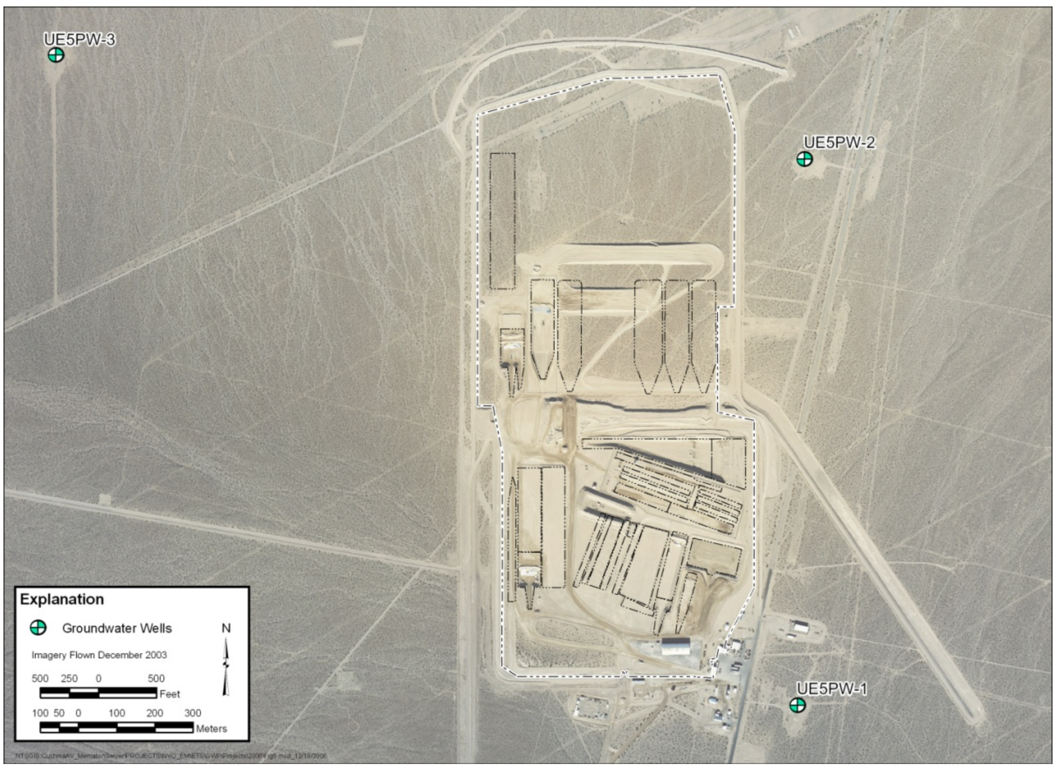

Figure 1-2 Location of Pilot Wells at the Area 5 RWMS

Some vertical groundwater flow is thought to occur between the uppermost aquifers in Frenchman Flat and the underlying regional LCA, and is being studied by the Underground Test Area Sub-Project (Stoller-Navarro, 2006). Based on measured groundwater elevations above mean sea level (AMSL) (Figure 1-3), the lateral hydraulic gradient in the upper Frenchman Flat aquifer is very low. Lateral groundwater movement beneath Frenchman Flat primarily occurs within the deep carbonate aquifer and is generally from the northeast to southwest. It eventually discharges in Amargosa Valley and Ash Meadows in southwest Nevada and Death Valley in California (Figure 1-4) (Laczniak et al., 1996).

For more detailed descriptions of Area 5 RWMS site characteristics, refer to the report *Revised Area 5 Radioactive Waste Management Site Outline of a Comprehensive Groundwater Monitoring Program* (BN, 1998).

1.3 MONITORING WELL DESCRIPTIONS

Pilot wells UE5PW-1, UE5PW-2, and UE5PW-3 were drilled between March and November 1992, and the groundwater has been monitored since 1993. Each well is completed with a centralized 6.35-centimeter (cm) (2.50-inch [in.]) diameter stainless steel casing with an 18.3-meter (m) (60-feet [ft]) dual-screen filter pack attached to the bottom of the casing. The borehole annulus below and around the screen is filled with 6/12 coarse mesh sand (Reynolds Electrical and Engineering Company, Inc. [REECo], 1994).

UE5PW-1 is 255.7 m (839 ft) deep from top of casing and is screened from 232.3 m (762 ft) to 250.5 m (822 ft). UE5PW-1 is completed in alluvium. During 2008, the average water table depth below the top of the well casing was 235.77 m (773.51 ft), and the average water table elevation was 733.61 m (2,406.84 ft) AMSL.

UE5PW-2 is 280.3 m (919.5 ft) deep from top of casing and is screened from 253.0 m (830 ft) to 271.3 m (890 ft). UE5PW-2 is completed in alluvium. During 2008, the average water table depth below the top of the well casing was 256.37 m (841.11 ft), and the average water table elevation was 733.75 m (2,407.32 ft) AMSL.

UE5PW-3 is 291.1 m (955 ft) deep from top of casing and is screened from 267.6 m (878 ft) to 282.9 m (928 ft). UE5PW-3 is completed in volcanic rock. The alluvium volcanic rock contact is 188 m (617 ft) deep at UE5PW-3 (REECo, 1994). During 2008, the average water table depth below the top of the well casing was 271.50 m (890.76 ft), and the average water table elevation was 733.72 m (2,407.21 ft) AMSL.

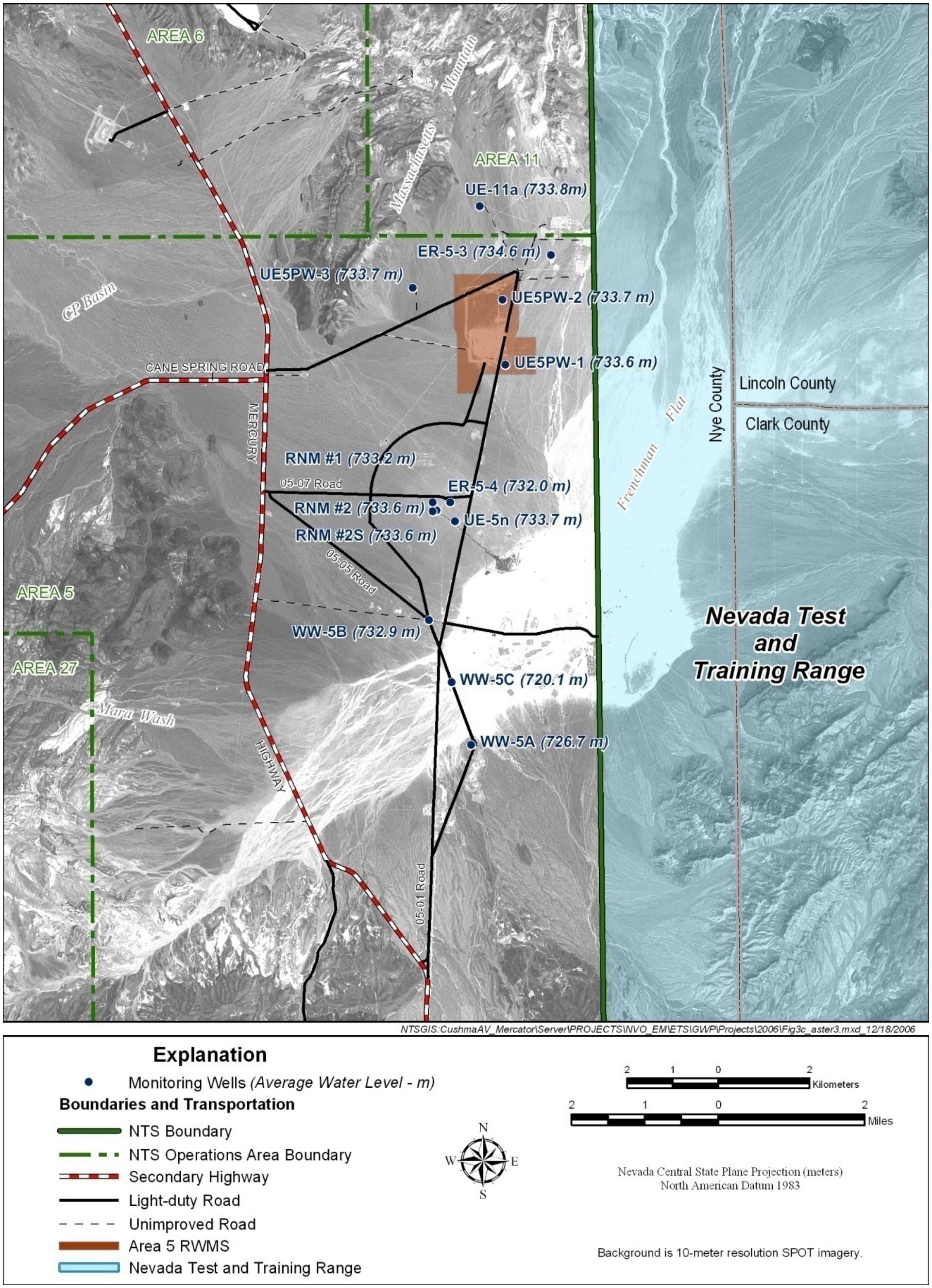

Figure 1-3 Average Water Level Elevations at Groundwater Monitoring Wells in the Vicinity of Area 5 RWMS (U.S. Geological Survey, 2008)

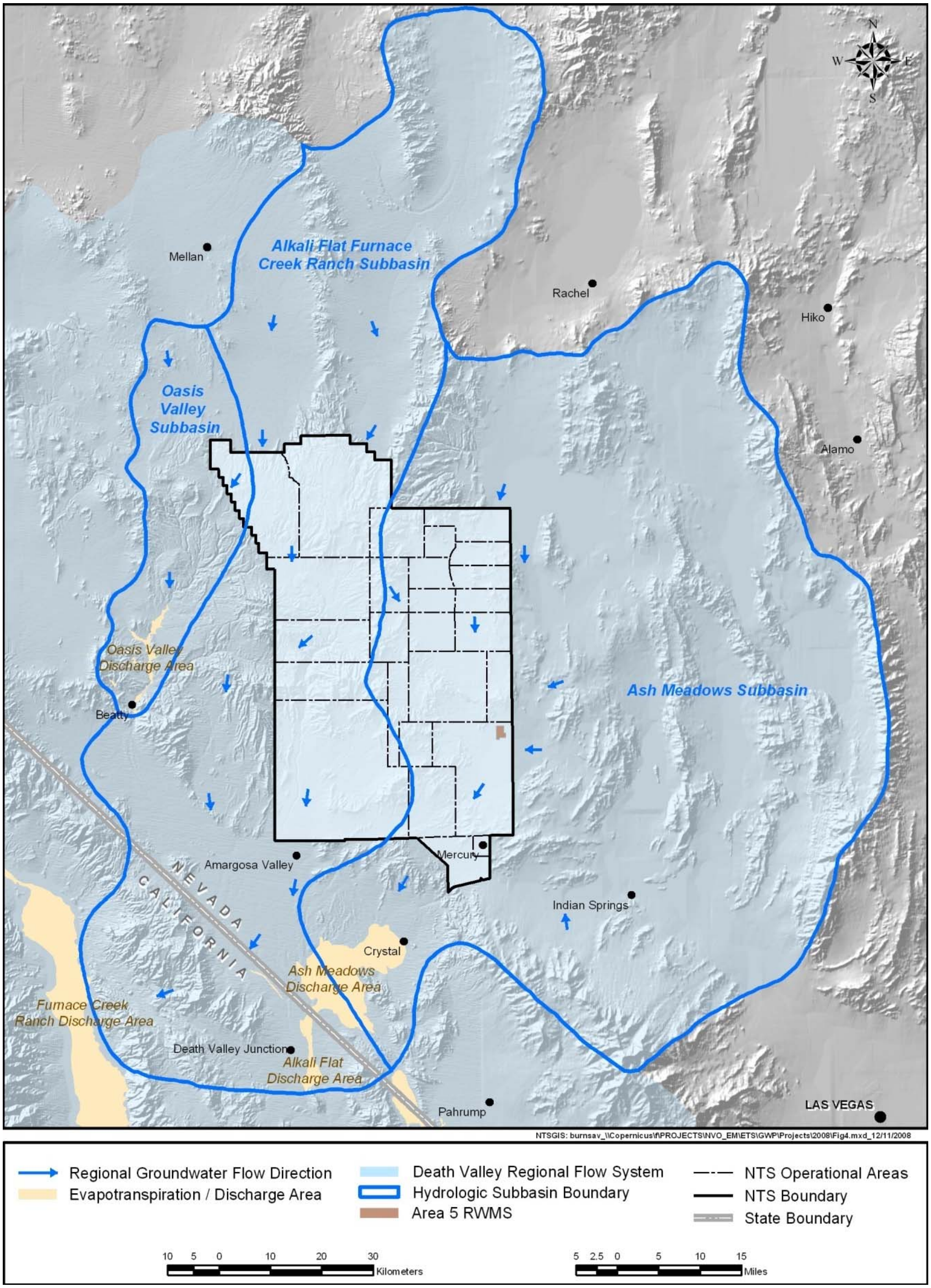

Figure 1-4 Groundwater Subbasins and Flow Directions in the Vicinity of the Area 5 RWMS

1.4 SITE METEOROLOGY

Meteorological data are measured at the Area 5 RWMS. These data include temperature, relative humidity, barometric pressure, wind speed and direction, and precipitation. During 2008 the average daily temperature at 3 m height was 16.2 degrees Celsius (°C) [61.2 degrees Fahrenheit (°F)]. The maximum observed temperature at 3 m height was 43.0°C (109.4°F) on July 9, 2008, and the minimum observed temperature at 3 m was -12.1°C (10.2°F) on December 20, 2008. The maximum observed wind gust at 3 m was 20.0 meters/second (44.7 miles per hour) on February 13, 2008. The average annual precipitation measured at the Area 5 RWMS from 1994 through 2008 was 12.4 cm per year (cm/yr) (4.88 in./yr). There was 6.1 cm (2.40 in.) of precipitation at the Area 5 RWMS during 2008. There were 27 days of measurable precipitation in 2008 at the Area 5 RWMS. The wettest month is February, which gets approximately 20 percent of the annual precipitation. Monthly precipitation at the Area 5 RWMS from January 1994 through December 2008 is provided in Figure 1-5.

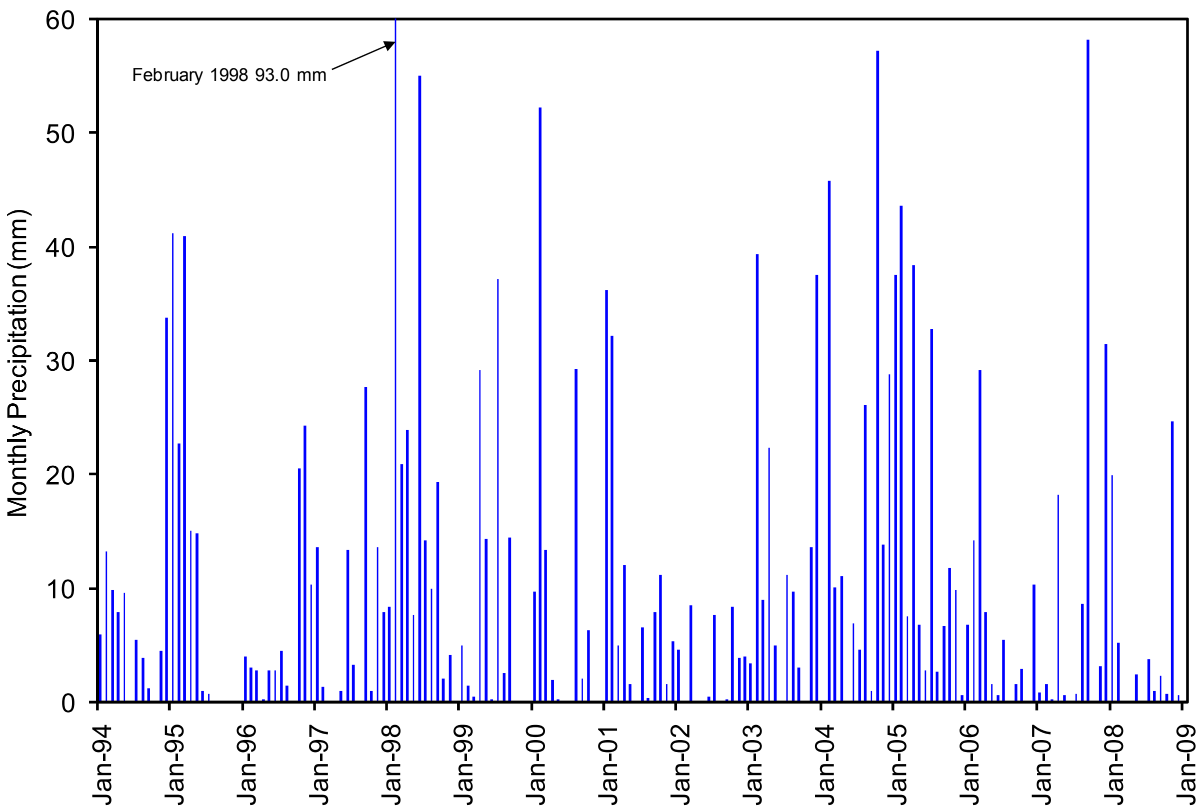

Figure 1-5 Monthly Precipitation at the Area 5 RWMS

2.0 MONITORING METHODS AND RESULTS

The Area 5 RWMS pilot wells have been monitored since 1993 (see Appendix A). The groundwater monitoring program has transitioned from monitoring all parameters required by 40 CFR 265 to a program that monitors parameters applicable to the Area 5 RWMS. The current monitoring program is modeled after the 40 CFR 265 detection-monitoring program.

2.1 METHODS

Samples are tested semiannually for the analytes listed below, which are divided into groups representing indicators of contamination and general water chemistry parameters:

Indicators of contamination:

- pH
- Specific conductance (SC)
- Total organic carbon (TOC)
- Total organic halides (TOX)
- Tritium

General water chemistry parameters:

- Cations: calcium (Ca), iron (Fe), magnesium (Mg), manganese (Mn), potassium (K), sodium (Na)
- Anions: bicarbonate (HCO_3), sulfate (SO_4), chloride (Cl), fluoride (F)
- Silicate (SiO_2)

Investigation levels (ILs) for each analyte identified as an indicator of contamination were established by DOE and NDEP in 1998 (Table 2-1). Further groundwater analyses are required if an analyte's IL is exceeded. The intent of ILs is to replace the need for rigorous statistical analyses to identify contamination. Statistical analyses are not presented in this report, as agreed upon by NDEP in a letter dated April 17, 2000 (Liebendorfer, 2000). The ILs for pH and SC are based on the distributions of data collected from 1993 through 1996. Historic analyses for TOC, TOX, and tritium typically have concentration levels less than the method detection limit (MDL) or the minimum detectable concentration (MDC), so the ILs for TOC and TOX are set slightly above their MDLs or MDCs. The tritium IL is set at 2,000 picoCuries per liter (pCi/L), which is 10 percent of the National Primary Drinking Water Standard of 20,000 pCi/L.

Wells UE5PW-1, UE5PW-2, and UE5PW-3 were sampled on March 11, 2008, and again on September 10, 2008. The current groundwater sampling procedure (National Security Technologies, LLC [NSTec], 2006) was followed. Tritium samples were enriched prior to shipment to a contract laboratory for analysis. Analyses for tritium were conducted by General Engineering Laboratory, and nonradiological analyses were conducted by Lionville Laboratory Incorporated.

Table 2-1 Investigation Levels of Indicator Parameters

Parameter	Investigation Level (IL)
pH	<7.6 or >9.2
SC	0.440 mmhos/cm[a]
TOC	1 mg/L[b]
TOX	50 µg/L[c]
Tritium	2,000 pCi/L

(a) mmhos/cm = millimhos per centimeter
(b) mg/L = milligrams per liter
(c) µg/L = micrograms per liter

For TOC and TOX analysis, three replicate water samples were collected consecutively from each well for each analyte. This provides sufficient sample backups in case any sample result is above the analyte's IL. Well resampling would be required if all three replicate water samples are above the analyte's IL. False detections of these analytes above their ILs and subsequent resampling of the wells have occurred in the past. No resampling was required in 2008.

2.2 RESULTS

This section lists the results for each of the five indicators of contamination, the general water chemistry parameters, and the groundwater elevation.

2.2.1 pH

The measured pH at each well remained within the ILs of 7.6 and 9.2 during 2008 (Table 2-2). The 2008 pH values ranged from 8.00 to 8.17 and represent the stable pH reading obtained from each well just prior to sampling for other analytes. Measured pH has remained relatively stable throughout the entire monitoring period (Figure 2-1). No groundwater contamination is indicated by the pH monitoring results.

Table 2-2 Area 5 RWMS pH Values

UE5PW-1		UE5PW-2		UE5PW-3	
Date	**pH**	**Date**	**pH**	**Date**	**pH**
03/31/1993	8.17	03/24/1993	7.99	04/14/1993	8.24
07/06/1993	8.30	06/22/1993	8.24	06/02/1993	8.68
09/01/1993	8.25	11/15/1993	8.40	10/12/1993	8.69
12/07/1993	7.91	01/19/1994	8.79	12/20/1993	8.60
06/15/1994	8.45	No sample		05/24/1994	8.87
08/01/1994	8.28	06/07/1994	8.81	08/08/1994	8.77
No sample		11/29/1994	8.79	01/18/1995	8.58
04/04/1995	8.25	04/04/1995	8.58	04/05/1995	8.28
11/09/1995	8.35	11/09/1995	8.08	11/09/1995	8.43
01/18/1996	8.41	01/25/1996	8.63	01/18/1996	8.55
04/16/1996	8.22	04/23/1996	8.21	04/23/1996	8.23
No sample		04/30/1996	8.15	04/30/1996	8.15
10/02/1996	8.18	10/02/1996	8.28	10/02/1996	8.18
11/20/1996	8.25	11/20/1996	8.16	11/20/1996	8.13

UE5PW-1		UE5PW-2		UE5PW-3	
04/16/1997	8.33	04/16/1997	8.40	04/16/1997	8.25
11/05/1997	8.30	11/05/1997	8.17	11/05/1997	8.22
05/13/1998	8.31	05/13/1998	8.37	05/13/1998	8.34
07/29/1998	8.63	No sample		No sample	
10/28/1998	8.34	10/28/1998	8.32	10/28/1998	8.14
05/19/1999	8.50	05/19/1999	8.49	05/19/1999	8.47
10/27/1999	8.49	10/27/1999	8.52	10/27/1999	8.34
04/26/2000	8.50	04/26/2000	8.39	04/26/2000	8.24
08/09/2000	8.26	08/09/2000	8.14	08/09/2000	8.23
05/29/2001	8.46	05/29/2001	8.25	05/29/2001	8.27
10/03/2001	8.39	10/03/2001	8.22	10/03/2001	8.13
05/15/2002	8.46	05/15/2002	8.30	05/15/2002	8.32
10/22/2002	8.43	10/22/2002	8.23	10/22/2002	8.24
04/15/2003	8.54	04/15/2003	8.38	04/15/2003	8.42
10/22/2003	8.37	10/22/2003	8.24	10/21/2003	8.16
05/04/2004	8.50	05/04/2004	8.25	05/04/2004	8.26
10/19/2004	8.30	10/19/2004	8.32	10/20/2004	8.24
04/19/2005	8.48	04/19/2005	8.30	04/19/2005	8.33
10/11/2005	8.47	10/11/2005	8.27	10/11/2005	8.31
04/26/2006	8.34	04/26/2006	8.12	04/26/2006	8.17
10/10/2006	8.11	10/10/2006	8.03	10/10/2006	8.07
03/19/2007	8.37	03/19/2007	8.13	03/19/2007	8.44
08/29/2007	8.29	08/29/2007	8.09	09/05/2007	8.10
03/11/2008	8.08	03/11/2008	8.00	03/11/2008	8.03
09/10/2008	8.17	09/10/2008	8.08	09/10/2008	8.14

Values before 05/19/1999 are means of multiple measurements, and values from 05/19/1999 to present are the stable pH value measured just prior to sampling.

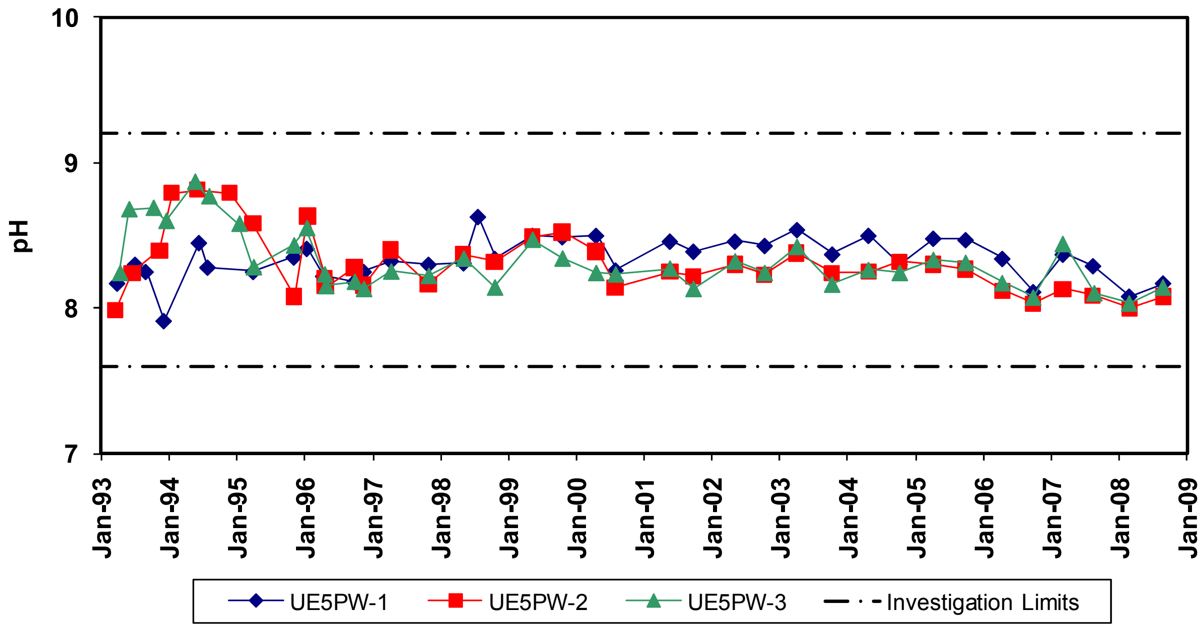

Figure 2-1 Area 5 RWMS Time Series Plot of pH

2.2.2 Specific Conductance

The 2008 measured SC of water samples from each well remained below the IL of 0.440 mmhos/cm and ranged from 0.360 to 0.386 mmhos/cm (Table 2-3). SC values from each well have remained relatively stable throughout the entire monitoring period (Figure 2-2). No groundwater contamination is indicated by the SC monitoring results.

Table 2-3 Area 5 RWMS SC Values in mmhos/cm

UE5PW-1		UE5PW-2		UE5PW-3	
Date	SC	Date	SC	Date	SC
03/31/1993	0.401	03/24/1993	0.371	04/14/1993	0.383
06/06/1993	0.391	06/22/1993	0.411	06/02/1993	0.382
09/01/1993	0.391	11/15/1993	0.384	10/12/1993	0.376
12/07/1993	0.383	01/19/1994	0.371	12/20/1993	0.359
06/15/1994	0.383	06/07/1994	0.363	05/24/1994	0.363
08/01/1994	0.380	No Sample		08/08/1994	0.367
No Sample		11/29/1994	0.325	01/18/1995	0.338
04/04/1995	0.320	04/04/1995	0.336	04/05/1995	0.347
11/09/1995	0.366	11/09/1995	0.348	11/09/1995	0.352
01/18/1996	0.360	01/25/1996	0.343	01/18/1996	0.355
04/16/1996	0.363	04/23/1996	0.355	04/23/1996	0.363
No Sample		04/30/1996	0.356	04/30/1996	0.379
10/02/1996	0.383	10/02/1996	0.363	10/02/1996	0.376
11/20/1996	0.374	11/20/1996	0.365	11/20/1996	0.378

UE5PW-1		UE5PW-2		UE5PW-3	
04/16/1997	0.385	04/16/1997	0.364	04/16/1997	0.376
11/05/1997	0.377	11/05/1997	0.358	11/05/1997	0.361
05/13/1998	0.377	05/13/1998	0.356	05/13/1998	0.370
07/29/1998	0.373	No Sample		No Sample	
10/28/1998	0.380	10/28/1998	0.358	10/28/1998	0.370
05/19/1999	0.379	05/19/1999	0.351	05/19/1999	0.369
10/27/1999	0.370	10/27/1999	0.355	10/27/1999	0.370
04/26/2000	0.378	04/26/2000	0.355	04/26/2000	0.369
08/09/2000	0.378	08/09/2000	0.357	08/09/2000	0.370
05/29/2001	0.377	05/29/2001	0.358	05/29/2001	0.371
10/03/2001	0.376	10/03/2001	0.358	10/03/2001	0.371
05/15/2002	0.386	05/15/2002	0.374	05/15/2002	0.384
10/22/2002	0.374	10/22/2002	0.368	10/22/2002	0.368
04/15/2003	0.372	04/15/2003	0.355	04/15/2003	0.369
10/22/2003	0.376	10/22/2003	0.357	10/21/2003	0.373
05/04/2004	0.378	05/04/2004	0.361	05/04/2004	0.353
10/19/2004	0.372	10/19/2004	0.352	10/20/2004	0.365
04/19/2005	0.377	04/19/2005	0.359	04/19/2005	0.369
10/11/2005	0.368	10/11/2005	0.352	10/11/2005	0.364
04/26/2006	0.361	04/26/2006	0.341	04/26/2006	0.357
10/10/2006	0.384	10/10/2006	0.363	10/10/2006	0.376
03/19/2007	0.390	03/19/2007	0.330	03/19/2007	0.332
08/29/2007	0.385	08/29/2007	0.359	09/05/2007	0.378
03/11/2008	0.386	03/11/2008	0.371	03/11/2008	0.386
09/10/2008	0.378	09/10/2008	0.360	09/10/2008	0.375

Values before 05/19/1999 are means of multiple measurements, and values from 05/19/1999 to present are the stable SC value measured just prior to sampling.

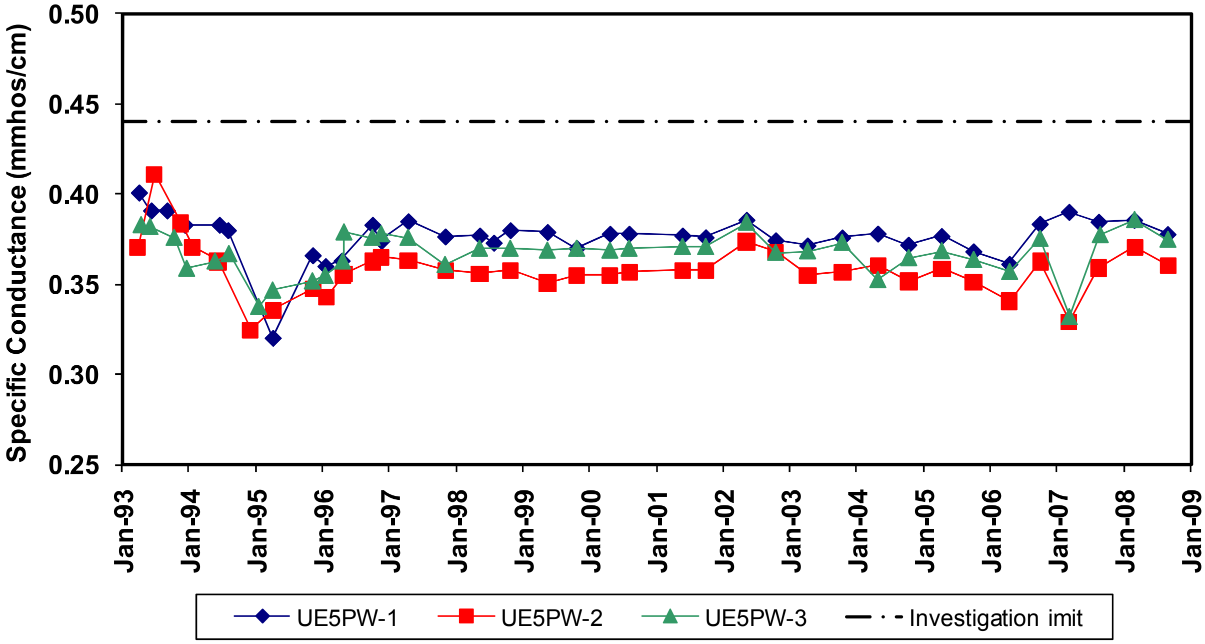

Figure 2-2 Area 5 RWMS Time Series Plot of SC

2.2.3 Total Organic Carbon

In 2008, three samples were collected consecutively from each well on both sample dates, and the averages of the three sample measurements are reported in Table 2-4. When sample TOC values fell below the sample's MDL of 0.5 mg/L, then 0.5 mg/L was the value used in calculating the reported average. Values shown as <0.5 mg/L indicate that all three sample results were less than the MDL. Samples collected from Well UE5PW-1 on September 10, 2008, had TOC results of <0.5 mg/L, <0.5 mg/L, and 0.61 mg/L; samples collected from Well UE5PW-2 on September 10, 2008, had TOC results of <0.5 mg/L, 0.53 mg/L, and 0.65 mg/L. All other TOC results from 2008 were <0.5 mg/L. All six TOC average values for 2008 are below the IL of 1 mg/L.

TOC values have remained relatively low and stable throughout the monitoring period (Figure 2-3). Most variation in TOC values is the result of variation in the MDL. No groundwater contamination is indicated by the TOC monitoring results.

Table 2-4 Area 5 RWMS TOC Values in mg/L

UE5PW-1		UE5PW-2		UE5PW-3	
Date	TOC	Date	TOC	Date	TOC
03/31/1993	<1.0	03/24/1993	<1.0	04/14/1993	<1.0
07/06/1993	<1.0	06/22/1993	<1.0	06/02/1993	<1.0
09/01/1993	<1.0	11/15/1993	<1.0	10/12/1993	<1.0
12/07/1993	<1.0	01/19/1994	<1.0	12/20/1993	<1.0
No Sample		06/07/1994	<1.0	No Sample	
08/01/1994	1.7	11/29/1994	<1.0	08/08/1994	<1.0

UE5PW-1		UE5PW-2		UE5PW-3	
01/18/1995	0.20	01/18/1995	0.50	01/18/1995	0.23
04/04/1995	<1.0	04/04/1995	<1.0	04/05/1995	<1.0
11/09/1995	<1.0	11/20/1995	<1.0	11/09/1995	<1.0
04/16/1996	<0.3	04/30/1996	<0.3	04/30/1996	<0.3
10/02/1996	<0.3	10/02/1996	<0.3	10/02/1996	<0.3
11/20/1996	<0.3	11/20/1996	<0.3	11/20/1996	<0.3
04/16/1997	<0.3	04/16/1997	<0.3	04/16/1997	<0.3
11/05/1997	<0.3	11/05/1997	<0.3	11/05/1997	<0.3
05/13/1998	<1.0	05/13/1998	<1.0	05/13/1998	<1.0
10/28/1998	<1.0	10/28/1998	<1.0	10/28/1998	<1.0
05/19/1999	<1.0	05/19/1999	<1.0	05/19/1999	<1.0
10/27/1999	<1.0	10/27/1999	1.3[a]	10/27/1999	<1.0
No Sample		12/13/1999	<0.5	No Sample	
04/26/2000	0.98[a]	04/26/2000	0.60[a]	04/26/2000	1.3[a]
08/09/2000	<0.5[b]	08/09/2000	<0.5[b]	04/26/2000	<0.5[b]
05/29/2001	0.51[b]	05/29/2001	<0.5[b]	05/29/2001	0.53[b]
10/03/2001	<0.5	10/03/2001	<0.5	10/03/2001	<0.5
05/15/2002	<0.5	05/15/2002	<0.5	05/15/2002	<0.5
10/22/2002	<0.5	10/22/2002	0.55	10/22/2002	0.58
04/15/2003	0.51	04/15/2003	0.58	04/15/2003	0.52
10/22/2003	0.64	10/22/2003	0.68	10/21/2003	0.62
05/04/2004	0.55	05/04/2004	<0.5	05/04/2004	0.58
10/19/2004	0.58	10/19/2004	0.90	10/20/2004	0.83
04/19/2005	0.65	04/19/2005	0.62	04/19/2005	0.50
10/11/2005	0.60	10/11/2005	0.53	10/11/2005	<0.5
04/26/2006	<0.5	04/26/2006	0.97	04/26/2006	0.51
10/10/2006	0.80	10/10/2006	1.12	10/10/2006	0.52
03/19/2007	0.62	03/19/2007	0.54	03/19/2007	<0.5
08/29/2007	<0.5	08/29/2007	<0.5	09/05/2007	<0.5
03/11/2008	<0.5	03/11/2008	<0.5	03/11/2008	<0.5
09/10/2008	0.54	09/10/2008	0.56	09/10/2008	<0.5

(a) Determined to be a false positive through resampling
(b) Multiple laboratories used; this value is the average of the Lionville Laboratory only

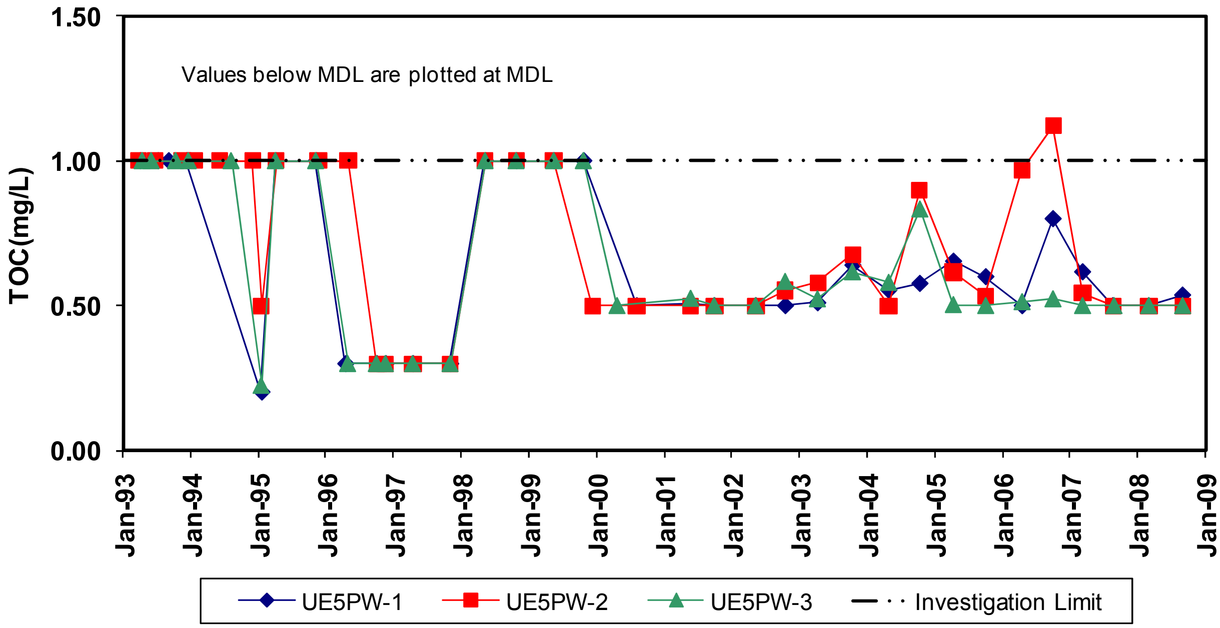

Figure 2-3 Area 5 RWMS Time Series Plot of TOC

2.2.4 Total Organic Halides

All 2008 TOX results are below the IL of 50 µg/L (Table 2-5). In 2008, three samples were collected from each well on each sample date, and the averages of the three sample results are reported in Table 2-5. When sample TOX values fell below the sample's MDL of 5.2 µg/L, then 5.2 µg/L was the value used in calculating the reported average. Values in Table 2-5 proceeded by a less than symbol (<) indicate that all three samples were less than the MDL. Samples collected from Well UE5PW-2 on September 10, 2008, had TOX results of 6.0 µg/L, 6.4 µg/L, and <5.2 µg/L; samples collected from Well UE5PW-3 on September 10, 2008, had TOX results of <5.2 µg/L, 16.2 µg/L, and <5.2 µg/L. All other TOX results from 2008 were <5.2 µg/L.

TOX values have remained relatively stable and below the IL throughout the monitoring period (Figure 2-4). No groundwater contamination is indicated by the TOX results.

Table 2-5 Area 5 RWMS TOX Values in µg/L

UE5PW-1		UE5PW-2		UE5PW-3	
Date	TOX	Date	TOX	Date	TOX
03/31/1993	17	03/24/1993	23	04/14/1993	<10
07/06/1993	<10	06/22/1993	<10	06/02/1993	13
09/01/1993	13	11/15/1993	<10	10/12/1993	<10
12/07/1993	<10	01/19/1994	<10	12/20/1993	<10
06/15/1994	<10	06/07/1994	<10	No Sample	
08/01/1994	11	11/29/1994	13	08/08/1994	<10

UE5PW-1		UE5PW-2		UE5PW-3	
01/18/1995	<10	01/18/1995	<10	01/18/1995	<10
04/04/1995	<10	04/04/1995	<10	04/05/1995	<10
11/09/1995	<40	11/09/1995	<40	11/09/1995	<40
04/16/1996	<40	04/30/1996	<40	04/30/1996	<40
No Sample		10/02/1996	<20	10/02/1996	<20
11/20/1996	<20	11/20/1996	<20	11/20/1996	<20
04/16/1997	<20	04/16/1997	<20	04/16/1997	<20
11/05/1997	<20	11/05/1997	<20	11/05/1997	<20
05/13/1998	391[a]	05/13/1998	843[a]	05/13/1998	1000[a]
07/29/1998	<5	No Sample		No Sample	
10/28/1998	<5	10/29/1998	<5	10/29/1998	<5
05/19/1999	<5	05/19/1999	<5	05/19/1999	<5
10/27/1999	<5	10/27/1999	<5	10/27/1999	7
04/26/2000	72[a]	04/26/2000	59[a]	04/26/2000	57[a]
08/09/2000	92[a,b]	08/09/2000	73[a,b]	08/09/2000	83[a,b]
05/29/2001	<12.7[b]	05/29/2001	<12[b]	05/29/2001	<12[b]
10/03/2001	<6.1	10/03/2001	<5.8	10/03/2001	<5.2
05/15/2002	<5.2	05/15/2002	5.4	05/15/2002	<5.2
10/22/2002	<5.2	10/22/2002	<5.2	10/22/2002	<5.2
04/15/2003	<5.2	04/15/2003	<5.2	04/15/2003	<5.2
10/22/2003	<5.2	10/22/2003	5.5	10/21/2003	<5.2
05/04/2004	<5.2	05/04/2004	<5.2	05/04/2004	<5.2
10/19/2004	<5.2	10/19/2004	<5.2	10/20/2004	<5.2
04/19/2005	<5	04/19/2005	<5	04/19/2005	<5
10/11/2005	5.2	10/11/2005	6.5	10/11/2005	<5
04/26/2006	7.3	04/26/2006	5.8	04/26/2006	7.4
10/10/2006	<5.1	10/10/2006	<5	10/10/2006	<5
03/19/2007	<5.2	03/19/2007	<5.2	03/19/2007	<5.2
08/29/2007	<5.2	08/29/2007	<5.2	09/05/2007	<5.2
03/11/2008	<5.2	03/11/2008	<5.2	03/11/2008	<5.2
09/10/2008	<5.2	09/10/2008	5.9	09/10/2008	8.9

(a) Determined to be a false positive through resampling

(b) Multiple laboratories used; this value is the average of the Lionville Laboratory only

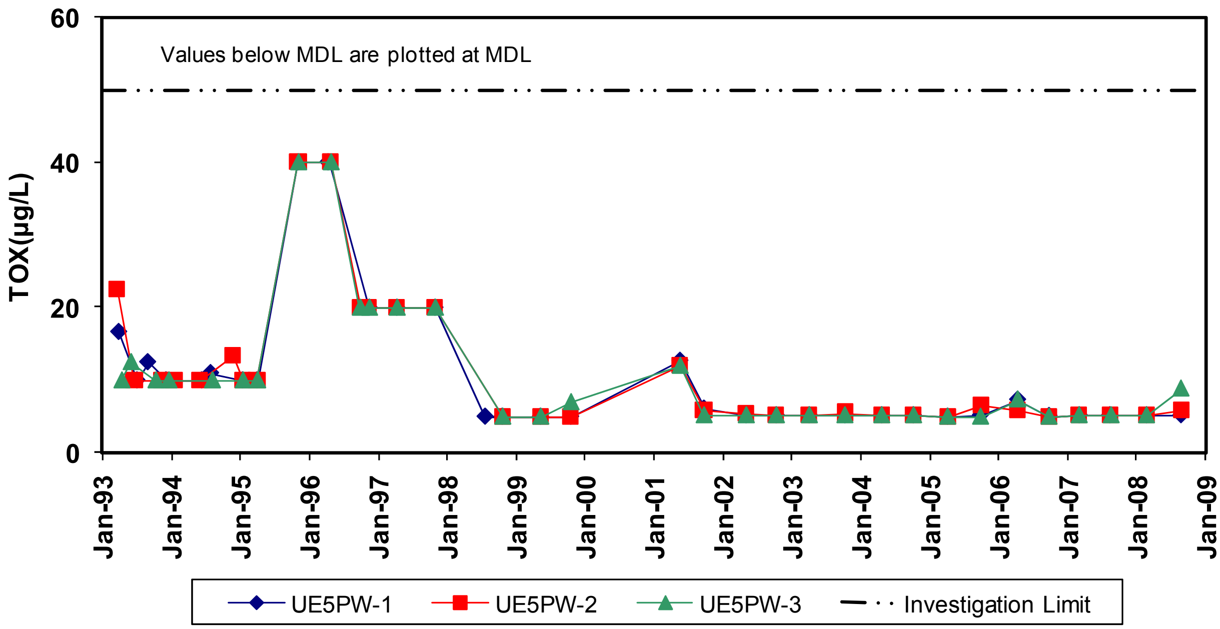

Figure 2-4 Area 5 RWMS Time Series Plot of TOX

2.2.5 Tritium

All tritium results from 2008 water samples were below the IL of 2,000 pCi/L and below the laboratory MDC of approximately 20 pCi/L (Table 2-6). In 2008, duplicate samples were collected from each well on each sample date. Table 2-6 reports the average of these two results.

Tritium values have remained relatively stable and below the IL and MDC throughout the monitoring period (Figure 2-5). No groundwater contamination is indicated by the tritium results.

Table 2-6 Area 5 RWMS Tritium Values in pCi/L

UE5PW-1		UE5PW-2		UE5PW-3	
Date	Tritium	Date	Tritium	Date	Tritium
03/31/1993	0.442	03/24/1993	-4.28	04/14/1993	1.96
12/07/1993	-1.58	11/15/1993	32.2	06/02/1993	-2.74
No Sample		01/19/1994	3.69	12/20/1993	-0.459
06/15/1994	-2.04	06/07/1994	1.29	05/24/1994	1.13
08/01/1994	1.86	11/29/1994	0.015	08/08/1994	1.04
04/04/1995	2.80	04/04/1995	-0.920	04/05/1995	1.50
04/16/1996	-1.72	04/30/1996	-1.91	04/30/1996	-2.29
04/16/1997	3.15	04/16/1997	0.189	04/16/1997	3.69
05/13/1998	-2.35	05/13/1998	-1.95	05/13/1998	-4.71
10/28/1998	-1.09	10/28/1998	-1.85	10/28/1998	-8.25
05/19/1999	5.17	05/19/1999	4.24	05/19/1999	4.60

UE5PW-1		UE5PW-2		UE5PW-3	
10/27/1999	-1.36	10/27/1999	-3.37	10/27/1999	1.08
04/26/2000	-2.56	04/26/2000	1.17	04/26/2000	-0.080
08/09/2000	-1.48	08/09/2000	6.97	08/09/2000	4.35
05/29/2001	-1.90	05/29/2001	-11.5	05/29/2001	-12.4
10/03/2001	-2.93	10/03/2001	-2.82	10/03/2001	2.46
05/15/2002	-2.82	05/15/2002	0.150	05/15/2002	-3.26
10/22/2002	-4.15	10/22/2002	0.113	10/22/2002	-1.17
04/15/2003	-1.13	04/15/2003	-5.22	04/15/2003	1.62
10/22/2003	0.952	10/22/2003	11.4	10/21/2003	0.405
05/04/2004	-2.69	05/04/2004	-6.17	05/04/2004	-6.04
10/19/2004	-1.50	10/19/2004	-10.0	10/20/2004	-6.39
04/19/2005	3.67	04/19/2005	3.76	04/19/2005	3.56
10/11/2005	8.83	10/11/2005	5.24	10/11/2005	-4.78
04/26/2006	0.480	04/26/2006	-2.70	04/26/2006	-6.71
10/10/2006	7.42	10/10/2006	9.35	10/10/2006	13.75
03/19/2007	-10.33	03/19/2007	-7.96	03/19/2007	-4.15
08/29/2007	-7.25	08/29/2007	-5.61	09/05/2007	-5.60
03/11/2008	5.33	03/11/2008	7.63	03/11/2008	-1.41
9/10/2008	4.53	9/10/2008	-2.03	9/10/2008	-4.98

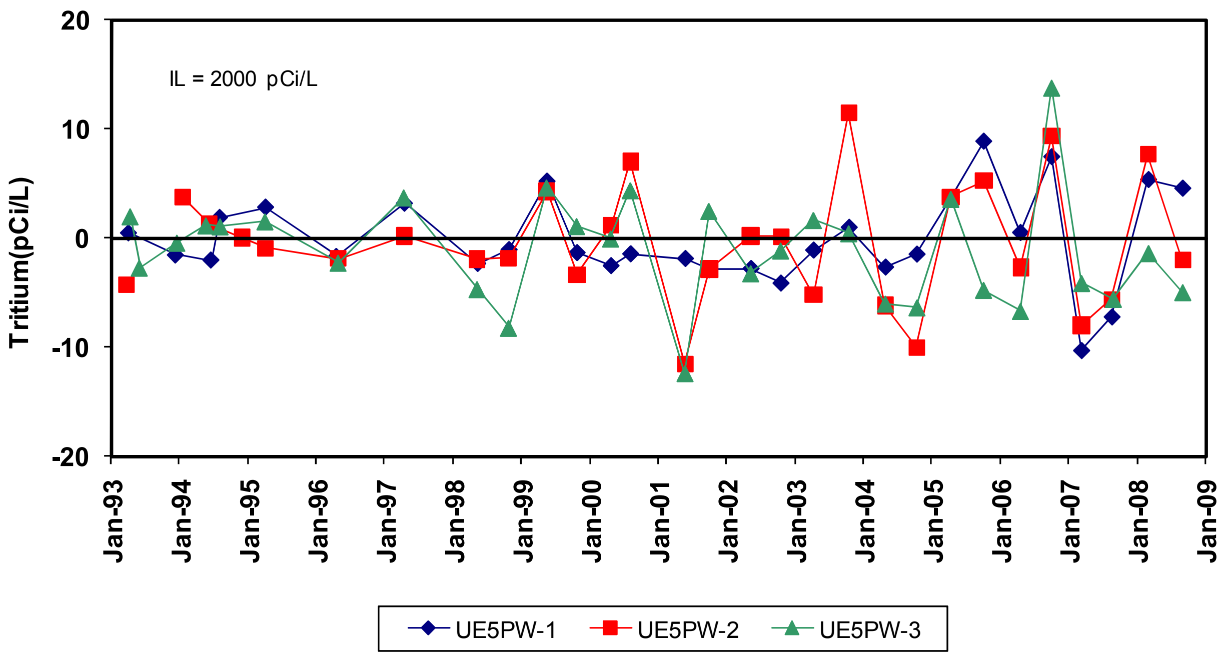

Figure 2-5 Area 5 RWMS Time Series Plot of Tritium

2.2.6 General Water Chemistry Parameters

General water chemistry analyses during 2008 for cations (Ca, Mg, Na, K, Fe), anions (Cl, F, SO_4, HCO_3), and SiO_2 indicate similar groundwater in all three wells and no changes in groundwater chemistry (Table 2-7, Table 2-8, and Table 2-9).

Groundwater temperatures measured in March 2008 ranged from 17.0 to 18.8°C (66.6 to 65.8°F) and in September 2008 ranged from 21.3 to 21.4°C (70.3 to 70.5°F). Temperature measurements are collected at the ground surface and are influenced by the ambient air temperature.

Stiff plots for 2007 and 2008 indicate similar groundwater chemistry for all three wells and no changes in the groundwater chemistry (Figure 2-6). A piper diagram for the same water chemistry data indicates that the groundwater is a sodium-bicarbonate type (Figure 2-7).

Table 2-7 UE5PW-1 General Water Chemistry Values in mg/L

Date	Ca	Mg	K	Na	Mn	Fe	SiO_2	SO_4	HCO_3	Cl	Fl
3/31/1993	No analysis	No analysis	No analysis	48.0	<0.006	0.013	No analysis	32	167	9.2	1.2
6/6/1993	No analysis	No analysis	No analysis	58.0	<0.001	0.059	No analysis	37	161	9.7	1.4
9/1/1993	No analysis	No analysis	No analysis	56.0	0.0066	0.027	No analysis	No analysis	192	8.4	5.7
12/7/1993	No analysis	No analysis	No analysis	57.0	<0.0012	0.012	No analysis	36	183	9.9	1.5
6/15/1994	No analysis	No analysis	No analysis	61.0	<0.004	0.01	No analysis	No analysis	No analysis	No analysis	No analysis
8/1/1994	No analysis	No analysis	No analysis	53.0	<0.0012	0.021	No analysis	36	No analysis	10.0	No analysis
4/4/1995	No analysis	No analysis	No analysis	58.0	<0.01	<0.05	No analysis	34	No analysis	9.9	No analysis
4/16/1996	No analysis	No analysis	No analysis	61.0	<0.001	0.02	No analysis	34	No analysis	9.9	No analysis
4/16/1997	15.1	5.3	5.9	54.5	<0.001	0.012	No analysis	32.2	156	9.3	1.3
11/5/1997	15.5	5.6	6.4	57.8	No analysis	0.012	No analysis	35.2	151	10.2	1.2
5/13/1998	14.0	5.4	5.2	55.8	0.0015	0.034	54.2	34.6	151	9.6	1.1
10/28/1998	14.9	5.6	6.9	57.6	0.0015	0.024	60.5	34.0	160	9.7	1.1
5/19/1999	12.5	5.3	6.9	61.0	<0.0025	<0.05	68.5	34.0	146	10.0	1.0
10/27/1999	14.5	6.0	6.6	63.5	<0.008	<0.009	62.0	35.0	159	8.8	1.1
4/26/2000	12.8	4.8	6.7	53.7	0.001	0.0326	58.4	35.7	165	10.0	1.0
8/9/2000	15.0	4.9	6.6	52.0	0.00045	<0.0164	59.9	37.1	146	10.4	1.1
5/29/2001	14.4	4.9	6.0	59.0	<0.025	0.01215	61.7	No analysis	143	No analysis	No analysis
10/3/2001	13.7	4.8	6.7	51.0	0.00020	<0.0156	58.3	36.0	151	10.2	1.0
5/15/2002	14.3	5.1	7.0	54.5	0.00053	0.02845	60.9	35.9	155	10.7	1.0
10/22/2002	14.6	5.2	6.4	50.0	0.0002	0.0181	60.7	35.6	143	10.1	1.0
4/15/2003	13.7	5.0	6.2	58.0	<0.0005	0.011	59.2	32.9	150	12.3	1.0
10/22/2003	14.0	5.0	6.0	58.1	<0.0156	0.0141	61.2	36.6	No analysis	9.5	1.1
5/4/2004	12.9	4.6	6.4	55.3	0.0027	0.0374	54.4	34.4	154	9.8	1.1
10/19/2004	13.1	5.2	6.0	56.2	<0.028	0.0279	59.9	37.3	168	10.1	1.0
4/19/2005	13.8	4.8	6.6	55.1	<0.0006	0.007	58.6	39.6	149	10.5	1.0
10/11/2005	13.4	5.0	6.1	50.5	<0.0002	<0.0026	61.2	35.7	156	9.7	1.0
4/26/2006	14.6	5.3	6.3	60.4	<0.0032	<0.0054	63.3	35.4	149	10.7	1.2
10/10/2006	14.0	5.2	5.9	58.8	0.0007	<0.0048	61.4	33.8	148	9.9	0.9
3/19/2007	15.7	5.4	6.0	57.4	<0.0036	0.0124	64.0	37.7	151	10.5	1.0
8/29/2007	15.4	5.4	6.2	59.0	0.00046	0.0058	64.6	35.9	148	10.0	1.2
3/11/2008	14.0	5.4	6.3	60.4	<0.00045	0.0066	63.1	37.4	149	11.1	1.2
9/10/2008	14.3	5.5	6.4	59.1	<00009	<0.045	62.5	34.7	155	11.0	1.2

Data source: Data before 10/27/1999 from BN, 2001.

Table 2-8 UE5PW-2 General Water Chemistry Values in mg/L

Date	Ca	Mg	K	Na	Mn	Fe	SiO_2	SO_4	HCO_3	Cl	Fl
3/24/1993	No analysis	No analysis	No analysis	46	0.11	0.062	No analysis	28	159	8.4	1.0
6/22/1993	No analysis	No analysis	No analysis	54	0.032	0.25	No analysis	30	183	9.7	1.1
11/15/1993	No analysis	No analysis	No analysis	51	<0.004	0.180	No analysis	31	171	9.4	1.3
1/19/1994	No analysis	No analysis	No analysis	45	<0.0012	0.074	No analysis	29	159	No analysis	1.2
6/7/1994	No analysis	No analysis	No analysis	55	<0.004	0.14	No analysis	No analysis	No analysis	No analysis	No analysis
11/29/1994	No analysis	No analysis	No analysis	No analysis	No analysis	No analysis	No analysis	28	No analysis	8.0	No analysis
4/4/1995	No analysis	No analysis	No analysis	50	<0.01	<0.05	No analysis	28	No analysis	8.5	No analysis
4/30/1996	No analysis	No analysis	No analysis	51	<0.001	0.013	No analysis	29	No analysis	8.3	No analysis
4/16/1997	15.9	6.0	5.0	47.6	<0.001	0.012	No analysis	26.4	149	7.9	1.2
11/5/1997	17.4	6.8	4.9	50.6	No analysis	0.018	No analysis	28.9	140	8.6	0.9
5/13/1998	14.8	5.7	3.8	45.2	<0.0011	0.066	50.8	28.4	151	8.2	1.0
10/28/1998	15.8	6.2	5.6	47.4	0.0009	0.015	55.9	28.4	157	8.3	1.0
5/19/1999	15.0	6.3	6.2	52.0	<0.0025	<0.05	62.0	27.5	134	8.7	0.9
10/27/1999	16.0	6.7	5.7	52.0	<0.0008	<0.009	55.6	28.0	152	7.4	1.0
4/26/2000	15.3	6.5	5.6	45.6	0.0007	0.0288	55.8	29.1	177	8.6	0.8
8/9/2000	17.0	6.6	5.3	44.5	<0.0002	<0.0164	59.2	28.8	155	9.3	0.9
5/29/2001	16.6	6.6	4.8	48.8	<0.0088	<0.0107	60.4	No analysis	152	No analysis	No analysis
10/3/2001	16.0	6.7	5.5	44.7	0.00017	0.0214	58.8	28.4	152	8.7	1.0
5/15/2002	16.5	6.8	5.6	46.1	0.00059	0.0603	60.1	28.7	155	9.3	0.9
10/22/2002	17.6	7.1	5.3	44.4	0.0031	<0.0156	63.0	28.7	149	8.7	0.8
4/15/2003	16.3	6.6	5.3	50.8	<0.0005	<0.0101	60.3	26.7	157	9.8	0.8
10/22/2003	16.1	6.6	5.2	49.6	<0.0016	0.0618	60.5	29.5	141	8.8	0.9
5/4/2004	16.0	6.3	5.4	47.2	<0.0007	0.0397	58.2	28.1	159	8.2	0.9
10/19/2004	15.7	6.7	5.1	48.6	<0.0003	<0.0279	59.7	29.6	169	8.9	0.9
4/19/2005	16.3	6.3	5.2	44.9	<0.0006	0.0115	58.6	31.3	133	8.4	0.9
10/11/2005	16.0	6.8	5.0	44.0	<0.0002	0.0270	62.2	29.0	167	8.1	0.9
4/26/2006	16.6	6.7	5.4	51.2	<0.0032	0.0612	62.5	28.1	152	8.8	1.1
10/10/2006	16.5	6.5	5.2	48.0	<0.0007	0.0170	61.2	27.2	156	8.6	1.1
3/19/2007	16.8	6.6	5.4	49.8	<0.0036	0.0387	62.9	42.2	149	11.3	0.9
8/29/2007	16.9	6.7	5.2	50.5	<0.00045	0.0098	63.7	27.9	151	9.0	1.1
3/11/2008	16.7	6.7	5.2	50.5	<0.00045	0.0159	60.3	30.7	149	10.0	1.0
9/10/2008	16.8	7.0	5.7	52.7	0.0020	<0.045	60.3	28.7	152	9.2	1.0

Data source: Data before 10/27/1999 from BN, 2001.

Table 2-9 UE5PW-3 General Water Chemistry Values mg/L

Date	Ca	Mg	K	Na	Mn	Fe	SiO_2	SO_4	HCO_3	Cl	Fl
04/14/93	No analysis	No analysis	No analysis	46	0.042	0.024	No analysis	31	157	8.5	1.3
06/02/93	No analysis	No analysis	No analysis	53	0.009	0.014	No analysis	31	162	9.1	1.2
10/12/93	No analysis	No analysis	No analysis	57	<0.006	0.11	No analysis	30	156	7.9	1.2
12/20/93	No analysis	No analysis	No analysis	48	<0.0012	0.1	No analysis	33	156	8.7	1.3
05/24/94	No analysis	No analysis	No analysis	56	<0.0012	0.02	No analysis	No analysis	No analysis	No analysis	No analysis
08/08/94	No analysis	No analysis	No analysis	51	<0.0012	<0.009	No analysis	33	No analysis	8.9	No analysis
04/05/95	No analysis	No analysis	No analysis	55	<0.01	<0.05	No analysis	31	No analysis	8.8	No analysis
04/30/96	No analysis	No analysis	No analysis	57	<0.001	0.0088	No analysis	32	No analysis	8.7	No analysis
04/16/97	15.8	5.7	4.0	54.2	<0.001	<0.006	No analysis	29	155	8.4	1.3
11/05/97	16.8	6.1	4.3	55.5	No analysis	0.0133	No analysis	32.1	140	9.2	1.1
05/13/98	15.8	5.8	3.3	53.8	<0.0011	0.035	56.6	31.0	151	8.6	1.0
10/28/98	15.6	5.7	4.2	53.7	0.0009	0.009	57.1	31.4	156	8.7	1.0
05/19/99	15.0	5.8	4.8	56.0	<0.0025	<0.05	66.3	30.5	146	9.2	0.9
10/27/1999	16.0	6.4	5.0	58.5	<0.0008	<0.009	59.9	31.0	159	7.7	0.9
4/26/2000	15.3	5.9	4.5	49.8	0.00033	0.0178	58.5	32.0	169	9.1	0.9
8/9/2000	16.0	5.8	4.3	48.3	<0.0002	<0.0164	57.8	32.6	162	9.9	1.0
5/29/2001	16.4	5.9	4.0	54.8	0.0018	<0.0107	60.5	No analysis	151	No analysis	No analysis
10/3/2001	15.6	6.0	4.5	48.4	0.00022	0.0237	57.9	31.5	154	8.9	1.0
5/15/2002	15.7	6.0	4.5	49.3	0.00027	0.0249	57.9	33.0	151	9.8	0.9
10/22/2002	17.2	6.2	4.3	47.6	<0.0002	<0.0181	60.5	32.2	143	9.3	0.9
4/15/2003	16.0	5.9	4.5	54.7	0.00083	0.0195	58.4	29.3	144	11.8	0.8
10/21/2003	16.3	5.8	4.1	54.4	<0.0016	0.0212	59.5	32.5	160	9.2	1.0
5/4/2004	16.1	5.6	4.7	52.2	0.0019	0.0453	58.2	31.1	155	8.7	1.0
10/20/2004	15.6	5.9	4.0	52.3	<0.0003	<0.0279	58.4	32.0	166	9.4	0.8
4/19/2005	16.2	5.6	4.5	50.9	<0.0006	0.0319	57.8	34.4	148	8.8	0.9
10/11/2005	16.1	6.1	4.3	48.5	<0.0002	<0.026	61.4	32.5	156	8.5	0.9
4/26/2006	16.6	6.1	4.2	58.1	<0.0032	0.0057	61.6	31.6	159	9.4	1.2
10/10/2006	15.9	5.5	4.0	49.7	0.0007	0.0114	57.3	30.1	152	9.0	1.0
3/19/2007	16.8	6.1	4.0	55.5	<0.0036	0.0921	61.2	19.9	149	9.3	0.8
9/5/2007	16.5	5.9	4.3	54.7	0.0012	0.0041	60.1	32.5	149	9.8	1.1
3/11/2008	16.7	6.1	4.2	57.2	<0.00045	0.0045	58.8	32.1	144	9.9	1.0
9/10/2008	16.4	6.1	4.5	56.4	<0.0009	<0.045	58.8	35.9	165	9.5	1.0

Data source: Data before 10/27/1999 from BN, 2001.

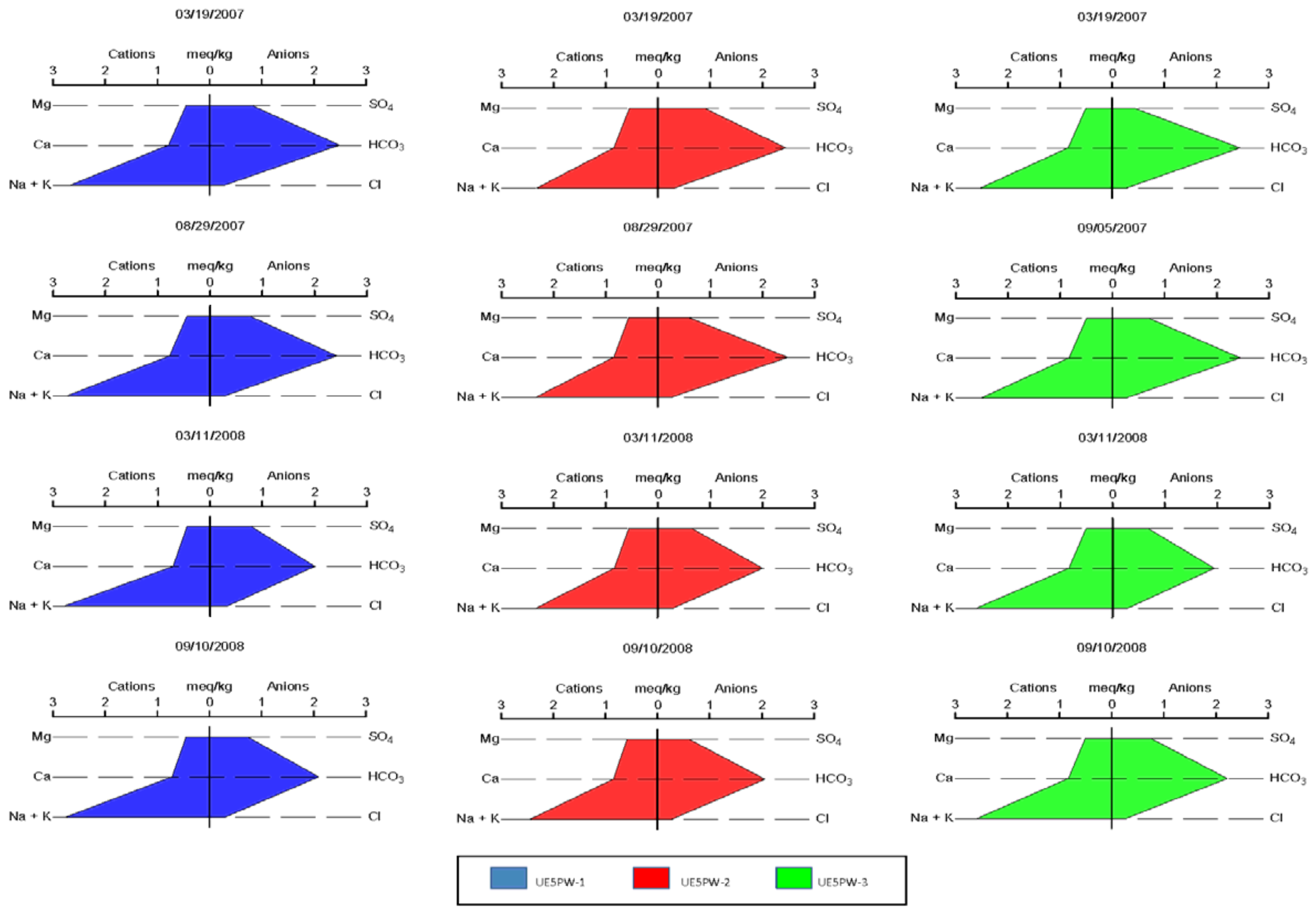

Figure 2-6 Area 5 RWMS Stiff Diagrams for 2007 and 2008

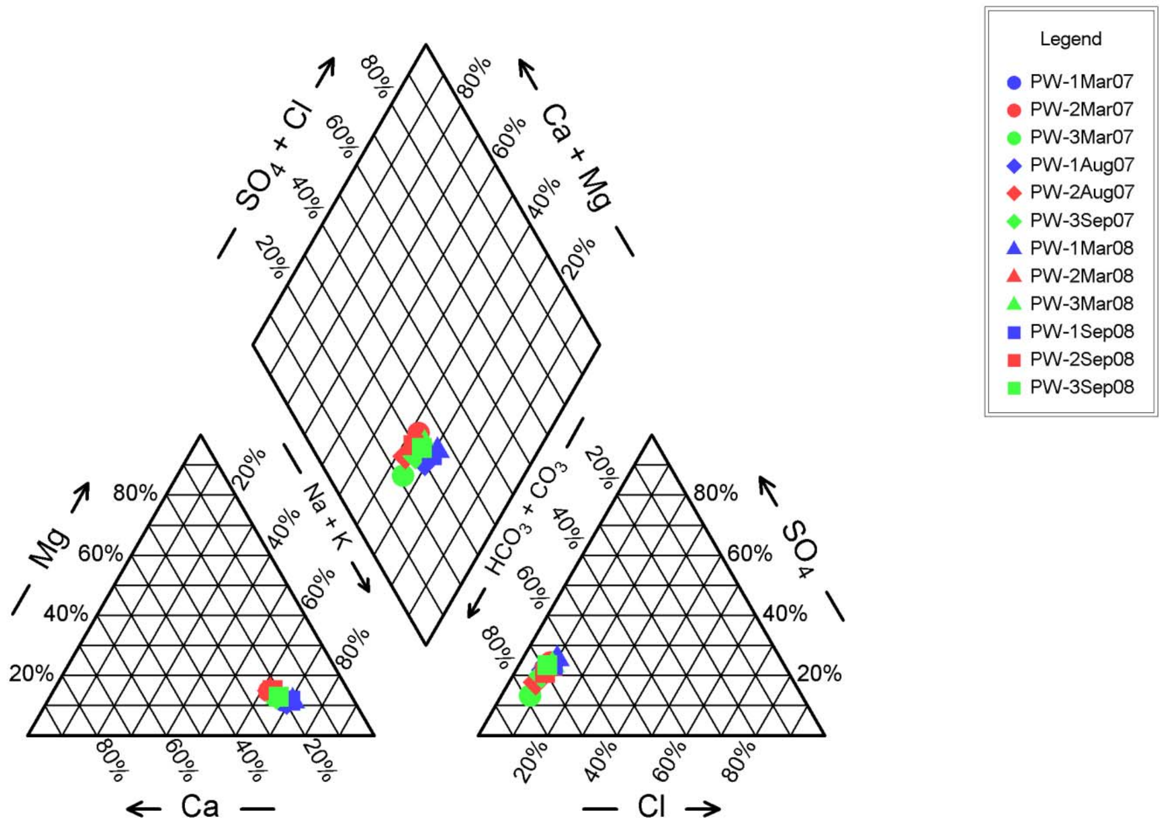

Figure 2-7 Area 5 RWMS Two-Year Piper Diagram

2.2.7 Groundwater Elevation

Groundwater elevations in UE5PW-1, UE5PW-2, and UE5PW-3 are measured quarterly using an electronic water-level tape (Table 2-10; Figure 2-8). The 2008 average depths to water from top of casing are 235.77 m (773.51 ft), 256.37 m (841.11 ft), and 271.50 m (890.76 ft) for UE5PW-1, UE5PW-2, and UE5PW-3, respectively. These measurements are corrected for borehole deviation (REECo, 1994).

The 2008 average groundwater elevations are 733.61 m (2,406.84 ft) AMSL, 733.75 m (2,407.32 ft) AMSL, and 733.72 m (2,407.21 ft) AMSL for UE5PW-1, UE5PW-2, and UE5PW-3, respectively. These measurements are corrected for borehole deviation (REECo, 1994). Based on the similar groundwater elevations, the groundwater table is essentially flat with little or no flow. Groundwater gradient, velocity, and flow direction are calculated from the groundwater elevations, borehole locations, and aquifer hydraulic properties (Table 2-11; Appendix B). The very low calculated flow velocities and the fluctuating flow directions indicate little or no groundwater flow.

Table 2-10 Area 5 RWMS Groundwater Elevation Data

Well Characteristics[a]	UE5PW-1		UE5PW-2		UE5PW-3	
Northing[b] (m)	233,386.48		234,817.13		235,089.93	
Easting[b] (m)	216,357.08		216,376.00		214,415.04	
Well Casing Elevation[c] (m)	969.37		990.12		1,005.22	
Casing Stickup Height[d] (m)	0.72		0.68		0.76	
Land Surface Elevation (m)	968.73		989.54		1,004.50	
Borehole Deviation Correction (m)	0.08		0.21		0.02	
Date	Depth to Water (m below Top of Casing)	Water Table Elevation (m)	Depth to Water (m below Top of Casing)	Water Table Elevation (m)	Depth to Water (m below Top of Casing)	Water Table Elevation (m)
03/22/1993	235.55	733.82	256.38	733.74	271.69	733.53
03/23/1993	235.53	733.84	256.48	733.64	271.68	733.54
03/24/1993	235.53	733.84	256.36	733.76	271.69	733.53
03/25/1993	235.53	733.84	256.35	733.77	271.69	733.53
03/29/1993	235.59	733.78	256.38	733.74	271.73	733.49
03/30/1993	235.62	733.75	256.43	733.69	271.75	733.47
03/31/1993	235.62	733.75	256.44	733.68	271.74	733.48
04/01/1993	235.54	733.83	256.37	733.75	271.69	733.53
04/05/1993	235.51	733.86	256.35	733.77	271.67	733.55
04/06/1993	235.59	733.78	256.40	733.72	271.75	733.47
05/10/1993	235.64	733.73	256.46	733.66	271.76	733.46
05/11/1993	235.56	733.81	256.42	733.70	271.70	733.52
05/12/1993	235.54	733.83	256.40	733.72	271.72	733.50
05/13/1993	235.61	733.76	256.45	733.67	271.75	733.47
05/17/1993	235.61	733.76	256.45	733.67	271.74	733.48
05/18/1993	235.59	733.78	256.45	733.67	271.74	733.48
05/19/1993	235.59	733.78	256.44	733.68	271.73	733.49
05/20/1993	235.54	733.83	256.39	733.73	271.70	733.52
05/24/1993	235.60	733.77	256.43	733.69	271.74	733.48
05/25/1993	235.61	733.76	256.45	733.67	271.74	733.48
06/01/1993	235.58	733.79	256.43	733.69	271.73	733.49
06/07/1993	235.64	733.73	256.46	733.66	271.76	733.46
06/14/1993	235.61	733.76	256.46	733.66	271.74	733.48
06/21/1993	235.58	733.79	256.43	733.69	271.73	733.49
07/26/1993	235.59	733.78	256.45	733.67	271.74	733.48
08/03/1993	235.54	733.83	256.42	733.70	271.70	733.52
08/09/1993	235.62	733.75	256.46	733.66	271.75	733.47
08/16/1993	235.59	733.78	256.42	733.70	271.73	733.49
08/30/1993	235.58	733.79	256.43	733.69	271.72	733.50
12/28/1993	235.59	733.78	256.47	733.65	271.74	733.48
01/03/1994	235.57	733.80	256.44	733.68	271.70	733.52
02/02/1994	235.53	733.84	256.44	733.68	271.66	733.56
02/22/1994	235.60	733.77	256.43	733.69	271.71	733.51

02/28/1994	235.60	733.77	256.45	733.67	271.70	733.52
03/07/1994	235.54	733.83	256.38	733.74	271.66	733.56
03/14/1994	235.55	733.82	256.45	733.67	271.67	733.55
03/21/1994	235.56	733.81	256.38	733.74	271.68	733.54
03/28/1994	235.63	733.74	256.47	733.65	271.70	733.52
04/04/1994	235.53	733.84	256.40	733.72	271.66	733.56
04/13/1994	235.55	733.82	256.43	733.69	271.65	733.57
04/20/1994	235.51	733.86	256.38	733.74	271.64	733.58
04/26/1994	235.55	733.82	256.35	733.77	271.65	733.57
01/18/1995	235.63	733.74	256.45	733.67	271.62	733.60
04/03/1995	235.57	733.80	256.39	733.73	271.61	733.61
01/16/1996	235.36	734.01	256.13	733.99	271.35	733.87
04/15/1996	235.56	733.81	256.30	733.82	271.43	733.79
10/01/1996	235.54	733.83	256.32	733.80	271.51	733.71
11/19/1996	235.59	733.78	256.33	733.79	271.52	733.70
03/03/1997	235.54	733.83	256.30	733.82	271.41	733.81
04/15/1997	235.63	733.74	256.40	733.72	271.54	733.68
06/18/1997	235.61	733.76	256.40	733.72	271.52	733.70
07/28/1997	235.60	733.77	256.37	733.75	271.51	733.71
08/20/1997	235.52	733.85	256.29	733.83	271.44	733.78
09/25/1997	235.59	733.78	256.35	733.77	271.49	733.73
10/27/1997	235.57	733.80	256.34	733.78	271.48	733.74
11/03/1997	235.65	733.72	256.40	733.72	271.55	733.67
11/06/1997	235.57	733.80	256.36	733.76	271.48	733.74
11/12/1997	235.66	733.71	256.45	733.67	271.54	733.68
11/13/1997	235.60	733.77	256.29	733.83	271.49	733.73
11/19/1997	235.63	733.74	256.42	733.70	271.55	733.67
11/20/1997	235.65	733.72	256.43	733.69	271.57	733.65
11/25/1997	235.64	733.73	256.39	733.73	271.54	733.68
11/26/1997	235.50	733.87	256.27	733.85	271.45	733.77
12/03/1997	235.71	733.66	256.43	733.69	271.60	733.62
01/26/1998	235.72	733.65	256.47	733.65	271.60	733.62
05/12/1998	235.60	733.77	256.32	733.80	271.52	733.70
10/27/1998	235.52	733.85	256.21	733.91	271.36	733.86
12/22/1998	235.54	733.83	256.20	733.92	271.35	733.87
02/02/1999	235.61	733.76	256.34	733.78	271.42	733.80
05/18/1999	235.56	733.81	256.26	733.86	271.35	733.87
08/25/1999	235.56	733.81	256.26	733.86	271.38	733.84
10/26/1999	235.57	733.80	256.26	733.86	271.34	733.88
04/24/2000	235.64	733.73	256.34	733.78	271.52	733.70
08/07/2000	235.59	733.78	256.30	733.82	271.47	733.75
11/13/2000	235.66	733.71	256.34	733.78	271.45	733.77
02/22/2001	235.57	733.80	256.26	733.86	271.38	733.84
05/21/2001	235.67	733.70	256.35	733.77	271.49	733.73
08/01/2001	235.66	733.71	256.36	733.76	271.48	733.74
10/01/2001	235.66	733.71	256.35	733.77	271.45	733.77
02/26/2002	235.76	733.61	256.43	733.69	271.52	733.70
05/13/2002	235.65	733.72	256.39	733.73	271.44	733.78
08/19/2002	235.61	733.76	256.28	733.84	271.42	733.80
10/21/2002	235.61	733.76	256.31	733.81	271.44	733.78
02/26/2003	235.65	733.72	256.28	733.84	271.43	733.79
04/10/2003	235.61	733.76	256.30	733.82	271.41	733.81
09/10/2003	235.74	733.63	256.35	733.77	271.50	733.72
10/20/2003	235.73	733.64	256.42	733.70	271.53	733.69
02/25/2004	235.78	733.59	256.36	733.76	271.52	733.70

04/27/2004	235.72	733.65	256.43	733.69	271.52	733.70
08/18/2004	235.72	733.65	256.38	733.74	271.48	733.74
10/18/2004	235.71	733.66	256.29	733.83	271.47	733.75
01/26/2005	235.67	733.70	256.45	733.67	271.46	733.76
04/18/2005	235.66	733.71	256.33	733.79	271.44	733.78
07/27/2005	235.75	733.62	256.42	733.70	271.51	733.71
10/10/2005	235.77	733.60	256.44	733.68	271.54	733.68
03/08/2006	235.74	733.63	256.39	733.73	271.50	733.72
05/03/2006	235.69	733.68	256.41	733.71	271.62	733.60
08/23/2006	235.76	733.61	256.43	733.69	271.50	733.72
10/09/2006	235.69	733.68	256.38	733.74	271.44	733.78
02/28/2007	235.74	733.63	256.29	733.83	271.49	733.73
07/11/2007	235.77	733.60	256.41	733.71	271.50	733.72
08/28/2007	235.78	733.59	256.42	733.70	271.47	733.75
10/15/2007	235.76	733.61	256.40	733.72	271.49	733.73
01/22/2008	235.79	733.58	256.39	733.73	271.53	733.69
03/03/2008	235.80	733.57	256.38	733.74	271.53	733.69
06/16/2008	235.74	733.63	256.32	733.80	271.48	733.74
09/09/2008	235.73	733.64	256.39	733.73	271.47	733.75

[a] Source for northings, eastings, well casing elevations, and deviation corrections: REECO, 1994
[b] Coordinate System: Nevada (Central) State Plane NAD27
[c] Measured from top of well casing
[d] Measured from top of well casing to land surface
Note: All elevations are m above mean sea level

Table 2-11 2008 Area 5 RWMS Groundwater Flow Calculations

Hydraulic Conductivity = 1.12E-03 cm/s (3.67E-05 ft/s)[a]			
Effective Porosity = 0.38[a]			
Date	**Hydraulic Gradient (m/m)**	**Velocity (m/yr)**	**Flow direction (degrees East of North)**
01/22/08	1.10E-04	0.10	198
03/03/08	1.25E-04	0.12	200
06/16/08	1.27E-04	0.12	202
09/09/08	6.29E-05	0.06	179

[a] Source: REECO, 1994

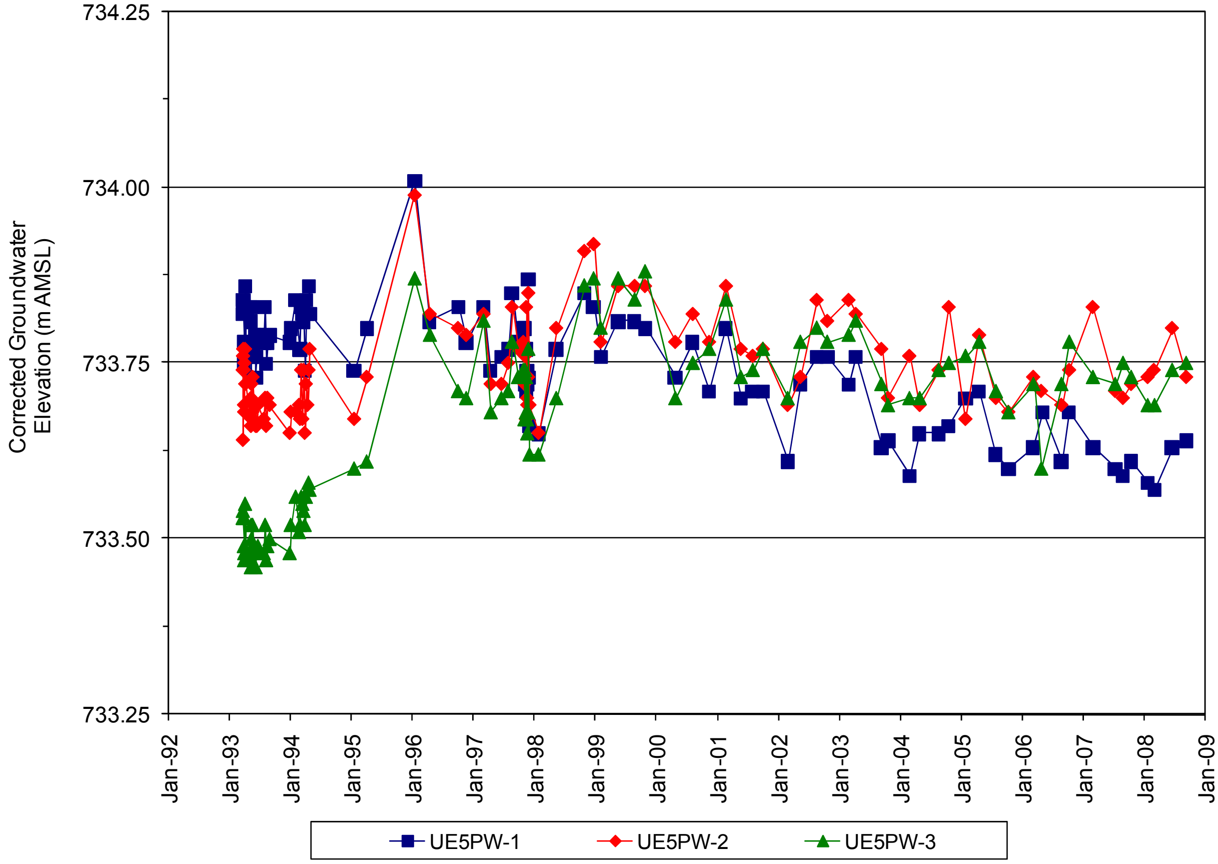

Figure 2-8 Area 5 RWMS Time Series Plot of Groundwater Elevations

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3.0 SUMMARY

The hydrologic conditions in the uppermost aquifer beneath the Area 5 RWMS remain stable. Groundwater flow in this uppermost aquifer is negligible. No significant changes were detected in the water chemistry, and all indicator parameters remain within the established ILs.

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4.0 CONCLUSION

There is no measurable impact to the uppermost aquifer from the Area 5 RWMS.

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Appendix A – Cumulative Chronology for the Area 5 Radioactive Waste Management Site Groundwater Monitoring Program

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Cumulative Chronology for Area 5 RWMS Groundwater (GW) Monitoring Program					
Date	**UE5PW-1**	**Date**	**UE5PW-2**	**Date**	**UE5PW-3**
03/20/1990	U.S. Department of Energy (DOE) letter requesting installation of monitoring wells near the Area 5 RWMS.				
03/13/1992	Drilling begins				
06/16/1992	Drilling ends	06/18/1992	Drilling begins		
09/11/1992	Well Developed	09/04/1992	Drilling ends		
				09/16/1992	Drilling begins
				11/09/1992	Drilling ends
		03/24/1993	GW Sampling		
03/31/1993	GW Sampling	03/30/1993	Well Developed	04/04/1993	Well Developed
				04/14/1993	GW Sampling
06/06/1993	GW Sampling	06/22/1993	GW Sampling	06/02/1993	GW Sampling
09/01/1993	GW Sampling			10/12/1993	GW Sampling
12/07/1993	GW Sampling	11/15/1993	GW Sampling	12/20/1993	GW Sampling
12/17/1993	DOE letter to Nevada Department of Environmental Protection (NDEP) requesting to establish Pilot Wells located near the Area 5 as Resource Conservation and Recovery Act (RCRA) groundwater monitoring wells.				
02/24/1994	NDEP letter stating that the Pilot Wells appear to meet the applicable design, construction, and development criteria for RCRA groundwater monitoring wells.				
06/15/1994	GW Sampling	06/07/1994	GW Sampling	05/24/1994	GW Sampling
08/01/1994	GW Sampling			08/08/1994	GW Sampling
		11/29/1994	GW Sampling		
09/30/1994	DOE submits 1993 groundwater-monitoring results from quarterly sampling effort.				
01/18/1995	UE5PW-3 GW resampling for 08/01/1994 total organic carbon (TOC) hit.				
02/23/1995	DOE transmits to NDEP Groundwater Monitoring Program Outline.				
03/01/1995	1994 GW Monitoring Report submitted to NDEP.				
04/04/1995	GW Sampling				
11/09/1995	GW Sampling				
11/09/1995	UE5PW-1 pump snagged in hole, resulting in a bent shaft on the reel.				
01/18/1996	GW Sampling	01/25/1996	GW Sampling	01/18/1996	GW Sampling
01/22/1996	Bennett pump seals replaced at all three wells.				

Cumulative Chronology for Area 5 RWMS Groundwater (GW) Monitoring Program					
Date	**UE5PW-1**	**Date**	**UE5PW-2**	**Date**	**UE5PW-3**
03/01/1996	DOE submits to NDEP the 1995 GW Monitoring Report.				
04/16/1996	GW Sampling	04/23/1996	GW Sampling		
		04/30/1996	GW Sampling		
10/02/1996	GW Sampling				
10/25/1996	NDEP requests clarifications/changes in the GW Monitoring Report.				
11/20/1996	GW Sampling				
03/01/1997	DOE submits 1996 GW Monitoring Report and revised GW Monitoring Program Outline.				
04/16/1997	GW Sampling				
08/12/1997	NDEP comments on 1996 GW Monitoring Report/Proposed Outline.				
10/22/1997	Pump and water-level meter lodge in UE5PW-1 well during simultaneous operation, retrieved 10/23/1997.				
10/22/1997	Larger diameter air lines installed at all three wells.				
11/05/1997	GW Sampling				
03/01/1998	DOE submits to NDEP the 1997 GW Monitoring Report and new outline.				
03/31/1998	NDEP letter stating that they concur on the indicator parameters and ILs submitted in the groundwater-monitoring outline.				
05/13/1998	GW Sampling				
06/22/1998	Total organic halides (TOX) detected in the 05/13/1998 samples and blanks from all three wells.				
07/10/1998	DOE and NDEP agree to resample UE5PW-1 to confirm no TOX.				
07/29/1998	GW resampling at UE5PW-1 for 05/13/1998 TOX hits.				
09/10/1998	Results from 07/29/1998 resampling are non-detect for TOX. TOX results from the 05/13/1998 sampling event are determined to be false positives.				
09/10/1998	Bennett pumps from three wells and spare pumps are sent to manufacturer for refurbishing.				
09/12/1998	Reels from three wells are returned to manufacturer for new tubing bundles.				
10/28/1998	GW Sampling				
09/12/1998	UE5PW-1 reel returned to manufacturer for repair of exhaust tube. Spare pump returned to manufacturer for the repair of a leaky seal.				
03/01/1999	DOE submits to NDEP 1998 Groundwater Monitoring Report.				
03/31/1999	NDEP requests statistical analysis of data and states that values determined to be false positives through resampling do not need to be presented graphically.				
05/19/1999	GW Sampling				
10/27/1999	GW Sampling				
12/13/1999	Resample UE5PW-2 after TOC hit from 10/27/1999.				

Cumulative Chronology for Area 5 RWMS Groundwater (GW) Monitoring Program					
Date	**UE5PW-1**	**Date**	**UE5PW-2**	**Date**	**UE5PW-3**
12/27/1999	Results from the resampling of UE5PW-2 are non-detect for TOC. TOC result from 10/27/1999 is determined to be a false positive.				
02/25/2000	DOE submits to NDEP 1999 Groundwater Monitoring Report.				
04/17/2000	NDEP states that future reports do not need to include statistical analyses.				
04/26/2000	GW Sampling				
06/28/2000	DOE contacts State to report TOX/TOC hits from 04/26/2000. DOE and NDEP agree that the wells will be resampled in August, which would also constitute the Fall sampling event.				
08/09/2000	GW Sampling				
09/20/2000	DOE contacts NDEP to report TOX hits from 08/09/2000 sampling.				
11/07/2000	Letter from NDEP stating that DOE does not have a valid data set for TOX and possibly TOC and requests a plan to address contamination concerns prior to next sampling event.				
11/20/2000	Video log well			11/27/2000	Video log well
12/20/2000	DOE transmits to NDEP a proposed plan to address contamination issues.				
01/31/2001	Letter from NDEP generally concurring that the plan submitted to determine the cause of TOX and TOC hits is sound.				
02/21/2001	DOE submits to NDEP 2000 Groundwater Monitoring Report				
03/14/2001	Letter from NDEP stating that the 2000 GW Monitoring report was received in a timely manner and contains all the data required by Title 40 Code of Federal Regulations Part 265.94. Letter also requests information regarding data in Appendix A of the 2000 GW Monitoring Report (Bechtel Nevada, 2001).				
04/19/2001	Letter from DOE responding to NDEP's 3/14/2001 request for information regarding presentation of TOX/TOC data in the 2000 report.				
04/30/2001	Letter from NDEP concurring with the approach to data presentation as outlined by DOE in the 4/19/2001 correspondence.				
05/29/2001	GW Sampling				
10/03/2001	GW Sampling				
03/01/2002	DOE submits to NDEP 2001 Groundwater Monitoring Report.				
05/15/2002	GW Sampling				
10/22/2002	GW Sampling				
03/01/2003	DOE submits to NDEP 2002 GW Monitoring Report.				
04/15/2003	GW Sampling				
10/22/2003	GW Sampling			10/21/2003	GW Sampling

Cumulative Chronology for Area 5 RWMS Groundwater (GW) Monitoring Program					
Date	**UE5PW-1**	**Date**	**UE5PW-2**	**Date**	**UE5PW-3**
03/01/2004	DOE submits to NDEP 2003 GW Monitoring Report.				
05/04/2004	GW Sampling				
10/19/2004	GW Sampling			10/20/2003	GW Sampling
02/25/2005	DOE submits to NDEP 2004 GW Monitoring Report.				
04/19/2005	GW Sampling				
10/11/2005	GW Sampling				
03/01/2006	DOE submits to NDEP 2005 GW Monitoring Report.				
04/26/2006	GW Sampling				
10/10/2006	GW Sampling				
03/01/2007	DOE submits to NDEP 2006 GW Monitoring Report.				
03/19/2007	GW Sampling				
08/29/2007	GW Sampling			09/05/2007	GW Sampling
03/01/2008	DOE submits to NDEP 2007 GW Monitoring Report				
03/11/2008	GW Sampling				
09/10/2008	GW Sampling				

Appendix B – Gradient/Velocity Calculations

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Calculation of Magnitude and Direction of Area 5 Alluvial Aquifer Gradient

Water level elevations measured at three wells near the Area 5 Radioactive Waste Management Site (UE5PW-1, UE5PW-2, and UE5PW-3) are used to calculate the magnitude and direction of the aquifer hydraulic gradient.

The locations of the three wells are given in Nevada State Central Zone coordinates in meters as Northing (N) and Easting (E) values. The coordinates of each of the three water elevation points define a plane that contains the water level points. The coordinates of the water elevation points are (E_i, N_i, e_i) where:

E_i is the East Coordinate of the i^{th} well (m)
N_i is the North Coordinate of the i^{th} well (m)
e_i is the water level elevation of the i^{th} well (m)

Assuming i=1 for UE5PW-1, i=2 for UE5PW-2, and i=3 for UE5PW-3, the vector **a** connecting the water level at UE5PW-1 to the water level at UE5PW-2 and the vector **b** connecting the water level at UE5PW-1 to the water level at UE5PW-3 are defined by:

$$\mathbf{a} = (E_2-E_1)\mathbf{i} + (N_2-N_1)\mathbf{j} + (e_2-e_1)\mathbf{k}$$
$$\mathbf{b} = (E_3-E_1)\mathbf{i} + (N_3-N_1)\mathbf{j} + (e_3-e_1)\mathbf{k}$$

The aquifer hydraulic gradient is the cross product **a** x **b.**

$$\boldsymbol{a\ x\ b} = \boldsymbol{DET}\begin{bmatrix} \boldsymbol{i} & \boldsymbol{j} & \boldsymbol{k} \\ \boldsymbol{E_2 - E_1} & \boldsymbol{N_2 - N_1} & \boldsymbol{e_2 - e_1} \\ \boldsymbol{E_3 - E_1} & \boldsymbol{N_3 - N_1} & \boldsymbol{e_3 - e_1} \end{bmatrix}$$

$$= [(N_2-N_1)(e_3-e_1)-(e_2-e_1)(N_3-N_1)]\mathbf{i} +$$

$$[(e_2-e_1)(E_3-E_1)-(E_2-E_1)(e_3-e_1)]\mathbf{j} +$$

$$[(E_2-E_1)(N_3-N_1)-(N_2-N_1)(E_3-E_1)]\mathbf{k}$$

$$= A\mathbf{i} + B\mathbf{j} + C\mathbf{k}$$

Where: $A = (N_2-N_1)(e_3-e_1)-(e_2-e_1)(N_3-N_1)$
$B = (e_2-e_1)(E_3-E_1)-(E_2-E_1)(e_3-e_1)$
$C = (E_2-E_1)(N_3-N_1)-(N_2-N_1)(E_3-E_1)$

Dividing hydraulic gradient by C gives the magnitude of the gradient in Easting (**i**) and Northing (**j**) for a unit change in elevation (**k**)

$$(\boldsymbol{a}\ x\ \boldsymbol{b})/C \ = \ {}^{A}/_{C}\,\boldsymbol{i} \ + \ {}^{B}/_{C}\,\boldsymbol{j} + \boldsymbol{k}$$

The magnitude of the gradient is:

$$\sqrt{{}^{A}/_{C}{}^{2} + {}^{B}/_{C}{}^{2}}$$

The direction of the gradient from north (θ) is calculated using the magnitudes of easting (E) and northing (N).

If B>0, then θ = arctan (a/b)
If B<0, then θ = 180° + arctan (a/b)
If B=0 and A>0, then θ = 90°
If B=0 and A<0, then θ = 270°
If B=0 and A=0, then the flow is straight down.

Calculation of Mean Groundwater Velocity

Groundwater flux is from calculated from Darcy's Law:

$$J = -K\,(\frac{\Delta e}{C})$$

Where: J is groundwater flux (m/s)
K is saturated hydraulic conductivity (m/s)
$\frac{\Delta e}{C}$ is the hydraulic gradient (m/m)

The mean groundwater velocity is calculated from the flux:

$$\boldsymbol{V} = {}^{\boldsymbol{J}}/_{\emptyset}$$

Where: V is mean groundwater velocity (m/s)
J is the groundwater flux (m/s)
Φ is porosity (m^3/m^3)

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D.1 Characterize Solid Waste Management Units (SWMU) [40 CFR 270.14(d)]

Closed SWMUs on the NTS are noted in NDEP Permit NEV HW0021 (November 2005), Part VII. A description of the closure/post-closure requirements are noted in Volume 1 of the Permit Application for Permit NEV HW0021. A list of solid waste management units is provided in Appendix II of the FFACO.

Closure reports for each unit are maintained in NNSA/NSO 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 the characterization.

F.1 Information Requirements for Tank Systems [40 CFR 270.16]

An aboveground tank will be used to contain leachate that is not applied for dust control within the MWDU. A description of the leachate tank is contained in Section B.1.b.1.

The final tank configuration will be based on the final design of the MWDU cell. Conceptual design drawings are provided in Figures 5 through 9. NNSA/NSO is seeking permit approval based on the conceptual design. Subsequent to approval, NNSA/NSO will use a subcontractor to design and build the proposed unit. NDEP permit approval is contingent upon review and approval of the final construction drawings.

40 CFR 270.16 requirements will be addressed based on the final configuration.

- A written assessment that is reviewed by a registered engineer as to the structural integrity and suitability for handling hazardous waste.
- Dimensions and capacity of the tank.
- Descriptions of feed systems, safety cutoff, bypass systems, and pressure controls.
- A diagram of piping, instrumentation, and process flow.
- Description of materials and equipment used to provide external corrosion protection **[40 CFR 264.192(a)(3)(ii)]**.
- Detailed description of how the tank will be installed **[40 CFR 264.192(b-e)]**.
- Detailed plan and description of how the secondary containment system is designed constructed, and operated **[40 CFR 264.193(a-f)]**.
- Description of controls and practices to prevent spills and overflows **[40 CFR 264.194(b)]**.