DOE/NV/25946--1015

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

May 2010

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the U.S. Government or any agency thereof.

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

1. Reason for Submittal MARK ALL BOX(ES) THAT APPLY	**Reason for Submittal:** ☐ To provide an Initial Notification (first time submitting site identification information / to obtain an EPA ID number for this location) ☒ To provide a Subsequent Notification (to update site identification information for this location) ☐ 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 (If marked, see sub-bullet below) ☐ Site was a TSD facility and/or generator of ≥1,000 kg of hazardous waste, >1 kg of acute hazardous waste, or >100 kg of acute hazardous waste spill cleanup in one or more months of the report year (or State equivalent LQG regulations)
2. Site EPA ID Number	**EPA ID Number** N V 3 8 9 0 0 9 0 0 0 1
3. Site Name	**Name:** U.S. Department of Energy - Nevada Test Site
4. Site Location Information	**Street Address:** Mercury Highway and Hardtack Avenue, Building 23-111 **City, Town, or Village:** Mercury **County:** Nye **State:** NV **Country:** USA **Zip Code:** 89061
5. Site Land Type	☐ Private ☐ County ☐ District ☒ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other
6. NAICS Code(s) for the Site (at least 5-digit codes)	**A.** 9 2 8 1 1 **C.** 5 4 1 3 3 **B.** 5 4 1 7 1 **D.** 5 6 2 9 9
7. Site Mailing Address	**Street or P.O. Box:** P. O. Box 98518 **City, Town, or Village:** Las Vegas **State:** NV **Country:** USA **Zip Code:** 89119-8518
8. Site Contact Person	**First Name:** Kenneth **MI:** M **Last:** Small **Title:** RCRA Program Manager **Street or P.O. Box:** P.O. Box 98518 **City, Town or Village:** Las Vegas **State:** Nevada **Country:** USA **Zip Code:** 89119-8518 **Email:** small@nv.doe.gov **Phone:** 702-295-1933 **Ext.:** **Fax:** 702-295-1153
9. Legal Owner and Operator of the Site	**A. Name of Site's Legal Owner:** U.S. DOE NNSA/NSO **Date Became Owner:** 02/12/1952 **Owner Type:** ☐ Private ☐ County ☐ District ☒ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other **Street or P.O. Box:** P.O. Box 98518 **City, Town, or Village:** Las Vegas **Phone:** 702-295-5855 **State:** NV **Country:** USA **Zip Code:** 89119-8518 **B. Name of Site's Operator:** National Security Technologies LLC (NSTec) **Date Became Operator:** 07/01/2006 **Operator Type:** ☒ Private ☐ County ☐ District ☐ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other

10. Type of Regulated Waste Activity (at your site)
Mark "Yes" or "No" for all current activities (as of the date submitting the form); complete any additional boxes as instructed.

A. Hazardous Waste Activities; Complete all parts 1-7.

Y ☒ N ☐ **1. Generator of Hazardous Waste**
If "Yes", mark only one of the following – a, b, or c.

☒ a. LQG: Generates, in any calendar month, 1,000 kg/mo (2,200 lbs./mo.) or more of hazardous waste; **or** Generates, in any calendar month, or accumulates at any time, more than 1 kg/mo (2.2 lbs./mo) of acute hazardous waste; **or** Generates, in any calendar month, **or** accumulates at any time, more than 100 kg/mo (220 lbs./mo) of acute hazardous spill cleanup material.

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

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

If "Yes" above, indicate other generator activities.

Y ☐ N ☒ d. Short-Term Generator (generate from a short-term or one-time event and not from on-going processes). If "Yes", provide an explanation in the Comments section.

Y ☐ N ☒ e. United States Importer of Hazardous Waste

Y ☒ N ☐ f. Mixed Waste (hazardous and radioactive) Generator

Y ☐ N ☒ **2. Transporter of Hazardous Waste**
If "Yes", mark all that apply.

☐ a. T ransporter

☐ b. Transfer Facility (at your site)

Y ☒ N ☐ **3. Treater, Storer, or Disposer of Hazardous Waste** Note: A hazardous waste permit is required for these activities.

Y ☐ N ☒ **4. Recycler of Hazardous Waste**

Y ☐ N ☒ **5. Exempt Boiler and/or Industrial Furnace**
If "Yes", mark all that apply.

☐ a. Small Quantity On-site Burner Exemption

☐ b. Smelting, Melting, and Refining Furnace Exemption

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

Y ☒ N ☐ **7. Receives Hazardous Waste from Off-site**

B. Universal Waste Activities; Complete all parts 1-2.

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

a. Batteries ☒

b. Pesticid es ☐

c. Mercury containing equipment ☒

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; Complete all parts 1-4.

Y ☐ N ☒ **1. Used Oil Transporter**
If "Yes", mark all that apply.

☐ a. T ransporter

☐ b. Transfer Facility (at your site)

Y ☐ N ☒ **2. Used Oil Processor and/or Re-refiner**
If "Yes", mark all that apply.

☐ a. Processor

☐ b. Re-refiner

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

Y ☐ N ☒ **4. Used Oil Fuel Marketer**
If "Yes", mark all that apply.

☐ 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

D. Eligible Academic Entities with Laboratories—Notification for opting into or withdrawing from managing laboratory hazardous wastes pursuant to 40 CFR Part 262 Subpart K

❖ You must check with your State to determine if you are eligible to manage laboratory hazardous wastes pursuant to 40 CFR Part 262 Subpart K

☐ 1. Opting into or currently operating under 40 CFR Part 262 Subpart K for the management of hazardous wastes in laboratories
See the item-by-item instructions for definitions of types of eligible academic entities. Mark all that apply:

☐ a. College or University

☐ b. Teaching Hospital that is owned by or has a formal written affiliation agreement with a college or university

☐ c. Non- profit Institute that is owned by or has a formal written affiliation agreement with a college or university

☐ 2. Withdrawing from 40 CFR Part 262 Subpart K for the management of hazardous wastes in laboratories

11. Description of Hazardous Waste

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.

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.

Attachment B						

12. Notification of Hazardous Secondary Material (HSM) Activity

Y ☐ N ☒ Are you notifying under 40 CFR 260.42 that you will begin managing, are managing, or will stop managing hazardous secondary material under 40 CFR 261.2(a)(2)(ii), 40 CFR 261.4(a)(23), (24), or (25)?

If "Yes", you must fill out the Addendum to the Site Identification Form: Notification for Managing Hazardous Secondary Material.

13. Comments

~~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.

14. 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 fines and imprisonment for knowing violations. For the RCRA Hazardous Waste Part A Permit Application, all owner(s) and operator(s) must sign (see 40 CFR 270.10(b) and 270.11).

Signature of legal owner, operator, or an authorized representative	Name and Official Title (type or print)	Date Signed (mm/dd/yyyy)
Steph A Mellingt	Stephen A. Mellington, Manager	05/26/2010
	NNSA/NSO-Owner	
M G Butchko	Stephen M. Younger, President	5/26/2010
	NSTec LLC-Operator	

Waste Codes

EPA ID NO: NV3 890 090 001
RCRA Subtitle C Identification Form
Section 11.A
Attachment A – Waste Codes for Federally Regulated Hazardous Waste

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 cleanups
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 Number N V 3 8 9 0 0 9 0 0 0 1 OMB#: 2050-0034; Expires 7/31/2012

United States Environmental Protection Agency

HARDOUS WASTE PERMIT INFORMATION FORM

1. Facility Permit Contact	**First Name:** Kenneth	**MI:** M	**Last Name:** Small
	Contact Title: RCRA Program Manager		
	Phone: 702-295-1933	**Ext.:**	**Email:** small@nv.doe.gov
2. Facility Permit Contact Mailing Address	**Street or P.O. Box:** P. O. Box 98518		
	City, Town, or Village: Mercury		
	State: NV		
	Country: USA	**Zip Code:** 89061	
3. Operator Mailing Address and Telephone Number	**Street or P.O. Box:** P.O. Box 98518		
	City, Town, or Village: Las Vegas		
	State: NV	**Phone:** 702-295-1150	
	Country: USA	**Zip Code:** 89119-8518	
4. Facility Existence Date	**Facility Existence Date (mm/dd/yyyy):** 02/12/1952		

5. Other Environmental Permits

A. Facility Type *(Enter code)*	B. Permit Number	C. Description
Attachment C		

6. Nature of Business: 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 and remediation, research and development, and work for others, as well as supporting other DOE and NNSA programs.

7. Process Codes and Design Capacities – Enter information in the Section on Form Page 3

A. **PROCESS CODE – Enter the code from the list of process codes below that best describes each process to be used at the facility. 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), describe the process (including its design capacity) in the space provided in Item 8.**

B. **PROCESS DESIGN CAPACITY – For each code entered in Item 7.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 Item 7.B(1), enter the code in Item 7.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 Unit 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; Hectares-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 Listed 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	Gallons; Liters; Cubic Meters; or Cubic Yards
S05	Drip Pad	Gallons; Liters; Cubic Meters; Hectares; or Cubic Yards
S06	Containment Building Storage	Cubic Yards or Cubic Meters
S99	Other Storage	Any Unit of Measure Listed Below
Treatment		
T01	Tank Treatment	Gallons Per Day; Liters Per Day
T02	Surface Impoundment	Gallons Per Day; Liters Per Day
T03	Incinerator	Short Tons Per Hour; Metric Tons Per Hour; Gallons Per Hour; Liters Per Hour; BTUs Per Hour; Pounds Per Hour; Short Tons Per Day; Kilograms Per Hour; Gallons 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; Short Tons Per Day; BTUs Per Hour; Gallons Per Day; Liters Per Hour; or Million BTU Per Hour
T80	Boiler	Gallons; Liters; Gallons Per Hour; Liters Per Hour; BTUs Per Hour; or Million BTU Per Hour

Process Code	Process	Appropriate Unit of Measure for Process Design Capacity
Treatment (Continued)		**(for T81 – T94)**
T81	Cement 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
T82	Lime Kiln	
T83	Aggregate Kiln	
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 Listed 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	Unit of Measure	Unit of Measure Code	Unit of Measure	Unit of Measure Code
Gallons	**G**	**Short Tons Per Hour**	**D**	**Cubic Yards**	**Y**
Gallons Per Hour	**E**	**Short Tons Per Day**	**N**	**Cubic Meters**	**C**
Gallons Per Day	**U**	**Metric Tons Per Hour**	**W**	**Acres**	**B**
Liters	**L**	**Metric Tons Per Day**	**S**	**Acre-feet**	**A**
Liters Per Hour	**H**	**Pounds Per Hour**	**J**	**Hectares**	**Q**
Liters Per Day	**V**	**Kilograms Per Hour**	**X**	**Hectare-meter**	**F**
		Million BTU Per Hour	**X**	**BTU Per Hour**	**I**

7. Process Codes and Design Capacities (Continued)

EX AMPLE FOR COMPLETING Item 7 (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	C. Process Total Number of Units	For Official Use Only					
X 1		**S**	**0**	**2**	**533.788**	**G**	**001**						
1		X	0	1	100.0	J	001						
2		S	0	1	61,600.00	L	001						
3													
4													
5													
6													
7													
8													
9													
1 0													
1 1													
1 2													
1 3													

Note: If you need to list more than 13 process codes, attach an additional sheet(s) with the information in the same format as above. Number the line sequentially, taking into account any lines that will be used for "other" process (i.e., D99, S99, T04, and X99) in Item 8.

8. Other Processes (Follow instructions from Item 7 for D99, S99, T04, and X99 process codes)

Line Number (Enter #s in sequence with Item 7)		A. Process Code (From list above)			B. PROCESS DESIGN CAPACITY (1) Amount (Specify)	(2) Unit of Measure	C. Process Total Number of Units	For Official Use Only					
X 2		**T**	**0**	**4**	**100.00**	**U**	**001**						

9. Description of Hazardous Wastes - 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 Item 9.A, estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in Item 9.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 Item 9.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 Item 9.A, select the code(s) from the list of process codes contained in Items 7.A and 8.A on page 3 to indicate all the processes that will be used to store, treat, and/or dispose of all listed hazardous wastes.

For non-listed waste: For each characteristic or toxic contaminant entered in Item 9.A, select the code(s) from the list of process codes contained in Items 7.A and 8.A 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 9.D(1).**
3. **Use additional sheet, enter line number from previous sheet, and enter additional code(s) in Item 9.E.**

2. PROCESS DESCRIPTION: If code is not listed for a process that will be used, describe the process in Item 9.D(2) or in Item 9.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 Item 9.A. On the same line complete Items 9.B, 9.C, and 9.D by estimating the total annual quantity of the waste and describing all the processes to be used to store, treat, and/or dispose of the waste.**
2. **In Item 9.A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In Item 9.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 9 (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 Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES (1) PROCESS CODES (Enter Code)	D. PROCESSES (2) PROCESS DESCRIPTION (If code is not entered in 9.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

9. Description of Hazardous Wastes ***(Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)***

Line Number	A. EPA Hazardous Waste No. (Enter code)	B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES (1) PROCESS CODES (Enter Code)	D. PROCESSES (2) PROCESS DESCRIPTION (If code is not entered in 9.D(1))
1	D001	2645	P	X01	EODU
2	D003				INCLUDED IN ABOVE
3	D034				INCLUDED IN ABOVE
4	D008	10,000	P	S01	HWSU
5	D002	492	P	S01	HWSU
6	D002	1,200	P	S01	HWSU
7	D008				INCLUDED IN ABOVE
8	D004				INCLUDED IN ABOVE
9	P042	28	P	S01	HWSU
10	P081				INCLUDED IN ABOVE
11	D001	200	P	S01	HWSU
12	F003				INCLUDED IN ABOVE
13	F005				INCLUDED IN ABOVE
14	U002				INCLUDED IN ABOVE
15	U012				INCLUDED IN ABOVE
16	U028				INCLUDED IN ABOVE
17	U080				INCLUDED IN ABOVE
18	U154				INCLUDED IN ABOVE
19	U220				INCLUDED IN ABOVE
20	U226				INCLUDED IN ABOVE
21	F003	2,169	P	S01	HWSU
22	D001				INCLUDED IN ABOVE
23	D004				INCLUDED IN ABOVE
24	D005				INCLUDED IN ABOVE
25	D006				INCLUDED IN ABOVE
26	D007				INCLUDED IN ABOVE
27	D008				INCLUDED IN ABOVE
28	D009				INCLUDED IN ABOVE
29	D010				INCLUDED IN ABOVE
30	D018				INCLUDED IN ABOVE
31	D019				INCLUDED IN ABOVE
32	D021				INCLUDED IN ABOVE
33	D022				INCLUDED IN ABOVE
34	D023				INCLUDED IN ABOVE
35	D024				INCLUDED IN ABOVE
36	D025				INCLUDED IN ABOVE

9. Description of Hazardous Wastes ***(Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)***

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES (1) PROCESS CODES (Enter Code)									(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)
3	7	D	0	2	7												INCLUDED IN ABOVE
3	8	D	0	2	8												INCLUDED IN ABOVE
3	9	D	0	2	9												INCLUDED IN ABOVE
4	0	D	0	3	0												INCLUDED IN ABOVE
4	1	D	0	3	2												INCLUDED IN ABOVE
4	2	D	0	3	3												INCLUDED IN ABOVE
4	3	D	0	3	4												INCLUDED IN ABOVE
4	4	D	0	3	5												INCLUDED IN ABOVE
4	5	D	0	3	6												INCLUDED IN ABOVE
4	6	D	0	3	7												INCLUDED IN ABOVE
4	7	D	0	4	0												INCLUDED IN ABOVE
4	8	D	0	8	0												INCLUDED IN ABOVE
4	9	D	0	0	4	1,933	P	S	0	1							HWSU
5	0	D	0	0	5												INCLUDED IN ABOVE
5	1	D	0	0	6												INCLUDED IN ABOVE
5	2	D	0	0	7												INCLUDED IN ABOVE
5	3	D	0	0	8												INCLUDED IN ABOVE
5	4	D	0	0	9												INCLUDED IN ABOVE
5	5	D	0	1	0												INCLUDED IN ABOVE
5	6	D	0	1	1												INCLUDED IN ABOVE
5	7	D	0	1	2												INCLUDED IN ABOVE
5	8	D	0	1	3												INCLUDED IN ABOVE
5	9	D	0	1	4												INCLUDED IN ABOVE
6	0	D	0	1	5												INCLUDED IN ABOVE
6	1	D	0	1	6												INCLUDED IN ABOVE
6	2	D	0	1	7												INCLUDED IN ABOVE
6	3	D	0	1	8												INCLUDED IN ABOVE
6	4	D	0	1	9												INCLUDED IN ABOVE
6	5	D	0	2	0												INCLUDED IN ABOVE
6	6	D	0	2	1												INCLUDED IN ABOVE
6	7	D	0	2	2												INCLUDED IN ABOVE
6	8	D	0	2	3												INCLUDED IN ABOVE
6	9	D	0	2	4												INCLUDED IN ABOVE
7	0	D	0	2	5												INCLUDED IN ABOVE
7	1	D	0	2	6												INCLUDED IN ABOVE
7	2	D	0	2	7												INCLUDED IN ABOVE

9. Description of Hazardous Wastes ***(Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)***

Line Number		A. EP A Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)									(2) PROCESS DESCRIPTION (If c is not entered in 9.D.1)
7	3	D	0	2	8												Included above
7	4	D	0	2	9												Included above
7	5	D	0	3	0												Included above
7	6	D	0	3	1												Included above
7	7	D	0	3	2												Included above
7	8	D	0	3	3												Included above
7	9	D	0	3	4												Included above
8	0	D	0	3	5												Included above
8	1	D	0	3	6												Included above
8	2	D	0	3	7												Included above
8	3	D	0	3	8												Included above
8	4	D	0	3	9												Included above
8	5	D	0	4	0												Included above
8	6	D	0	4	1												Included above
8	7	D	0	4	2												Included above
8	8	D	0	4	3												Included above
8	9	D	0	0	8	1,500	P	S	0	1							HWSU
9	0	D	0	0	9												Included above
9	1	D	0	1	8												Included above
9	2	F	0	0	2	2,500	P	S	0	1							HWSU
9	3	F	0	0	3												Included above
9	4	F	0	0	4												Included above
9	5	F	0	0	5												Included above
9	6	D	0	0	5												Included above
9	7	D	0	0	6												Included above
9	8	D	0	0	7												Included above
9	9	D	0	0	8												Included above
10	0	D	0	1	0												Included above
10	1	D	0	1	8												Included above
10	2	D	0	3	5												Included above
10	3	D	0	3	9												Included above
10	4	D	0	0	4	100	P	S	0	1							HWSU
10	5	D	0	0	6												Included above
10	6	D	0	0	8												Included above
10	7	D	0	0	9												Included above
10	8	D	0	1	1												Included above
10	9	D	0	1	8												Included above

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9. Description of Hazardous Wastes ***(Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)***

Line Number		A. EP A Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES (1) PROCESS CODES (Enter Code)									D. PROCESSES (2) PROCESS DESCRIPTION (If entered in 9.D.1)
11	0	D	0	1	9												Included above
11	1	D	0	2	7												Included above
11	2	D	0	2	8												Included above
11	3	D	0	2	9												Included above
11	4	D	0	3	0												Included above
11	5	D	0	3	2												Included above
11	6	D	0	3	3												Included above
11	7	D	0	3	4												Included above
11	8	D	0	3	6												Included above
11	9	D	0	3	7												Included above
12	0	D	0	3	8												Included above
12	1	D	0	3	9												Included above
12	2	D	0	4	0												Included above
12	3	D	0	4	2												Included above
12	4	D	0	4	3												Included above
12	5	F	0	0	5												Included above
12	6	F	0	0	2	1,000	P	S	0	1							HWSU
12	7	F	0	0	3												Included above
12	8	F	0	0	4												Included above
12	9	F	0	0	5												Included above
13	0	D	0	0	1												Included above
13	1	D	0	0	6												Included above
13	2	D	0	0	7												Included above
13	3	D	0	0	8												Included above
13	4	D	0	0	9												Included above
13	5	D	0	1	8												Included above
13	6	D	0	1	9												Included above
13	7	D	0	2	1												Included above
13	8	D	0	2	2												Included above
13	9	D	0	2	3												Included above
14	0	D	0	2	4												Included above
14	1	D	0	2	5												Included above
14	2	D	0	2	7												Included above
14	3	D	0	2	8												Included above
14	4	D	0	2	9												Included above
14	5	D	0	3	0												Included above

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9. Description of Hazardous Wastes ***(Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)***

Line Number		A. EP A Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)									(2) PROCESS DESCRIPTION (If entered in 9.D.1)
14	6	D	0	3	9												Included above
14	7	D	0	0	1	10,000	P	S	0	1							HWSU
14	8	D	0	0	2												Included above
14	9	D	0	0	3												Included above
15	0	D	0	0	5												Included above
15	1	D	0	0	6												Included above
15	2	D	0	0	7												Included above
15	3	D	0	0	8												Included above
15	4	D	0	0	9												Included above
15	5	D	0	1	0												Included above
15	6	D	0	1	1												Included above
15	7	D	0	1	8												Included above
15	8	D	0	1	9												Included above
15	9	D	0	2	2												Included above
16	0	D	0	2	7												Included above
16	1	D	0	2	8												Included above
16	2	D	0	2	9												Included above
16	3	D	0	3	0												Included above
16	4	D	0	3	3												Included above
16	5	D	0	3	4												Included above
16	6	D	0	3	5												Included above
16	7	D	0	3	6												Included above
16	8	D	0	3	7												Included above
16	9	D	0	3	8												Included above
17	0	D	0	3	9												Included above
17	1	D	0	4	0												Included above
17	2	D	0	4	2												Included above
17	3	D	0	4	3												Included above
17	4	U	0	0	2												Included above
17	5	U	2	3	9												Included above
17	6	D	0	0	1	500	P	S	0	1							HWSU
17	7	D	0	0	3												Included above
17	8	U	1	3	5												Included above
17	9	D	0	0	1	1,000	P	S	0	1							HWSU
18	0	D	0	0	4												Included above

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9. Description of Hazardous Wastes ***(Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)***

Line Number		A. EP A Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)									(2) PROCESS DESCRIPTION (If entered in 9.D.1)
18	1	D	0	0	6												Included above
18	2	D	0	0	7												Included above
18	3	D	0	0	8												Included above
18	4	D	0	1	0												Included above
18	5	D	0	1	1												Included above
18	6	D	0	1	2												Included above
18	7	D	0	1	3												Included above
18	8	D	0	1	4												Included above
18	9	D	0	1	5												Included above
19	0	D	0	1	6												Included above
19	1	D	0	1	7												Included above
19	2	D	0	1	8												Included above
19	3	D	0	1	9												Included above
19	4	D	0	2	0												Included above
19	5	D	0	2	1												Included above
19	6	D	0	2	2												Included above
19	7	D	0	2	3												Included above
19	8	D	0	2	4												Included above
19	9	D	0	2	5												Included above
20	0	D	0	2	6												Included above
20	1	D	0	2	7												Included above
20	2	D	0	2	8												Included above
20	3	D	0	2	9												Included above
20	4	D	0	3	0												Included above
20	5	D	0	3	1												Included above
20	6	D	0	3	2												Included above
20	7	D	0	3	3												Included above
20	8	D	0	3	4												Included above
20	9	D	0	3	5												Included above
21	0	D	0	3	6												Included above
21	1	D	0	3	7												Included above
21	2	D	0	3	8												Included above
21	3	D	0	3	9												Included above
21	4	D	0	4	0												Included above
21	5	D	0	4	1												Included above
21	6	D	0	4	2												Included above

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9. Description of Hazardous Wastes ***(Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)***

Line Number		A. EP A Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)									(2) PROCESS DESCRIPTION (If entered in 9.D.1)
21	7	D	0	4	3												Included above
21	8	D	0	0	2	2,000	P	S	0	1							HWSU
21	9	D	0	0	3												Included above
22	0	D	0	0	1	30	P	S	0	1							HWSU
22	1	D	0	0	3												Included above
22	2	D	0	0	1	28,000	P	S	0	1							HWSU
22	3	D	0	0	2												Included above
22	4	D	0	0	3												Included above
22	5	D	0	0	4												Included above
22	6	D	0	0	5												Included above
22	7	D	0	0	6												Included above
22	8	D	0	0	7												Included above
22	9	D	0	0	8												Included above
23	0	D	0	0	9												Included above
23	1	D	0	1	0												Included above
23	2	D	0	1	1												Included above
23	3	D	0	1	2												Included above
23	4	D	0	1	3												Included above
23	5	D	0	1	4												Included above
23	6	D	0	1	5												Included above
23	7	D	0	1	6												Included above
23	8	D	0	1	7												Included above
23	9	D	0	1	8												Included above
24	0	D	0	1	9												Included above
24	1	D	0	2	0												Included above
24	2	D	0	2	1												Included above
24	3	D	0	2	2												Included above
24	4	D	0	2	3												Included above
24	5	D	0	2	4												Included above
24	6	D	0	2	5												Included above
24	7	D	0	2	6												Included above
24	8	D	0	2	7												Included above
24	9	D	0	2	8												Included above
25	0	D	0	2	9												Included above
25	1	D	0	3	0												Included above
25	2	D	0	3	1												Included above

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9. Description of Hazardous Wastes ***(Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)***

Line Number		A. EP A Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES (1) PROCESS CODES (Enter Code)									(2) PROCESS DESCRIPTION (If entered in 9.D.1)
25	3	D	0	3	2												Included above
25	4	D	0	3	3												Included above
25	5	D	0	3	4												Included above
25	6	D	0	3	5												Included above
25	7	D	0	3	6												Included above
25	8	D	0	3	7												Included above
25	9	D	0	3	8												Included above
26	0	D	0	3	9												Included above
26	1	D	0	4	0												Included above
26	2	D	0	4	1												Included above
26	3	D	0	4	2												Included above
26	4	D	0	4	3												Included above
26	5	F	0	0	1												Included above
26	6	F	0	0	2												Included above
26	7	F	0	0	3												Included above
26	8	F	0	0	4												Included above
26	9	F	0	0	5												Included above
27	0	F	0	0	6												Included above
27	1	F	0	0	7												Included above
27	2	F	0	0	9												Included above
27	3	F	0	2	7												Included above
27	4	P	0	1	2												Included above
27	5	P	0	1	5												Included above
27	6	P	0	2	2												Included above
27	7	P	0	3	0												Included above
27	8	P	0	4	2												Included above
27	9	P	0	8	1												Included above
28	0	P	0	9	2												Included above
28	1	P	0	9	5												Included above
28	2	P	0	9	8												Included above
28	3	P	1	0	4												Included above
28	4	P	1	0	5												Included above
28	5	P	1	0	6												Included above
28	6	P	1	1	9												Included above
28	7	P	1	2	0												Included above
28	8	U	0	0	2												Included above

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9. Description of Hazardous Wastes ***(Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)***

Line Number		A. EP A Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)									(2) PROCESS DESCRIPTION (If entered in 9.D.1)
28	9	U	0	0	3												Included above
29	0	U	0	0	4												Included above
29	1	U	0	0	7												Included above
29	2	U	0	1	2												Included above
29	3	U	0	1	9												Included above
29	4	U	0	2	2												Included above
29	5	U	0	3	1												Included above
29	6	U	0	3	7												Included above
29	7	U	0	4	4												Included above
29	8	U	0	4	8												Included above
29	9	U	0	5	2												Included above
30	0	U	0	5	6												Included above
30	1	U	0	5	7												Included above
30	2	U	0	7	0												Included above
30	3	U	0	7	2												Included above
30	4	U	0	7	5												Included above
30	5	U	0	7	7												Included above
30	6	U	0	8	0												Included above
30	7	U	0	8	1												Included above
30	8	U	0	8	2												Included above
30	9	U	0	8	6												Included above
31	0	U	1	0	3												Included above
31	1	U	1	0	8												Included above
31	2	U	1	1	2												Included above
31	3	U	1	1	7												Included above
31	4	U	1	2	0												Included above
31	5	U	1	2	1												Included above
31	6	U	1	2	2												Included above
31	7	U	1	2	3												Included above
31	8	U	1	2	6												Included above
31	9	U	1	2	9												Included above
32	0	U	1	3	4												Included above
32	1	U	1	3	5												Included above
32	2	U	1	4	0												Included above
32	3	U	1	5	1												Included above
32	4	U	1	5	4												Included above

EPA ID Number **N V 3 8 9 0 0 9 0 0 0 1**	OMB#: 2050-0034; Expir es 7/31/2012

9. Description of Hazardous Wastes ***(Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)***

Line Number		A. EP A Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)									(2) PROCESS DESCRIPTION (If entered in 9.D.1)
32	5	U	1	5	9												Included above
32	6	U	1	6	0												Included above
32	7	U	1	6	1												Included above
32	8	U	1	6	5												Included above
32	9	U	1	7	1												Included above
33	0	U	1	8	8												Included above
33	1	U	1	9	6												Included above
33	2	U	1	9	7												Included above
33	3	U	2	0	1												Included above
33	4	U	2	0	8												Included above
33	5	U	2	0	9												Included above
33	6	U	2	1	0												Included above
33	7	U	2	1	1												Included above
33	8	U	2	1	3												Included above
33	9	U	2	1	8												Included above
34	0	U	2	1	9												Included above
34	1	U	2	2	0												Included above
34	2	U	2	2	1												Included above
34	3	U	2	2	3												Included above
34	4	U	2	2	6												Included above
34	5	U	2	2	7												Included above
34	6	U	2	2	8												Included above
34	7	U	2	3	9												Included above
34	8	U	3	5	9												Included above

10. Map

Attach to this application a topographical 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 intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all spring, rivers, and other surface water bodies in this map area. See instructions for precise requirements.

11. Facility Drawing

All existing facilities must include a scale drawing of the facility (see instructions for more detail).

12. Photo graphs

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).

13. Co mments

None.

List of Existing Permits

Type	Numbe r Ty	pe, Area, Location
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	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	Non-Proliferation Test and Evaluation Complex Hazardous Materials Permit
R	NEVHW0021	NTS Hazardous Waste Management Permit (RCRA)
E	AP9711-2557	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-40 98-12NC	Area 25
E	NY-40 99-12NC	Area 12
E	NY-0835-12NP	NTS (Water Hauler) #84846
E	NY-0836-12NP	NTS (Water Hauler) #84847
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 10: Maps

Map A: Existing TSDFs

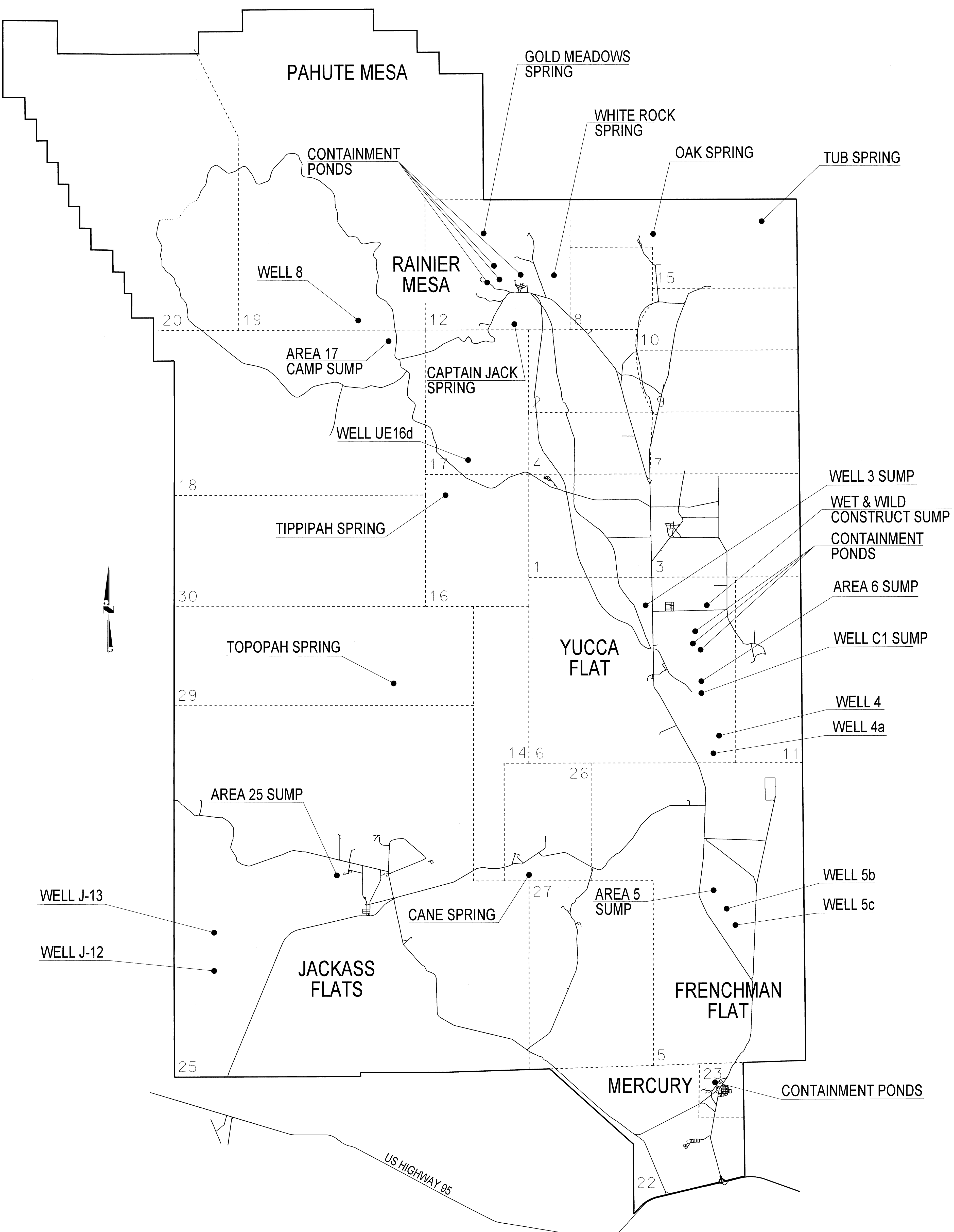
Not available for public viewing

Map B: Past, Present, and Future TSDFs

Not available for public viewing

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

EPA ID NUMBER: NV3 890 009 001



Reviewed and determined to be UNCLASSIFIED.
This review does not constitute clearance for public release.
Derivative Classifier: JC Anderson/ENIG
(Name/Organization)
Date: 5/10/10

SECTION 10. MAP - C: NTS WELLS, SPRINGS, & SURFACE WATER BODIES

SCALE : NONE

5/6/2010 4:09:42 PM grossre
G:\Projects\10\10027\DELIVERABLES\Drawings\Section 10 Map Ceodu.dgn

Map D: Topographical Features and Infrastructure of NTS

Not available for public viewing

Section 11: Map A Facility Drawings HWSU

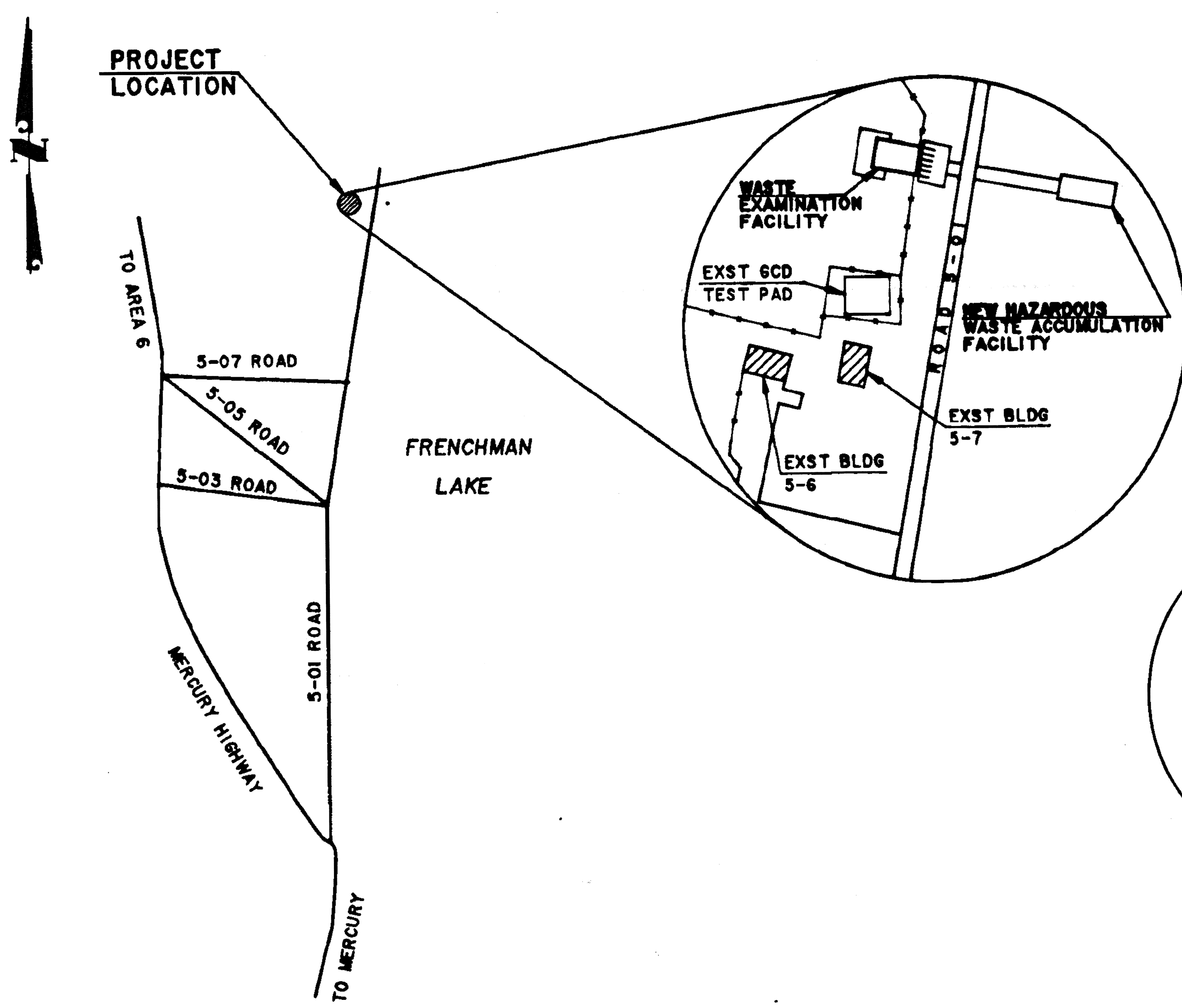
UNITED STATES DEPARTMENT OF ENERGY

NEVADA OPERATIONS OFFICE

LAS VEGAS, NEVADA

HAZARDOUS WASTE ACCUMULATION FACILITY

AREA 5



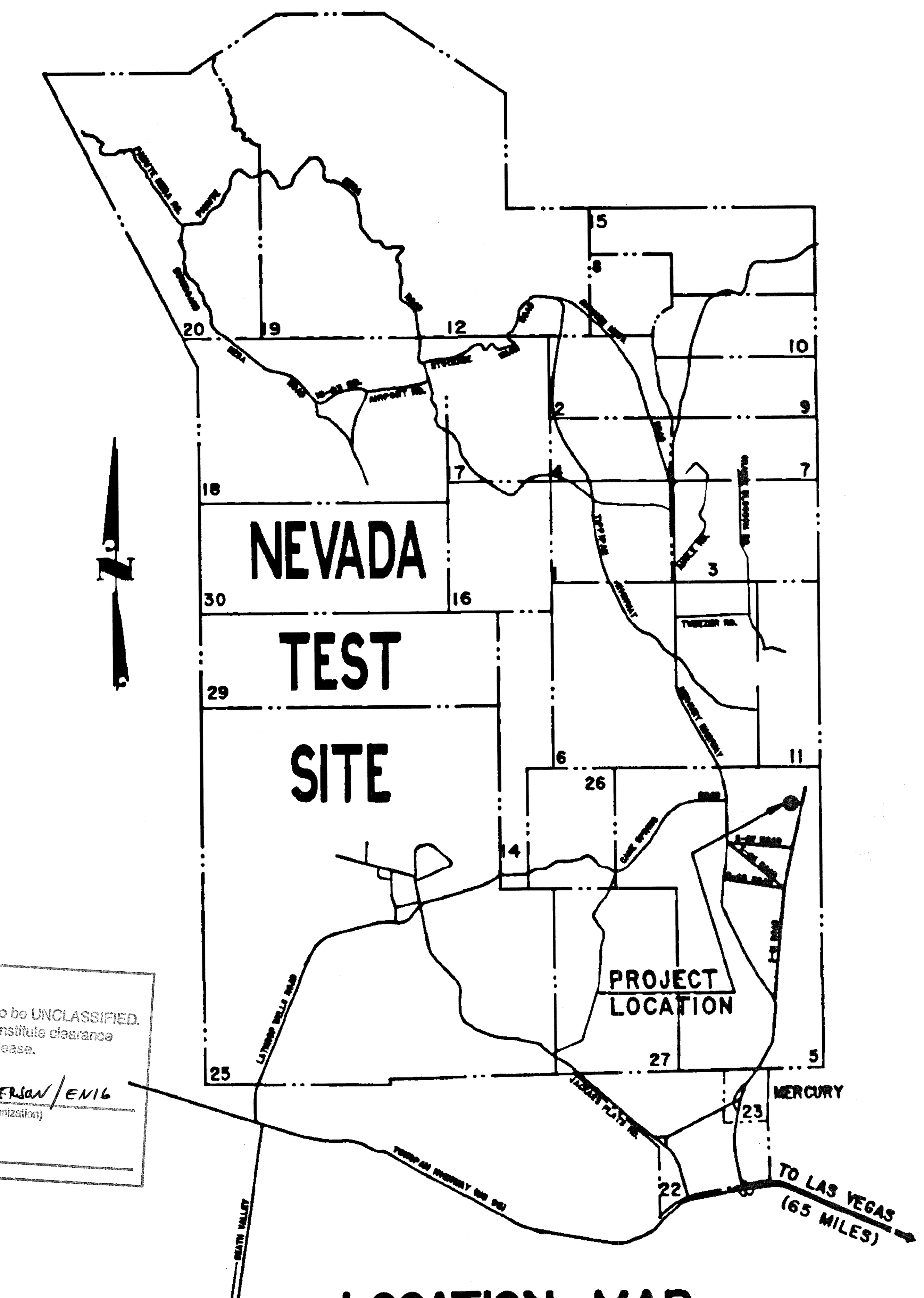
VICINITY MAP

NOT TO SCALE

DRAWING INDEX

DRAWING NUMBER	REV No	DRAWING TITLE
JS-005-020-T1	REV 3	TITLE SHEET
CIVIL		
JS-005-020-C1	REV 1	SITE & GRADING PLAN
JS-005-020-C2	REV 1	DETAILS
STRUCTURAL		
JS-005-020-S1	REV 2	PLAN ELEVATION & SECTIONS
JS-005-020-S2	REV 2	FOUNDATION PLAN & DETAILS
ARCHITECTURAL		
NO DRAWINGS		
MECHANICAL		
NO DRAWINGS		
ELECTRICAL		
JS-005-020-E1	REV 2	SITE PLAN, FIRE DET & MISC ELEC
JS-005-020-E2	REV 2	PLAN, SECTIONS & DETAILS
TELEPHONE & ALARM SYSTEMS		
JS-005-020-W1	REV 1	TELEPHONE PLANS

Reviewed and determined to be UNCLASSIFIED. This review does not constitute clearance for public release.
Derivative Classifier: JC Anderson / EM16 (Name / Organization)
Date: 12/16/09



LOCATION MAP

NOT TO SCALE

NO.	DATE	REVISIONS	DESIGN / DRAWN	CHECK / ENVIR	SAFETY	PE/ENG / USER	DOE
3 (2)		ELECTRICAL DRAWINGS CURRENT STATUS DTD 2/9/99	RM				

Bechtel Nevada

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

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NO.	DATE	REVISIONS	BY / CK	SAF / QA	PE / ENV	USR / AE	DOE
2		AS BUILT - CURRENT STATUS DTD 9/18/90	TS				
1 (3)	1-10-90	REVISED PER SUBMITTAL #78063-4A DATED 12/31/89					

ORIGINAL MYLAR SIGNED BY:

NO.	DATE	REVISIONS	BY / CK	SAF / QA	PE / ENV	USR / AE	DOE

U.S. DEPARTMENT OF ENERGY

NEVADA OPERATIONS OFFICE — LAS VEGAS, NEVADA

DESIGNED: PAO	DRAWN: TEB
CHECKED: RBH	ENVIR: 6/26/89 PW
SAFETY: CD	QA: 6/13/89 GTL
PROJECT ENGINEER: 6/14/89 R FRAZIER	

NEVADA TEST SITE —— AREA 5

HAZARDOUS WASTE ACCUMULATION FACILITY

TITLE SHEET

SUBMITTED: R S ZIEGENBEIN, HOLMES & NARVER, INC.

USER:

APPROVAL BLOCK

DEPT. OF ENERGY APPROVAL: DAVID WENZLAFF — DATE: 6/26/89

PROJECT ENGINEER

HOLMES & NARVER, INC.
ARCHITECTS - ENGINEERS
ENERGY SUPPORT DIVISION
1050 E. FLAMINGO ROAD LAS VEGAS, NEVADA 89109

I.D. NO. 78062

PROJ. NO. 8809.A05

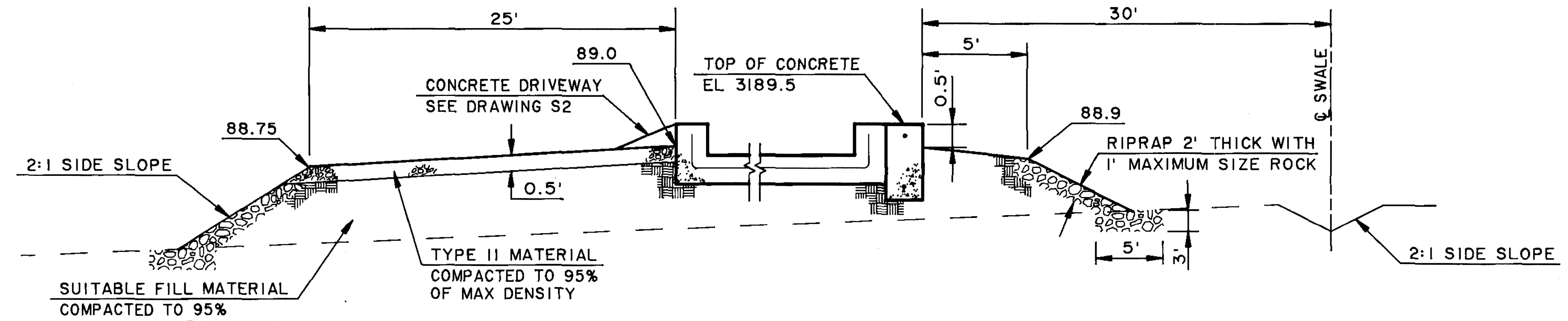
DRAWING NUMBER: JS-005-020-T1.3

SHEET ____ OF ____

Prepared By

HOLMES & NARVER, INC.

ENERGY SUPPORT DIVISION



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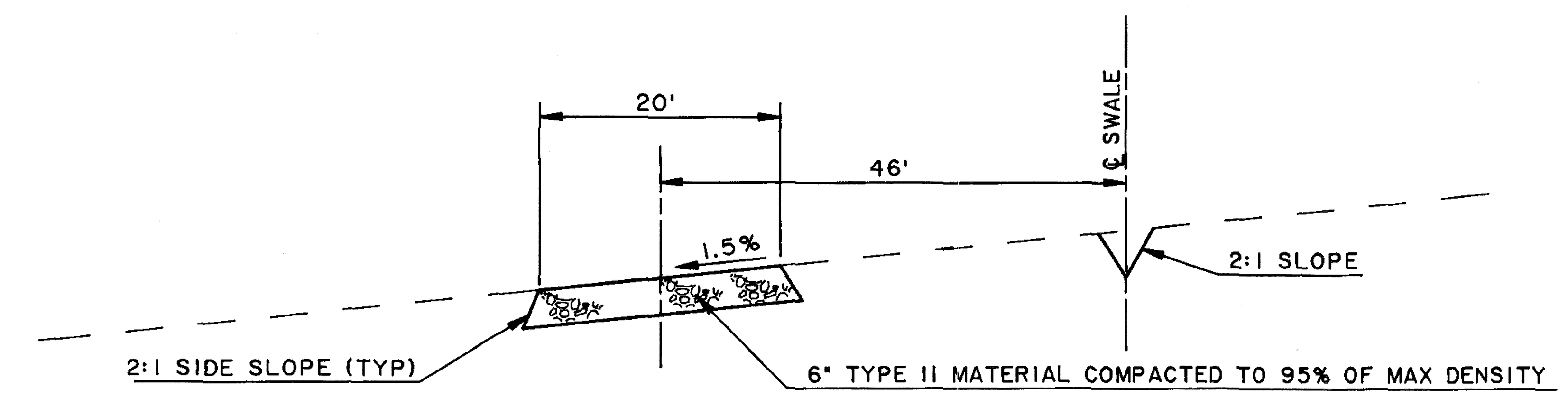
NOT TO SCALE



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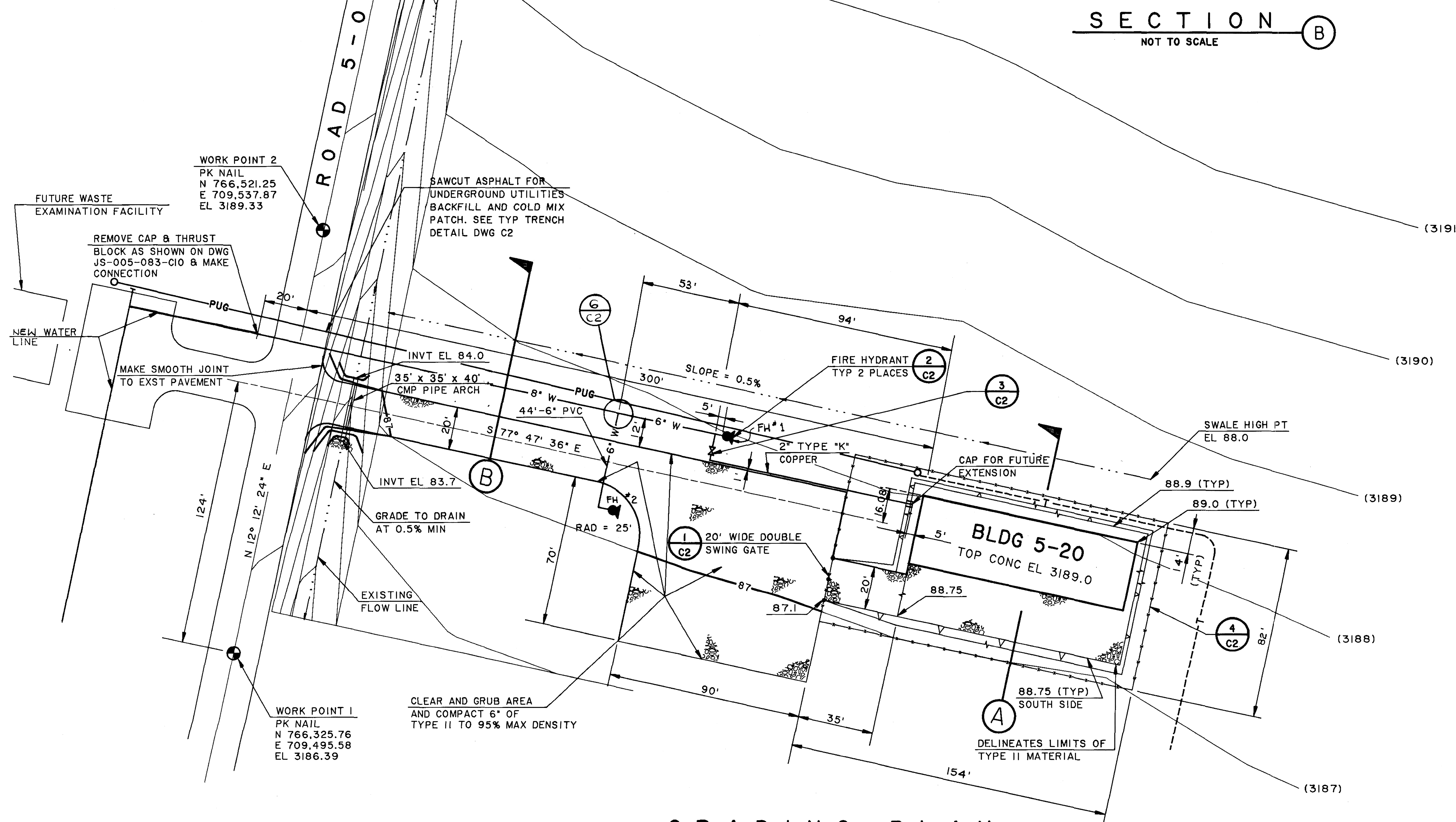

GRADING PLAN
SCALE 1"=30'

GRADING NOTES

1. ALL MATERIALS AND CONSTRUCTION METHODS SHALL BE IN ACCORDANCE WITH THE USDOE/NV STANDARD CONSTRUCTION SPECIFICATIONS, LATEST EDITION.
2. ALL FINISH GRADE ELEVATIONS SHOWN ARE FINAL GRADES. SUBGRADE ELEVATIONS MUST BE ESTABLISHED WHERE REQUIRED PRIOR TO FINAL GRADING.
3. IN AREAS UNDER CONCRETE SLABS AND BUILDING FOUNDATIONS. ALL SUBGRADE SHALL BE COMPACTED IN 6" LIFTS TO NOT LESS THAN 95% OF MAXIMUM DENSITY DETERMINED BY ASTM D1557.
4. IN AREAS OF EXCAVATION, AND AREAS REQUIRING FILL, SCARIFY THE TOP 6 INCHES (MIN) OF EXISTING GROUND AND COMPACT TO NOT LESS THAN 95% OF MAXIMUM DENSITY DETERMINED BY ASTM D1557. IN NO CASE SHALL ANY FILL MATERIAL BE PLACED ON FROZEN, MUDDY, OR UNSTABLE EXISTING GROUND.
5. ALL FILL FOR ROADS INCLUDING NATIVE MATERIAL AND AGGREGATE BASE COURSE, SHALL BE COMPACTED TO NOT LESS THAN 95% OF MAXIMUM DENSITY DETERMINED BY ASTM D1557.

LEGEND

——89——	FINISH CONTOURS
——(3189)——	EXISTING CONTOURS
	FLOW LINE
	GRADE BREAK
	2:1 SIDE SLOPES-FANGS POINT DOWNHILL. DELINEATES LIMITS OF RIPRAP
—— PUG ——	NEW UNDER GROUND POWER
- - - T - - -	NEW BURIED TELEPHONE
—— 8" W ——	NEW WATER LINE, SIZE AS SHOWN, PVC PER AWWA C900 FITTINGS TO BE DUCTILE IRON MECHANICAL JOINT
	8' HIGH CHAIN LINK FENCE

FOR REFERENCE DRAWINGS SEE DRAWING T1

Reviewed and determined to be UNCLASSIFIED.
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Derivative Classifier: JC ANDERSON / EN16
(Name / Organization)
Date: 12/16/09

NO.	DATE	REVISIONS
△		AS BUILT - CURRENT STATUS DTD 9/18/90

U.S. DEPARTMENT OF ENERGY
NEVADA OPERATIONS OFFICE — LAS VEGAS, NEVADA

DESIGNED: RAM — DRAWN: TEB — CHECKED: H — ENVIR: — SAFETY: — QA: — PROJECT ENGINEER: — SUBMITTED:

NEVADA TEST SITE — AREA 5

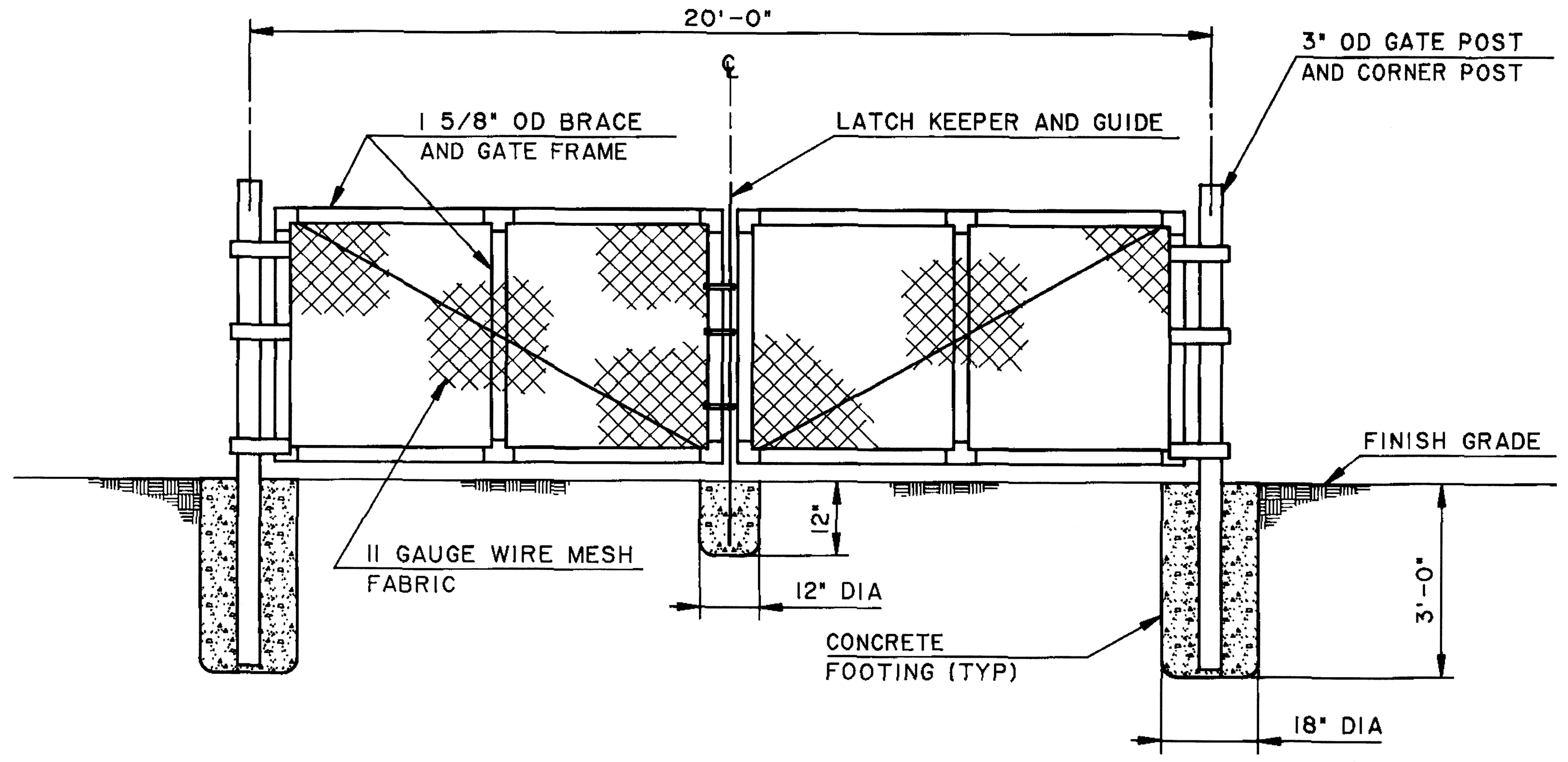
HAZARDOUS WASTE ACCUMULATION FACILITY
SITE & GRADING PLAN

HOLMES & NARVER, INC.
ARCHITECTS - ENGINEERS
ENERGY SUPPORT DIVISION
1050 E. FLAMINGO ROAD LAS VEGAS, NEVADA 89109

I.D. NO. 78062
PROJ. NO. 8809.A05

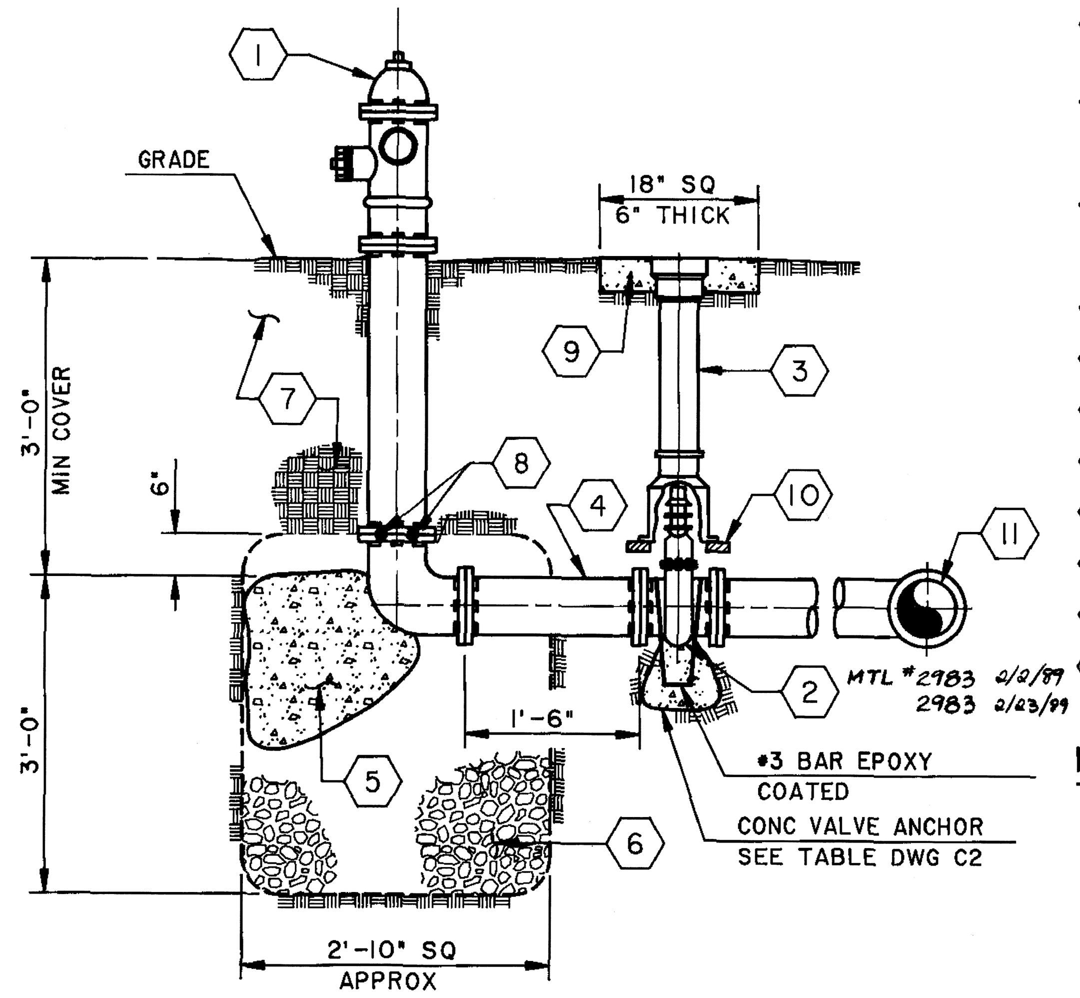
APPROVAL BLOCK
DEPT. OF ENERGY APPROVAL — DATE: 6/6/89
PROJECT ENGINEER
DRAWING NUMBER
JS-005-020-C1.1
SHEET ___ OF ___

M



SWING GATE DETAIL 1/C1

NOT TO SCALE



DETAIL 2/C1

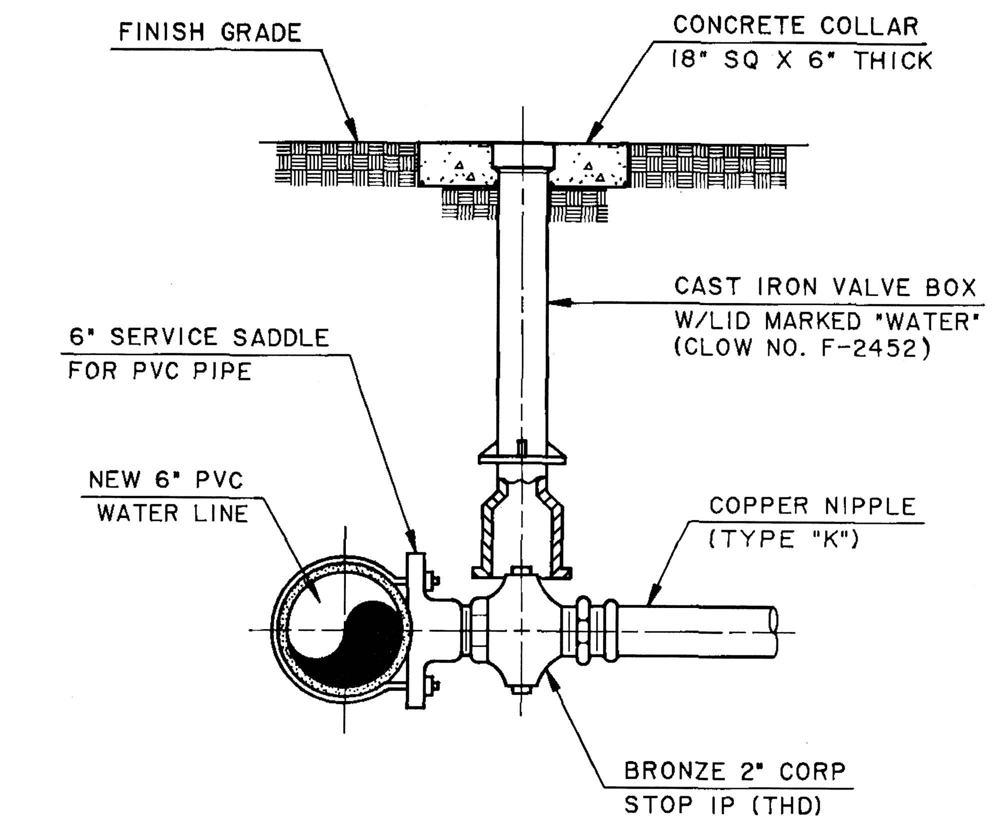
NOT TO SCALE

PARTS LIST

1. FIRE HYDRANT MUELLER NO. A421 (GFM)
2. VALVE, 6" UL LISTED/FM APPROVED MUELLER NO 1-2052-16 W/2" SQ WRENCH NUT
3. CI VALVE BOX W/LID MARKED "WATER" TYLER NO. 6855
4. SPOOL (6" DI, FLANGE BOTH ENDS).
5. THRUST BLOCK (BEARING AREA = 2.0 SQ FT).
6. COARSE ROCK (APPROX 2 1/2" DIA).
7. COMPACTED FILL DIRT.
8. DRAIN HOLES (KEPT CLEAN).
9. CONCRETE COLLAR.
10. BRICK SUPPORT (2 REQUIRED).
11. TEE, (8"X8"X6" MJDI) (TYP FOR FH# 2)

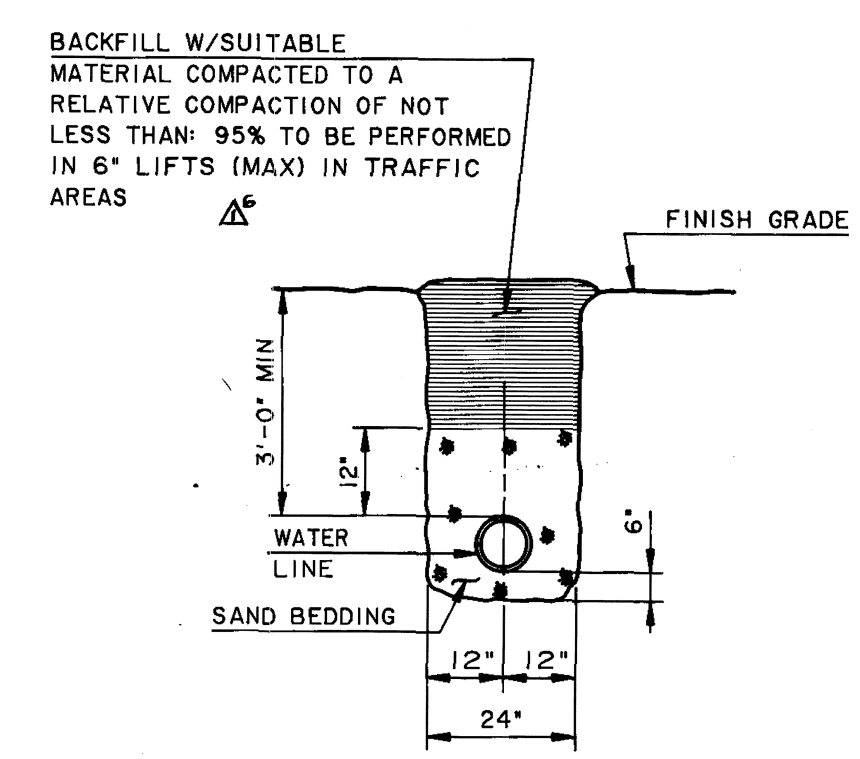
NOTES

1. ALL VALVES MUST OPEN COUNTERCLOCKWISE.
2. THE 4 1/2" PUMPER NOZZLE CONNECTION ON FIRE HYDRANT SHALL FACE THE ROAD.
3. PAINT FIRE HYDRANT W/ TWO (2) COATS OF "FEDERAL SAFETY YELLOW" (CHROME SAFETY YELLOW NO. 944)
4. 4 GUARD POSTS REQUIRED. SPACING 4' SQUARE. SEE DETAIL 5



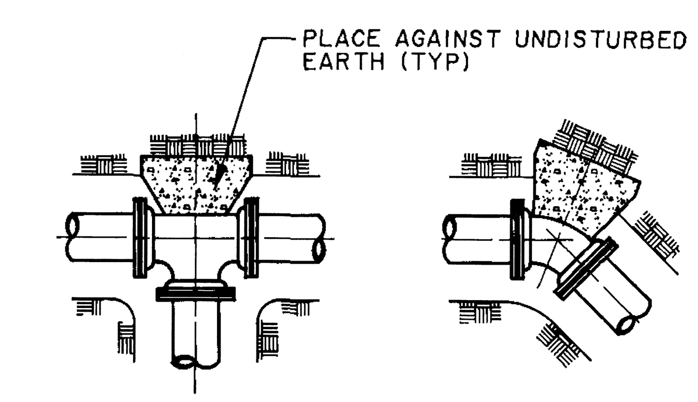
DETAIL 3/C1

NOT TO SCALE



TYPICAL TRENCH DETAIL

NOT TO SCALE



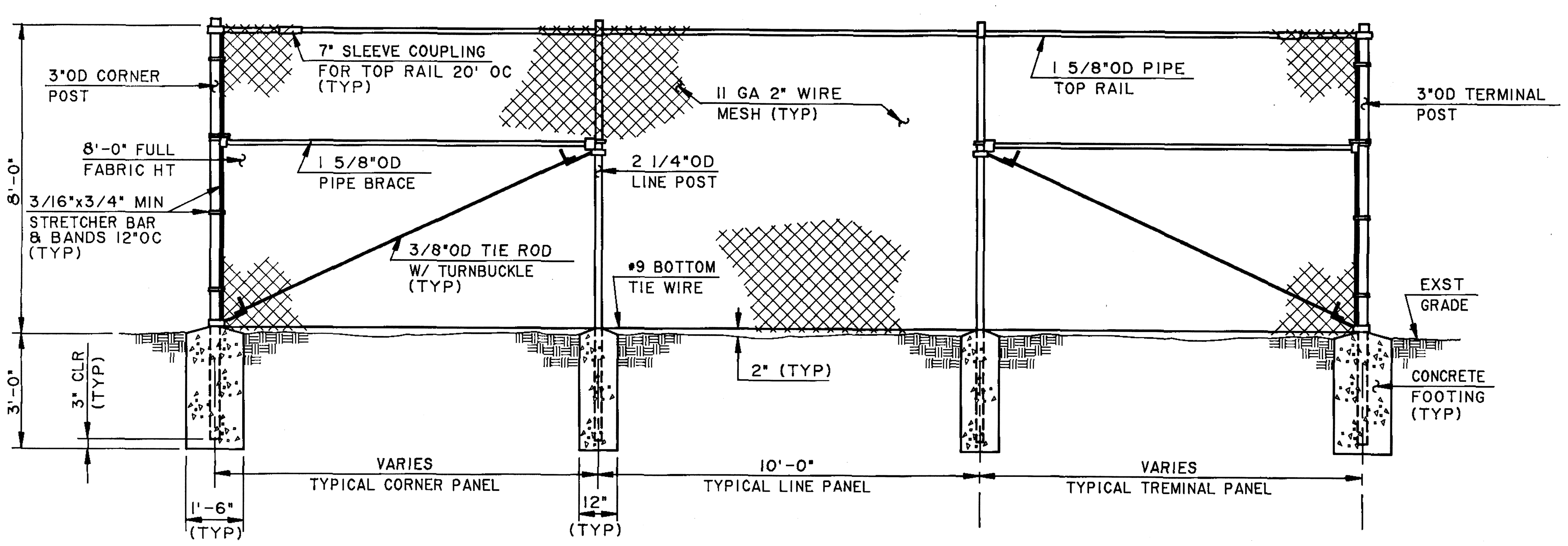
TEE OR END **BEND**

FITTING SIZE	REQD BEARING AREA IN SQUARE FEET			
	TEE, END	90°	22.5°	45°
4"	1.5	2.0	1.0	1.0
6"	2.0	2.5	1.0	1.5
8"	3.0	3.5	2.0	2.5
10"	3.5	4.0	3.0	3.5

AREAS DERIVED FROM A TEST PRESSURE OF 200 PSI, A WORKING PRESSURE OF 100 PSI AND A SOIL RESISTANCE OF 4000 PSF (NFPA STD 24)

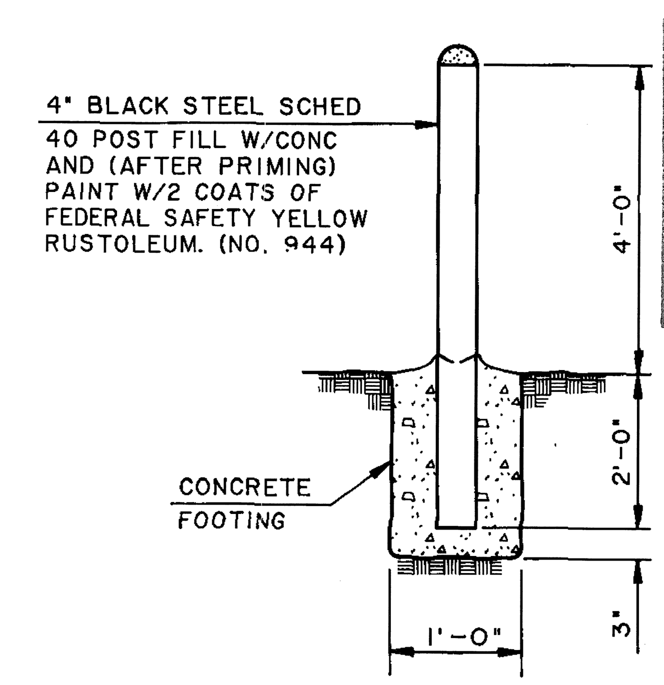
THRUST BLOCK DETAIL

NOT TO SCALE



TYPICAL FENCE DETAIL 4/C1

NOT TO SCALE



DETAIL 5

NOT TO SCALE

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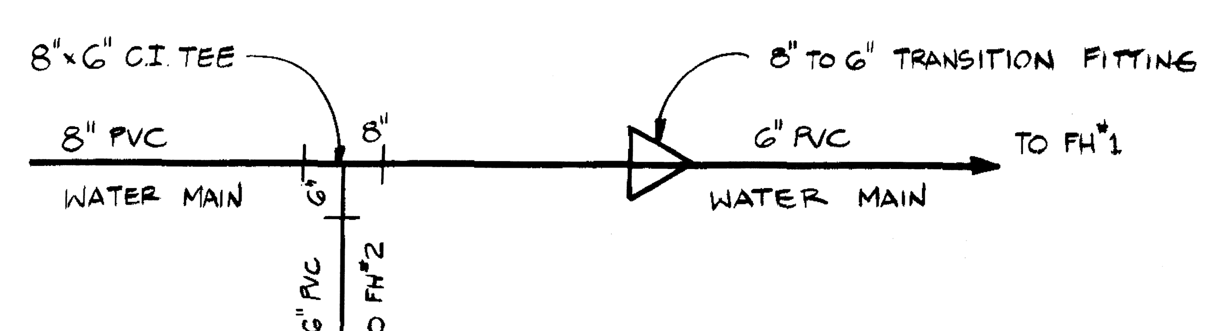
Derivative Classifier: JC ANDERSON / EN16 (Name / Organization)

Date: 12/16/09



DETAIL 6/C1

NOT TO SCALE

FOR REFERENCE DRAWINGS SEE DRAWING T1

NO.	DATE	REVISIONS	BY	CK	SAF	QA	PE	ENV	USR	AE	DOE
1		AS BUILT - CURRENT STATUS DTD 9/18/90									

U.S. DEPARTMENT OF ENERGY

NEVADA OPERATIONS OFFICE — LAS VEGAS, NEVADA

DESIGNED: JH — DRAWN: TEB — CHECKED: JAS — ENVIR: 2/24/89 — SAFETY: — QA: 2/23/89 — PROJECT ENGINEER: — SUBMITTED: — USER:

NEVADA TEST SITE — AREA 5

HAZARDOUS WASTE ACCUMULATION FACILITY DETAILS

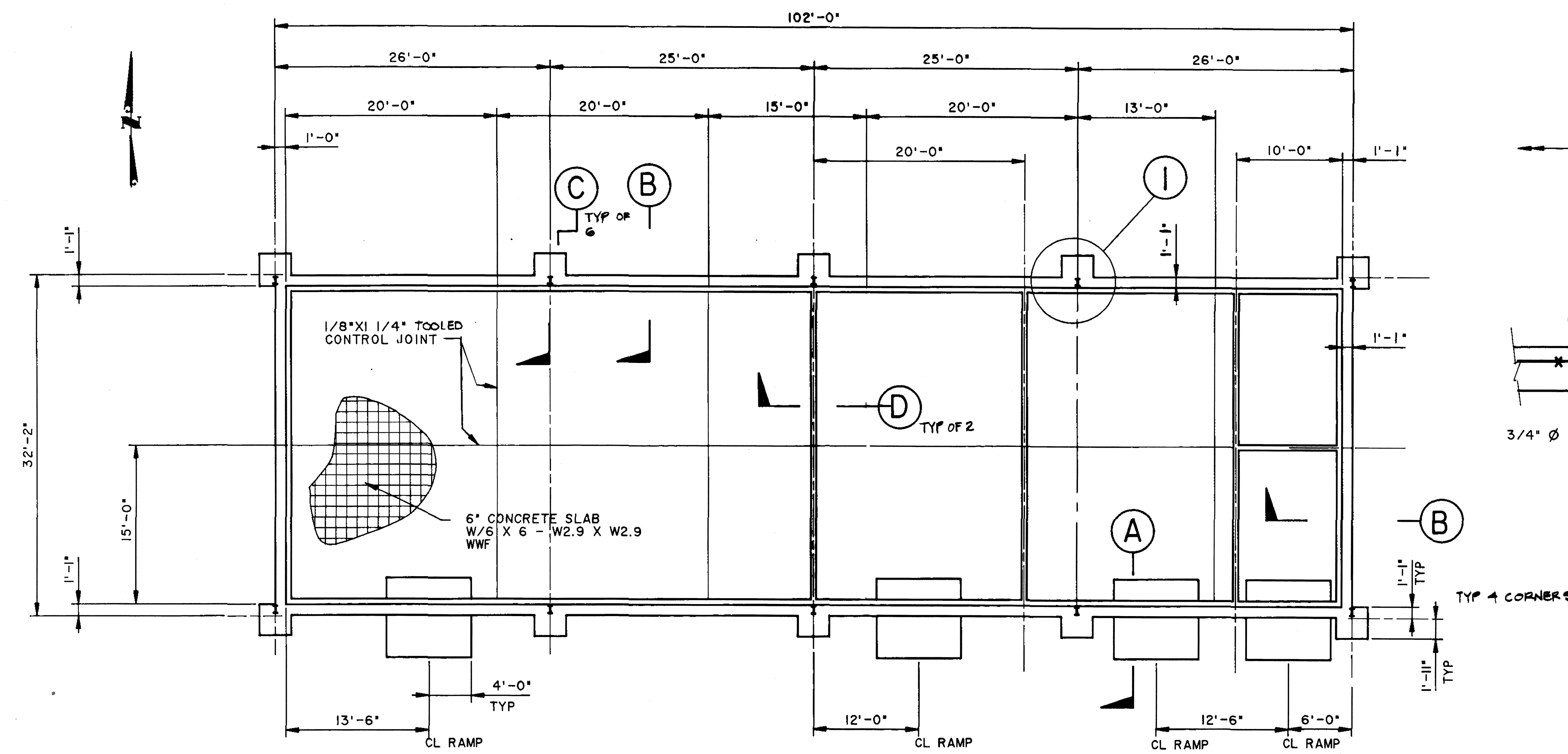
HOLMES & NARVER, INC.
ARCHITECTS - ENGINEERS
ENERGY SUPPORT DIVISION
1050 E. FLAMINGO ROAD LAS VEGAS, NEVADA 89109

I.D. NO. 78062 — PROJ. NO. 8809.A05

APPROVAL BLOCK — DEPT. OF ENERGY APPROVAL — DATE: 6/26/89 — PROJECT ENGINEER

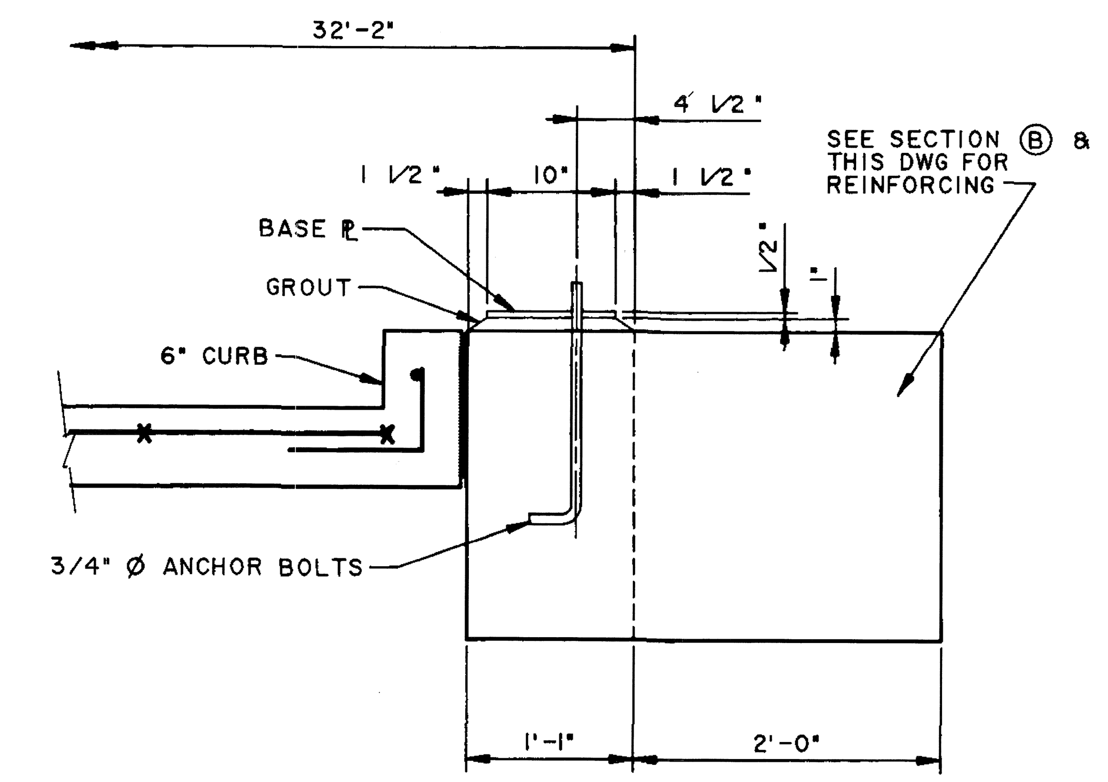
DRAWING NUMBER: JS-005-020-C2.1

SHEET ___ OF ___



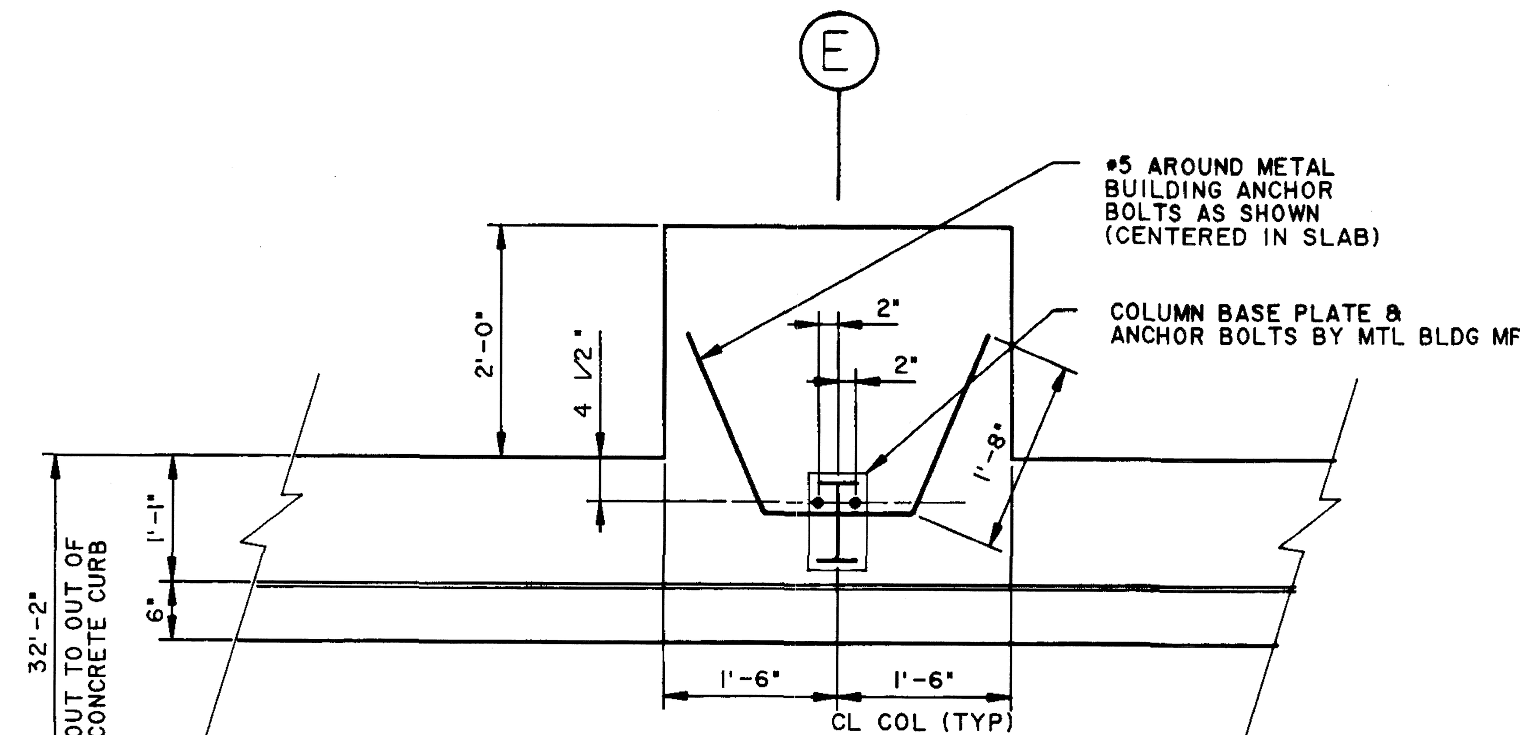
FOUNDATION PLAN

SCALE: 1/8"=1'0"



SECTION (E)

SCALE: 1"=1'-0"



DETAIL (I)

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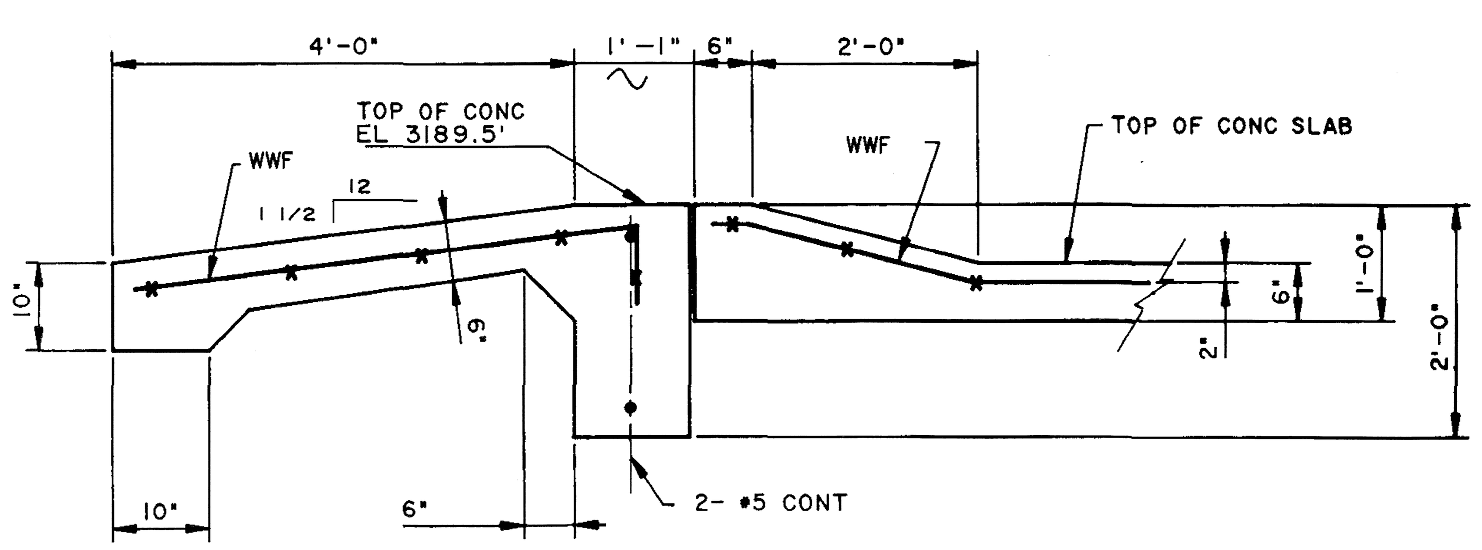

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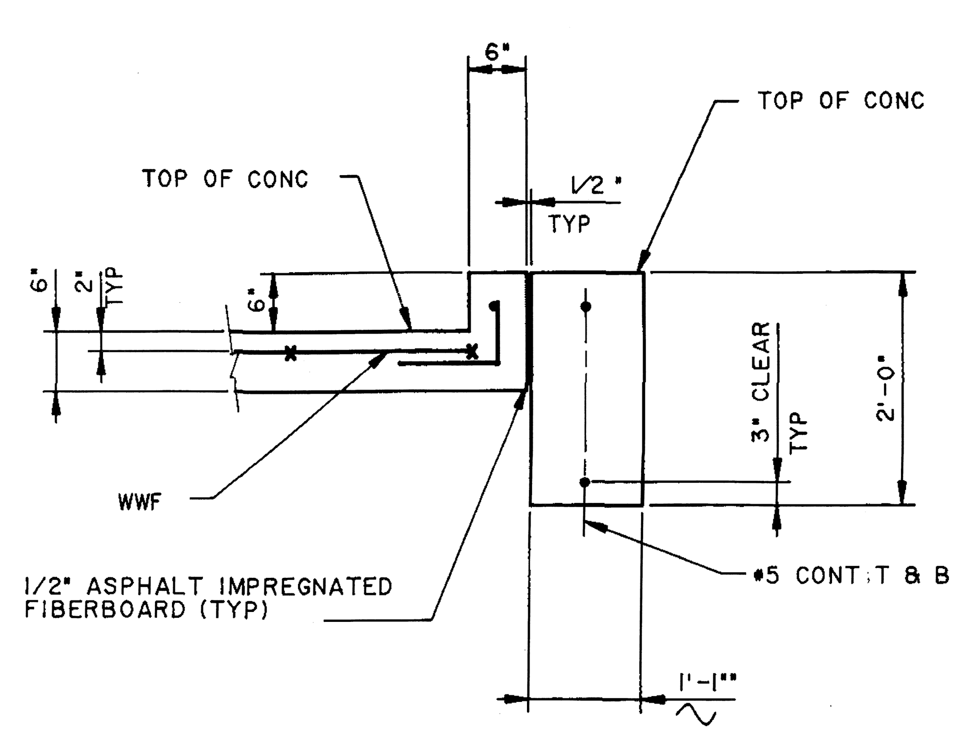

SECTION (B)

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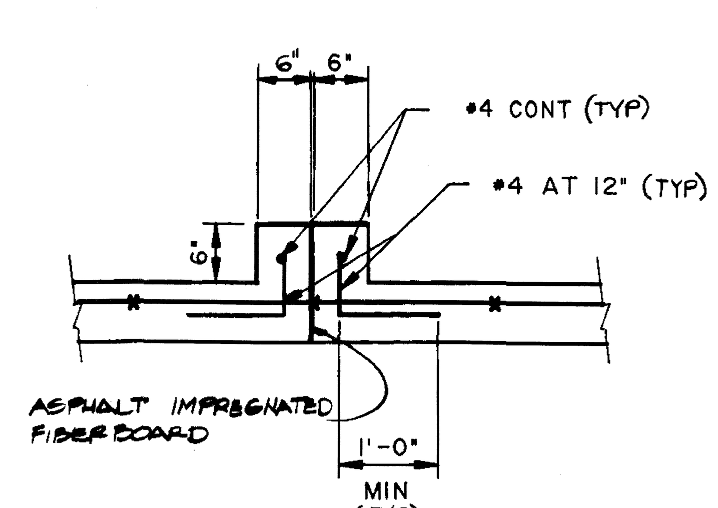

SECTION (D)

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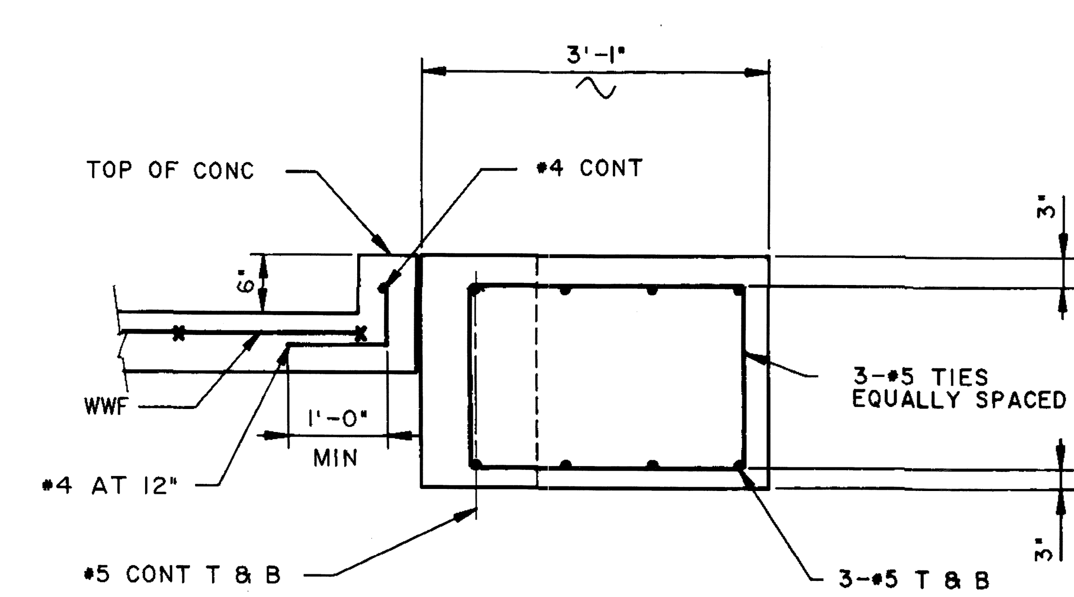

SECTION (C)

SCALE: 3/4"=1'-0"

TYP INSIDE 6 LOCATIONS

GENERAL NOTES

1. ALL MATERIALS AND CONSTRUCTION METHODS SHALL BE IN ACCORDANCE WITH THE USDOE/NV STD CONSTRUCTION SPECIFICATIONS, LATEST EDITION.
2. EXCAVATION SHALL BE CLEANED OF ALL LOOSE ROCK AND DEBRIS. SURFACES TO BE IN DIRECT CONTACT WITH FRESH CONCRETE SHALL BE THOROUGHLY MOISTENED BUT NOT MUDDY OR FROZEN AT THE TIME OF CONCRETE PLACEMENT. ALL OVER EXCAVATION SHALL BE EITHER FILLED WITH CONCRETE.
3. ALL CAST-IN-PLACE CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI AT 28 DAYS. ALL CONCRETE WORK AND REINFORCEMENT DETAILING SHALL BE IN ACCORDANCE WITH ACI BUILDING CODE, LATEST EDITION.
4. REINFORCING BAR SHALL BE ASTM A615, GRADE 60.
5. WELDED WIRE FABRIC (WWF) SHALL CONFORM TO ASTM A185.
6. ALL DIMENSIONS, FOOTINGS AND REINFORCING STEEL ARE APPROXIMATE AND FOR ESTIMATING PURPOSES ONLY. EXACT DIMENSIONS AND FINAL FOUNDATION DESIGN SHALL BE VERIFIED AND COMPLETED AFTER SUBMITTAL OF APPROVED METAL BUILDING SHOP DRAWINGS.
7. NO CONCRETE WORK SHALL BE PERFORMED PRIOR TO OBTAINING APPROVAL FROM THE DOE PROJECT ENGINEER.
8. ALL CONTROL JOINTS SHALL BE TOOLED. JOINTS SHALL BE FILLED LEVEL WITH ADJACENT CONCRETE SURFACE USING SIKAFLEX-1A, AS MANUFACTURED BY SIKA CORPORATION, USE DOUBLE APPLICATION.
9. REINFORCING SPLICES, IF NECESSARY, SHALL HAVE A MINIMUM LENGTH AS SHOWN BELOW:

   #4 BAR - 14" LAP
   #5 BAR - 16" LAP
   WWF - 8" LAP

10. ANCHOR BOLTS SHALL BE ASTM A36 AND SHALL BE FURNISHED WITH TWO NUTS EACH. ANCHOR BOLTS SHALL BE SET BY TEMPLATES.
11. CONCRETE SLAB SURFACE SHALL BE SEALED WITH SIKAGARD 62, AS MANUFACTURED BY SIKA CORPORATION, ADD SAND FOR NON-SKID FINISH SURFACE.

FOR REFERENCE DRAWINGS SEE DRAWING TI

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Derivative Classifier: JC Anderson/EN16 (Name/Organization)
Date: 12/16/09

NO.	DATE	REVISIONS
2		AS BUILT - CURRENT STATUS DTD 9/18/90
1	1-10-90	REVISED PER SUBMITTAL #78063-4A DATED 12/31/89

ORIGINAL MYLAR SIGNED BY:

U.S. DEPARTMENT OF ENERGY
NEVADA OPERATIONS OFFICE — LAS VEGAS, NEVADA

NEVADA TEST SITE — AREA 5

HAZARDOUS WASTE ACCUMULATION FACILITY
FOUNDATION PLAN & DETAILS

DESIGNED: AP	DRAWN: AP
CHECKED: RBH	ENVIR: 6/26/89 PW
SAFETY: CD	QA: 6/13/89 GTL
PROJECT ENGINEER: 6/14/89 R FRAZIER	
SUBMITTED: R S ZIEGENBEIN	USER:

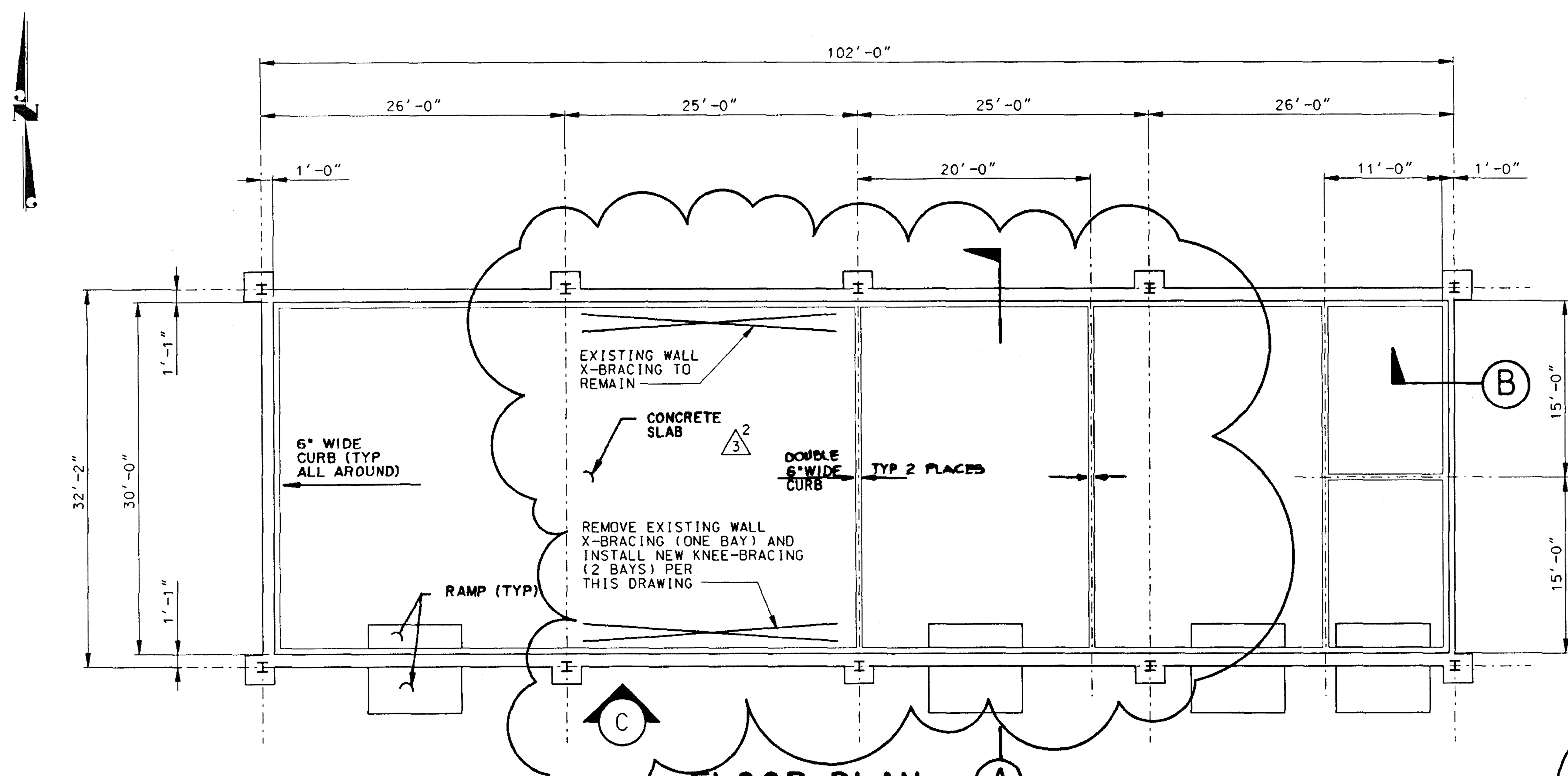
HOLMES & NARVER, INC.
ARCHITECTS - ENGINEERS
ENERGY SUPPORT DIVISION
1050 E. FLAMINGO ROAD LAS VEGAS, NEVADA 89109

I.D. NO. 78062
PROJ. NO. 8901.A05

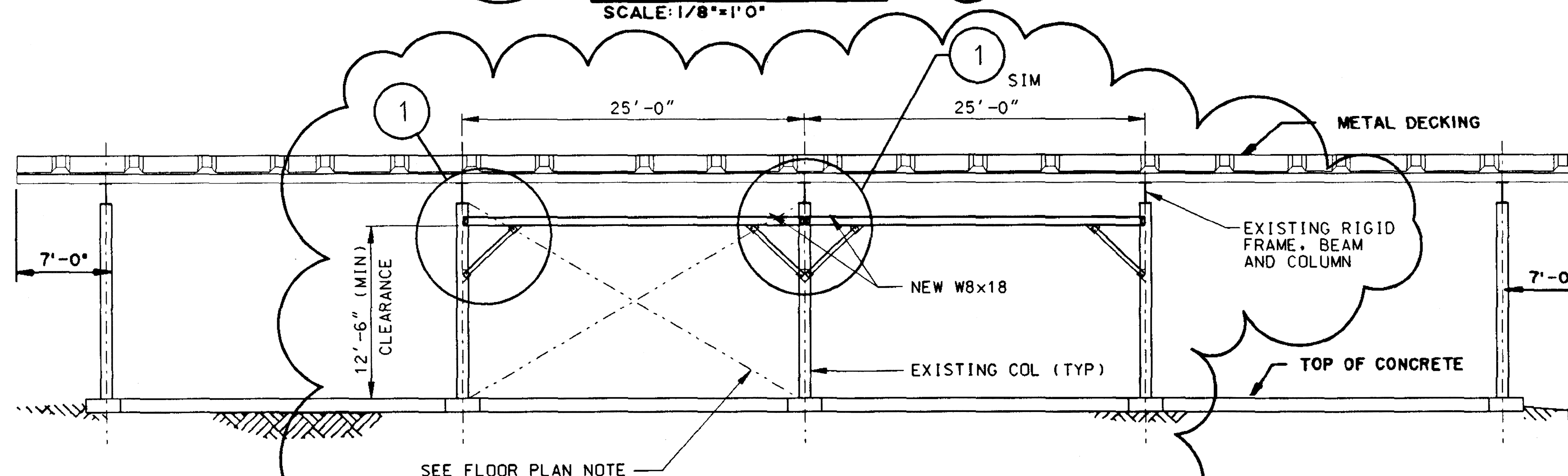
APPROVAL BLOCK
DEPT. OF ENERGY APPROVAL: DAVID WENZLAFF — DATE: 6/26/89
PROJECT ENGINEER
DRAWING NUMBER: JS-005-020-S2.2
SHEET ____ OF ____

SRV/ REMOTE.005.020.S2-1 (DRAWING 1)
PLOTTED: 01/10/90

M.1



FLOOR PLAN (A)
SCALE: 1/8"=1'0"



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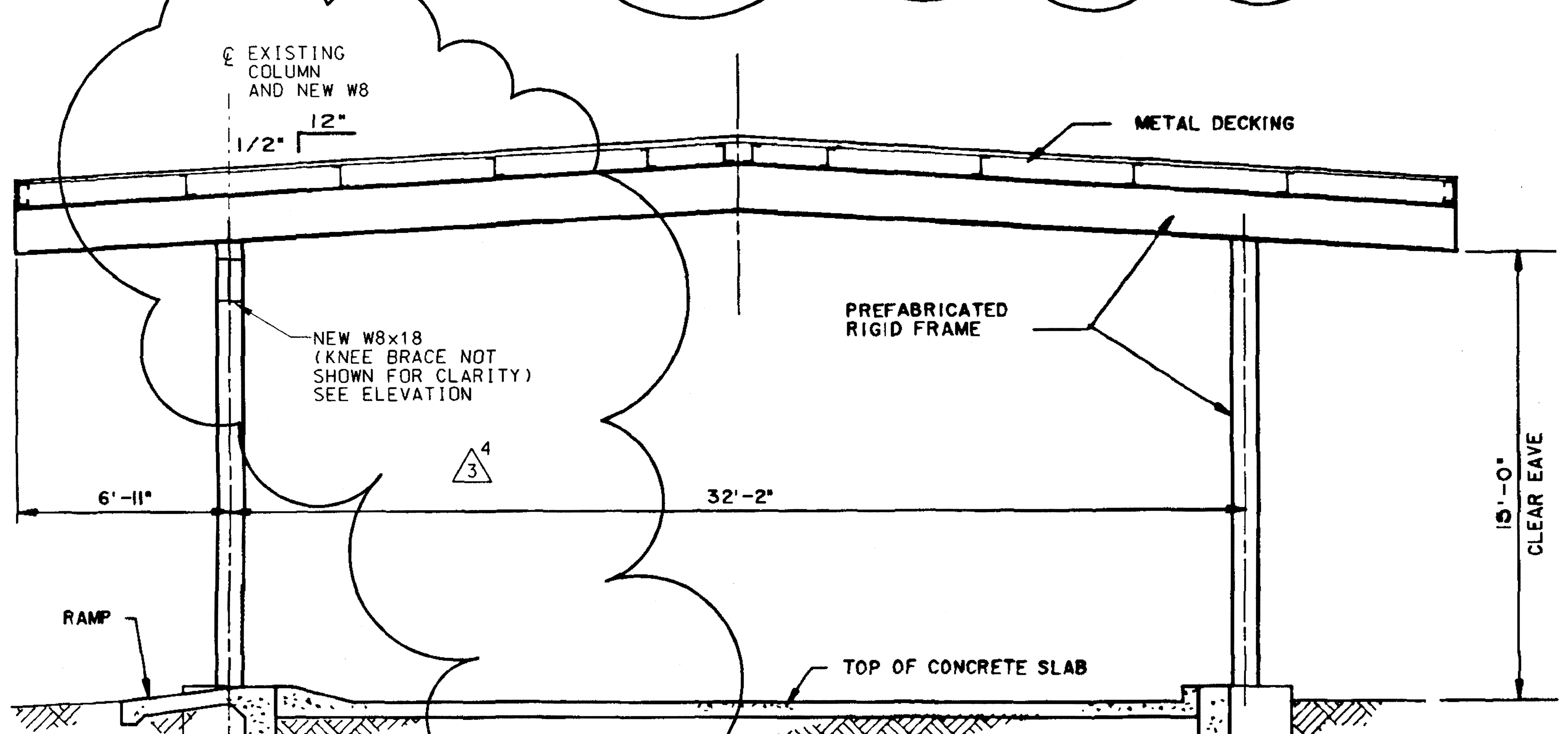

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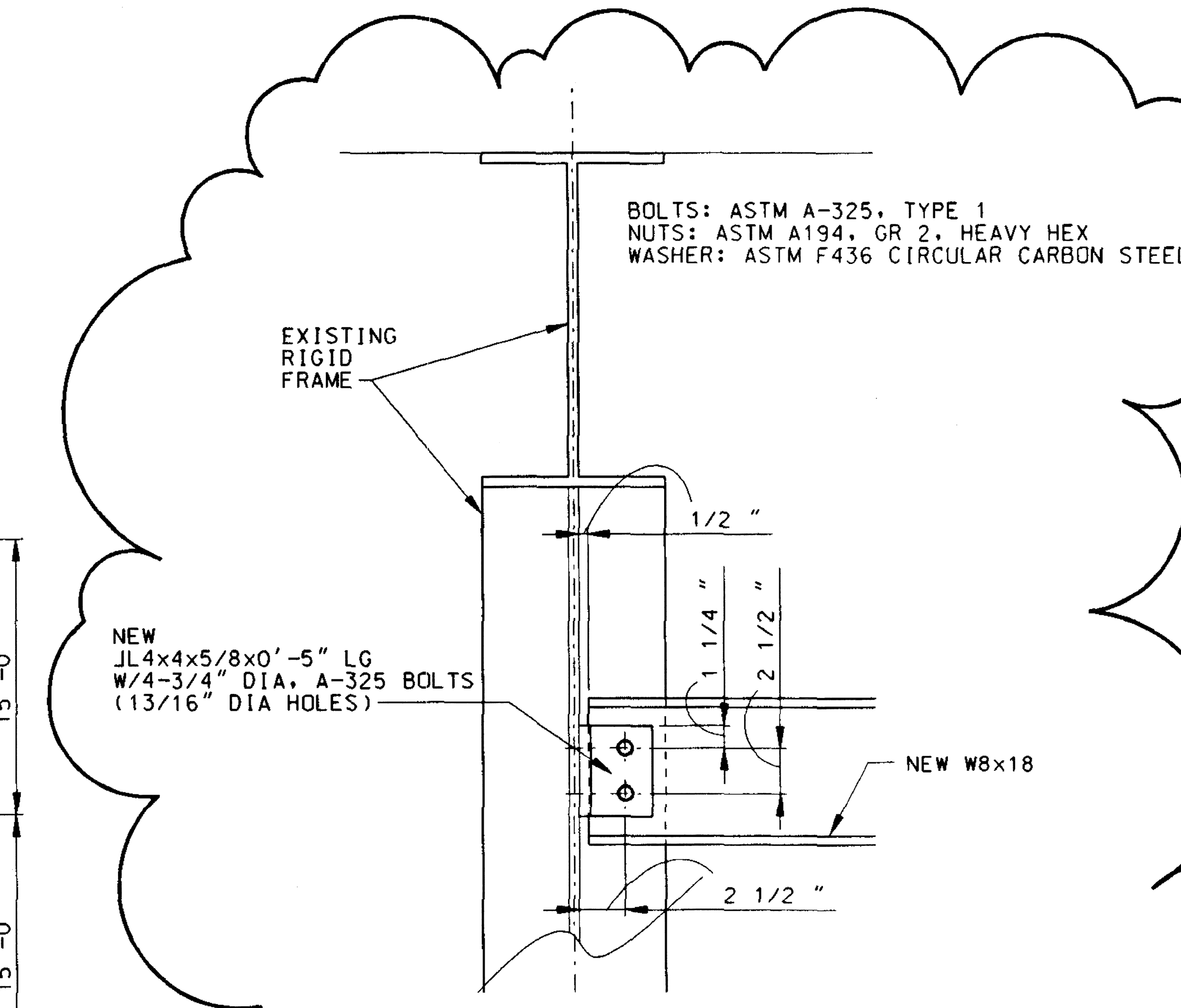
(TYPICAL 2 BAYS)



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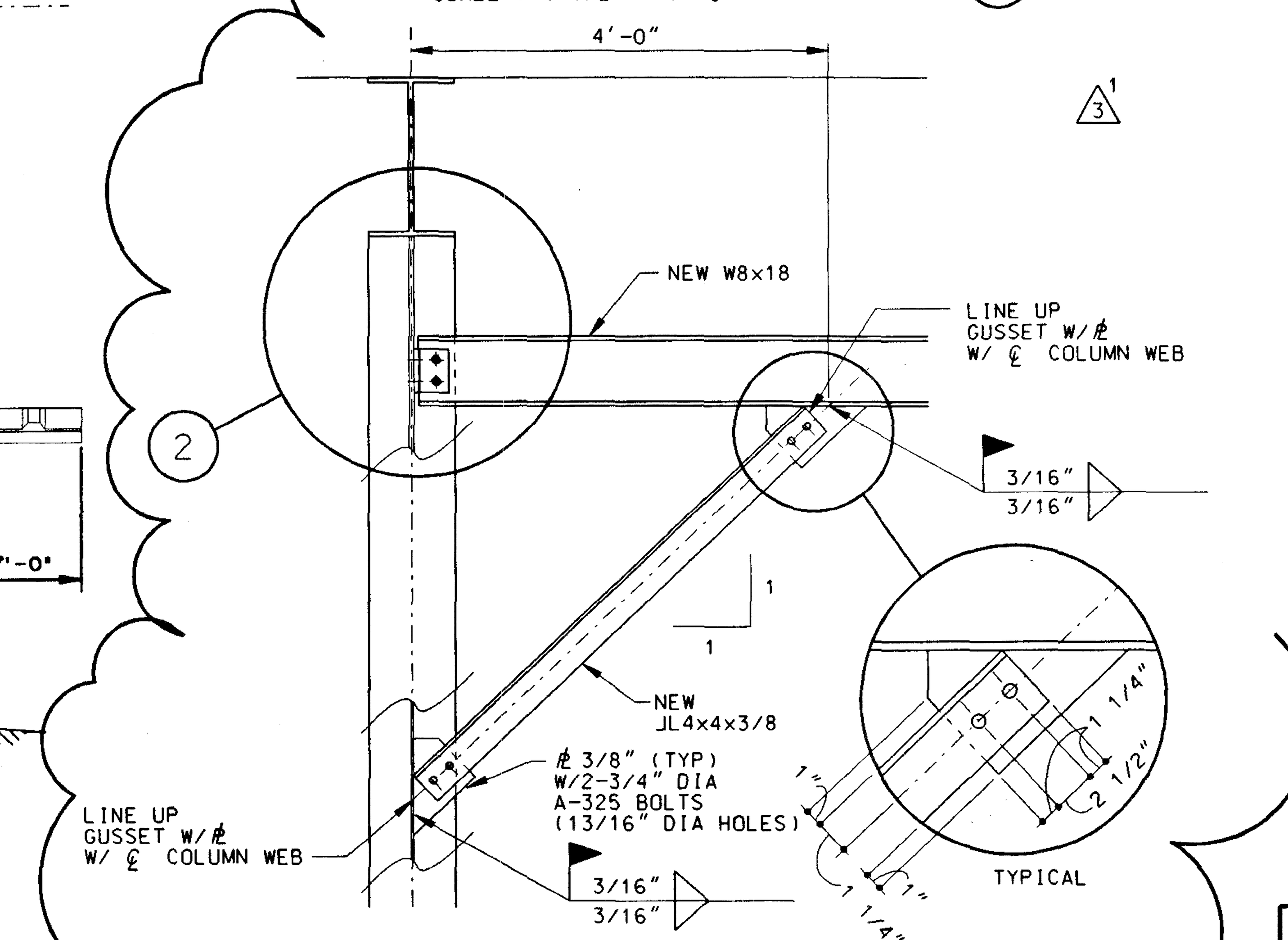

DETAIL (1)
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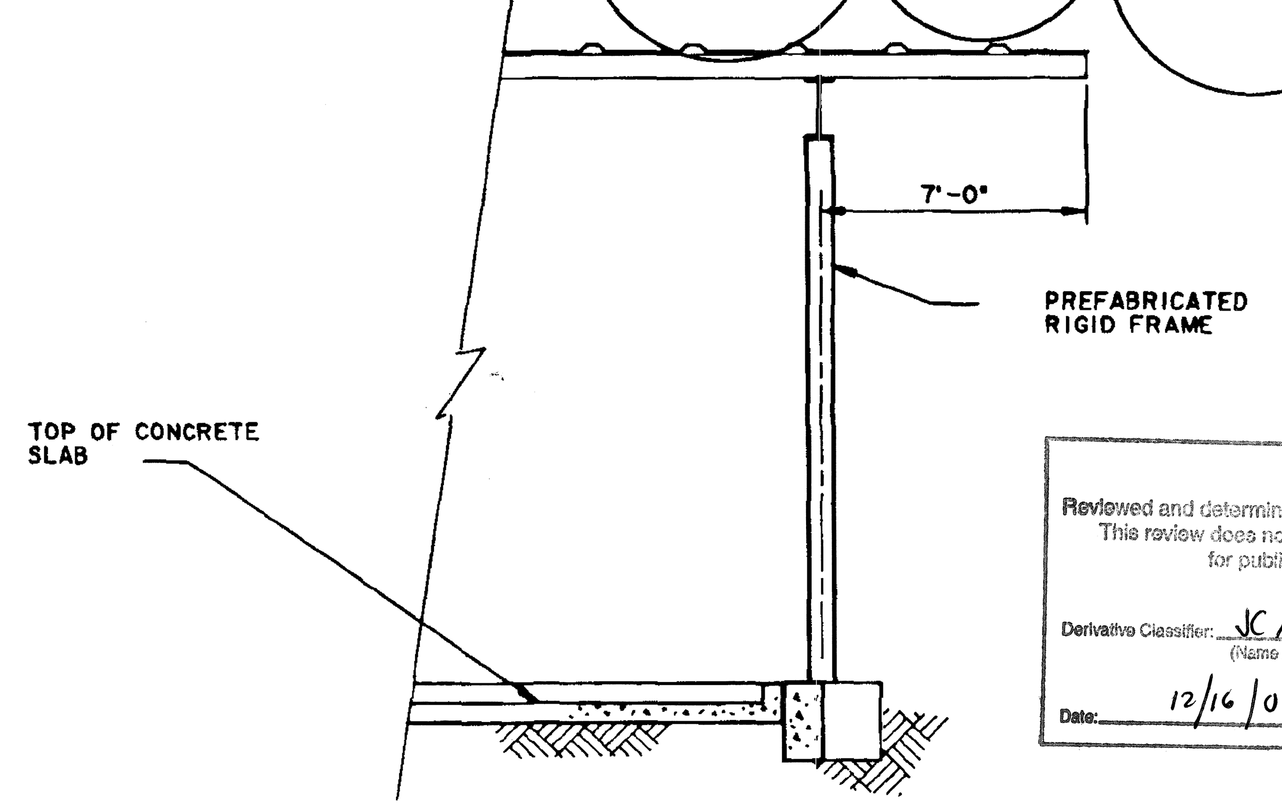
(TYP 2 PLACES)



SECTION (B)
SCALE: 1/4"=1'0"

METAL BUILDING NOTES

1. THE BUILDING SHALL BE A PREFABRICATED METAL BUILDING OF THE RIGID FRAME TYPE AND SHALL BE THE STANDARD PRODUCT OF A MANUFACTURER ENGAGED IN THE PRODUCTION OF PREFABRICATED METAL BUILDINGS.
2. THE BUILDING MANUFACTURER SHALL FURNISH ALL STRUCTURAL CALCULATIONS AND DRAWINGS FOR THE ERECTION, INSTALLATION, AND ASSEMBLY AS REQUIRED TO ASSEMBLE ALL COMPONENTS FURNISHED BY THE BUILDING MANUFACTURER. ALL DRAWINGS SHALL INDICATE PIECE MARKS OF ALL PARTS TO BE ASSEMBLED OR ERECTED. AN ANCHOR BOLT SETTING PLAN PLUS COLUMN REACTIONS SHALL BE PROVIDED. NINE COPIES OF CALCULATIONS AND SHOP/ERECTION DRAWINGS SHALL BE SUBMITTED FOR APPROVAL PRIOR TO FABRICATION.
3. FABRICATION AND ERECTION OF STRUCTURAL STEEL SHALL CONFORM TO THE LATEST EDITION OF THE AISC AND AISI SPECIFICATIONS. ALL WELDING OF STRUCTURAL STEEL SHALL CONFORM TO THE AWS STRUCTURAL WELDING CODE D1.1, LATEST EDITION, AND SHALL BE PERFORMED BY CERTIFIED WELDERS.
4. DESIGN LOADS SHALL CONFORM TO THE REQUIREMENTS OF "MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES" ANSI A58.1, LATEST EDITION, WITH THE FOLLOWING:
   - A. ROOF LIVE LOAD -- 20 PSF
   - B. SEISMIC -- ZONE 4
   - C. OCCUPANCY IMPORTANCE FACTOR -- I=1.0
   - D. BASIC WIND SPEED -- 80 MPH
   - E. SITE EXPOSURE -- C

   LOAD COMBINATIONS SHALL CONFORM TO THE UNIFORM BUILDING CODE, LATEST EDITION.
5. ALL CONSTRUCTION FEATURES, MATERIAL, TEST, AND DETAILS SHALL CONFORM TO USDOE/NV STANDARD CONSTRUCTION SPECIFICATIONS, LATEST EDITION.

GENERAL NOTES

1. ALL MATERIALS AND CONSTRUCTION METHODS NOT GIVEN ON THIS DRAWING SHALL COMPLY WITH THE DECEMBER 1994 EDITION OF THE DOE/NV STANDARD CONSTRUCTION SPECIFICATION.
2. ALL PERTINENT DIMENSIONS OF EXISTING STRUCTURE SHALL BE FIELD VERIFIED BY THE CONSTRUCTOR PRIOR TO COMMENCEMENT OF ANY WORK.
3. STRUCTURAL STEEL - ASTM A36.
4. ALL WELDING OF STEEL SHALL CONFORM TO THE LATEST EDITION OF THE AWS STRUCTURAL WELDING CODE D1.1 AND BE PERFORMED BY CERTIFIED WELDERS USING E70XX LOW HYDROGEN ELECTRODES.
5. ALL HIGH STRENGTH BOLTS (ASTM A325) SHALL BE TIGHTENED BY THE TURN OF THE NUT METHOD PER THE LATEST SPECIFICATION "STRUCTURAL JOINTS USING ASTM A325 OR A490 BOLTS" APPROVED BY THE "RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS".
6. ALL FERROUS METAL, INCLUDING WELDS, SHALL BE THOROUGHLY CLEANED AND PAINTED WITH ONE COAT OF ALKYD PRIMER, FOLLOWED BY TWO COATS OF EXTERIOR OIL PAINT, PER NTS SPECIFICATIONS.

ISSUE FOR CONSTRUCTION

FOR REFERENCE DRAWINGS SEE DRAWING TI

NO.	DATE	REVISIONS					
4		REVISED AND REDRAWN 10/9/98, REMOVED X-BRACING ADDED KNEE BRACING					

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

THIS DRAWING HAS BEEN REVISED BY BECHTEL NEVADA. BECHTEL NEVADA IS RESPONSIBLE ONLY FOR THE PORTION OF THIS DRAWING THAT HAS BEEN REVISED AND THEREFORE DOES NOT WARRANT OR GUARANTEE ANY PART OF THE ORIGINAL DESIGN ISSUED BY THE PREVIOUS CONTRACTOR AS SHOWN BELOW.

NO.	DATE	REVISIONS
2		AS BUILT CURRENT STATUS DTD 9/18/90
1	1-19-90	REVISED PER SUBMITTAL #78063-4A DATED 12/31/89

U.S. DEPARTMENT OF ENERGY
NEVADA OPERATIONS OFFICE — LAS VEGAS, NEVADA

NEVADA TEST SITE — AREA 5
HAZARDOUS WASTE ACCUMULATION FACILITY
PLAN ELEVATION & SECTIONS

DESIGNED: AP — DRAWN: AP
CHECKED: RBH — ENVIR: PW
SAFETY: CD — Q&I: GTL
PROJECT ENGINEER: R FRAZIER
SUBMITTED: R S ZIEGENBEIN
HOLMES & NARVER, INC.

DEPT. OF ENERGY APPROVAL: DAVID WENZLAFF — DATE: 6/26/89
PROJECT ENGINEER
DRAWING NUMBER: JS-005-020-S1.3
SHEET ___ OF ___

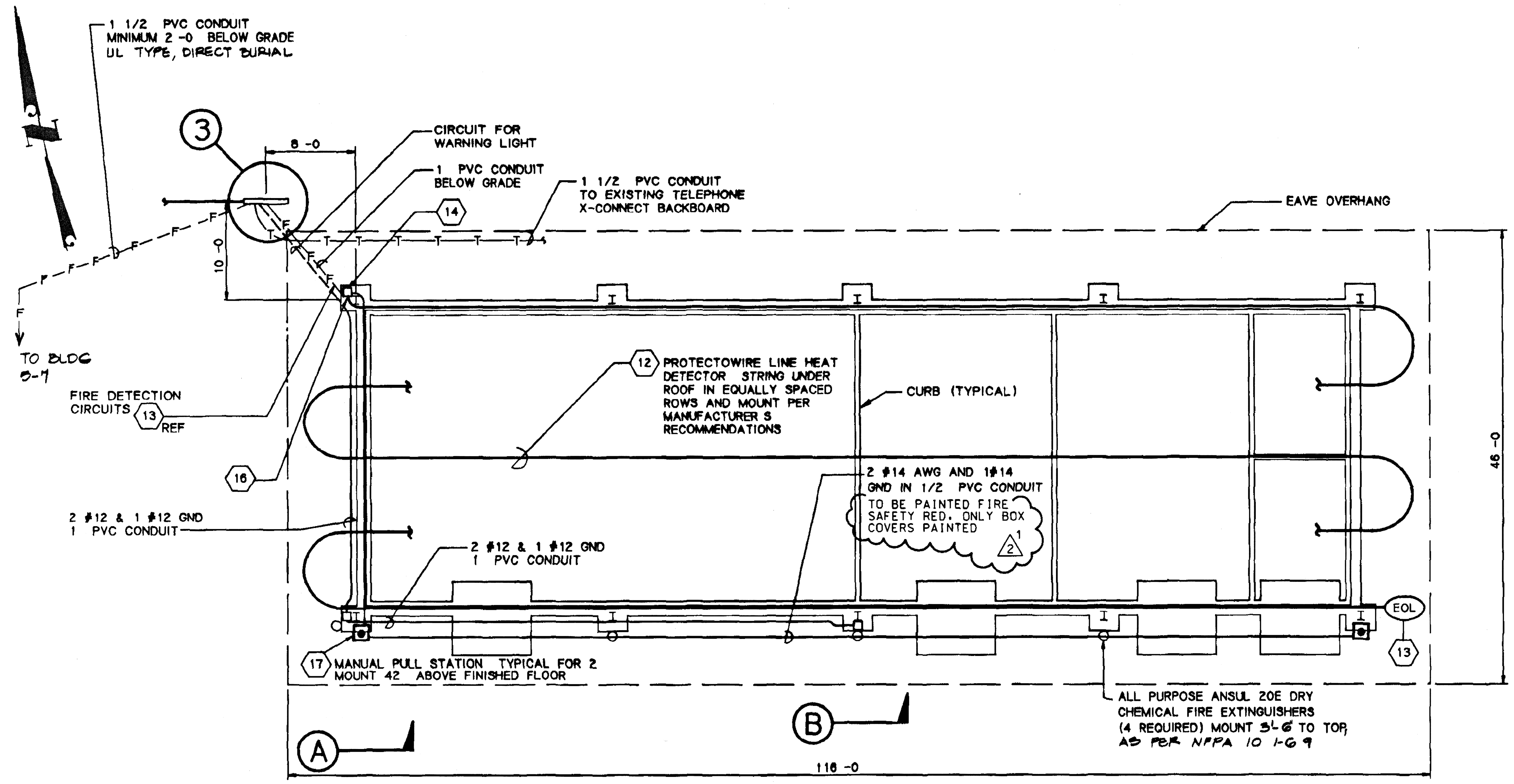
HOLMES & NARVER, INC.
ARCHITECTS - ENGINEERS
ENERGY SUPPORT DIVISION
1050 E. FLAMINGO ROAD LAS VEGAS, NEVADA 89109
I.D. NO. 78062
PROJ. NO. 8901.A05

ORIGINAL MYLAR SIGNED BY:

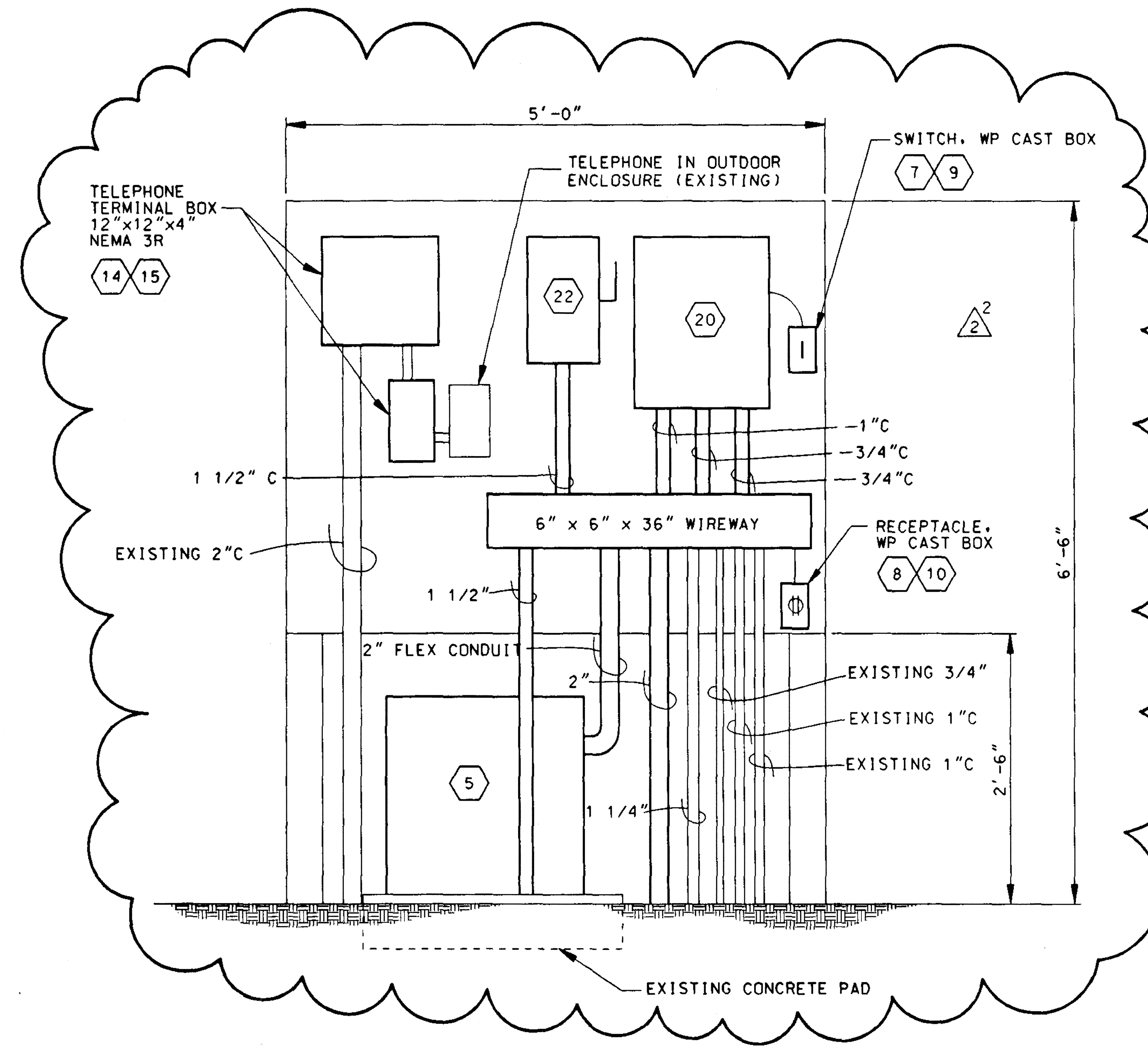
Reviewed and determined to be UNCLASSIFIED. This review does not constitute clearance for public release.
Derivative Classifier: JC Anderson / EN16 (Name/Organization)
Date: 12/16/09

Site Plan

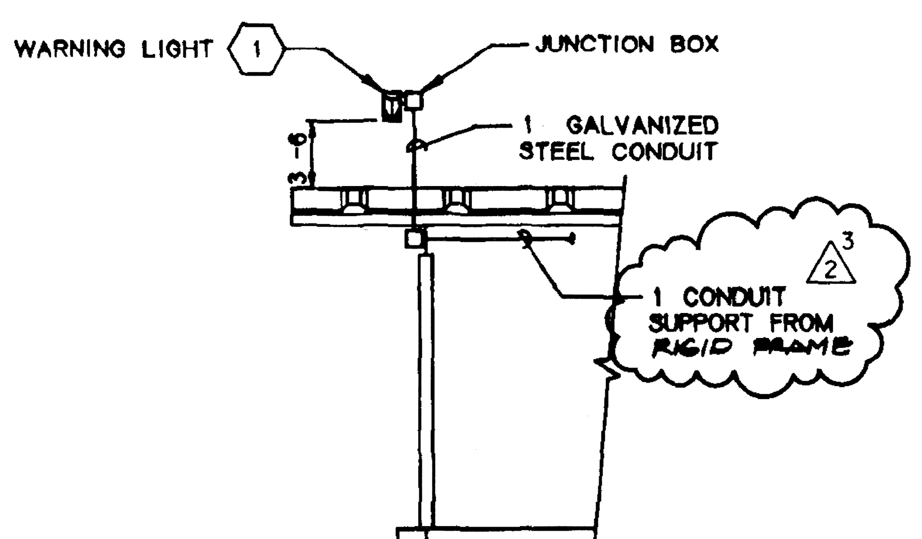
Not available for public viewing



FLOOR PLAN
SCALE 1/8 = 1-0



SERVICE ENTRANCE DETAIL 3 3/E1
SCALE NONE



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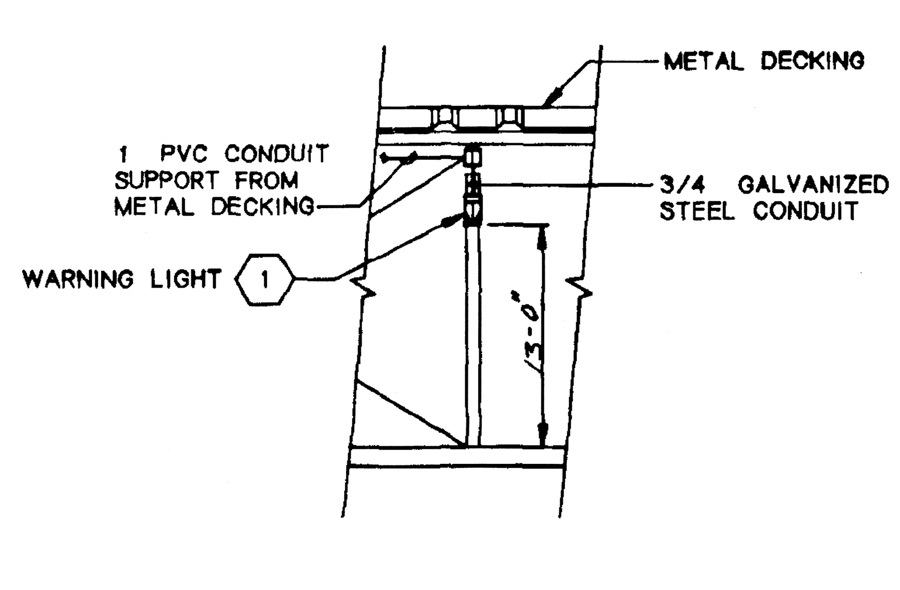


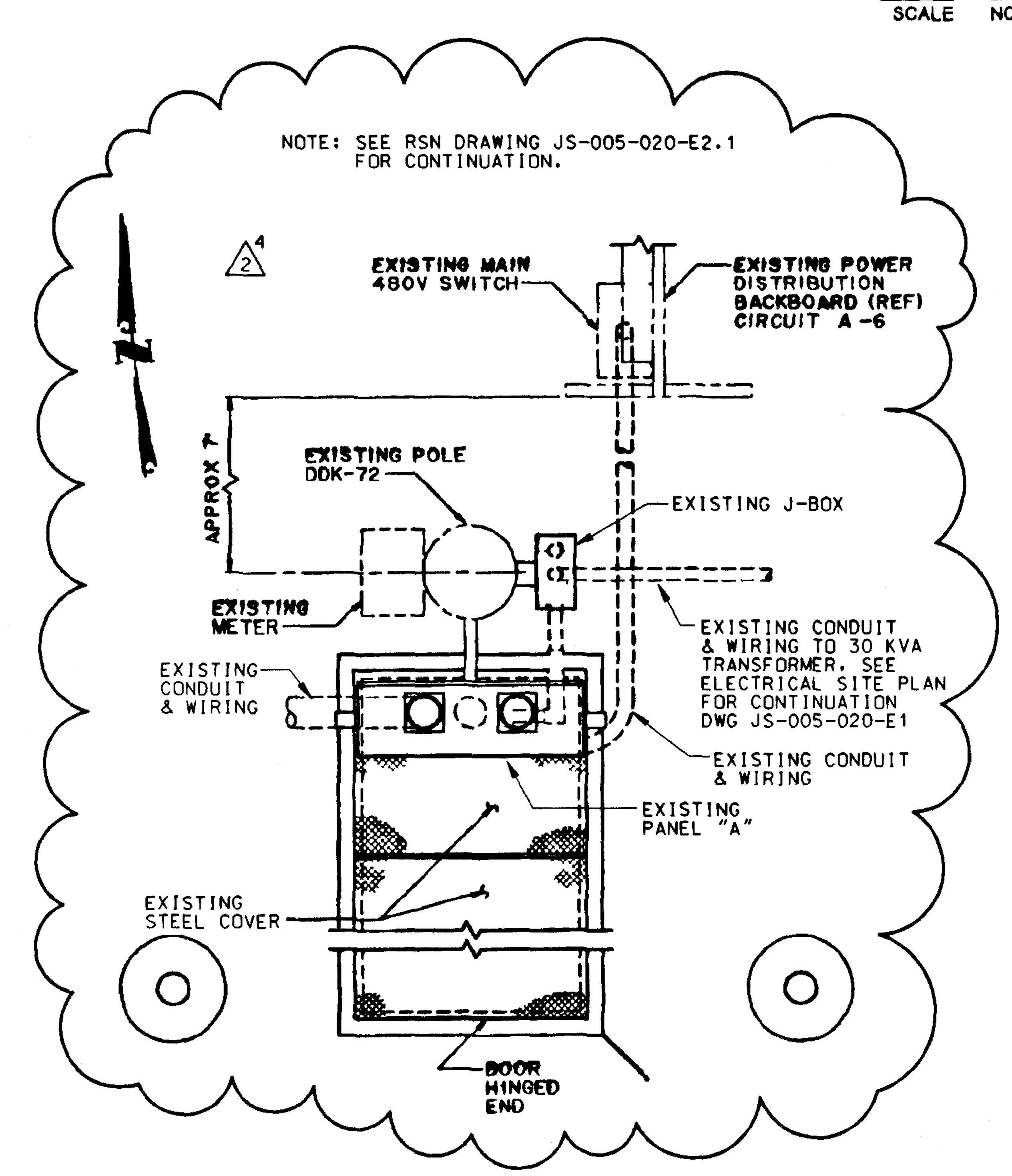
SECTION B
SCALE 1/8 = 1-0

AS-BUILT			
Bechtel Nevada	Surveyor Signature	Date	DOE Initials/Date
D.F. VINCENT 2/9/99	2/9/99 DFV	PE Initials/Date	PM Signature
Agency Approval	Date	DOE Approval	Date

UNLESS NOTED BY MARKED CHANGES, ALL DIMENSIONS, NOTES, REFERENCES AND CONSTRUCTION FEATURES ARE CORRECTED, AND WERE CONSTRUCTED AS SHOWN ON THIS DRAWING.

ORIGINAL AS-BUILT SIGNED BY

NOTE: SEE RSN DRAWING JS-005-020-E2.1 FOR CONTINUATION.



EXISTING POLE #72 TAP DETAIL 2/E1
SCALE NONE

Reviewed and determined to be UNCLASSIFIED. This review does not constitute clearance for public release.
Derivative Classifier: JC ANDERSON / EN16 (Name / Organization)
Date: 12/16/09

FOR REFERENCE DRAWINGS SEE DRAWING T1

FOR GENERAL NOTES, EQUIPMENT LIST ONE LINE DIAGRAM AND PANEL SCHEDULE SEE DRAWING E1

NO	DATE	REVISIONS
4		AS-BUILT - CURRENT STATUS AS OF 2/9/99
1		AS BUILT-CURRENT STATUS DTD 9/18/90

U S DEPARTMENT OF ENERGY
NEVADA OPERATIONS OFFICE — LAS VEGAS NEVADA

NEVADA TEST SITE — AREA 5

HAZARDOUS WASTE ACCUMULATION FACILITY
PLAN, SECTIONS & DETAILS

DESIGNED: GSR — DRAWN: LC/CCC
CHECKED: GWW

HOLMES & NARVER INC
ARCHITECTS - ENGINEERS
ENERGY SUPPORT DIVISION
1050 E FLAMINGO ROAD LAS VEGAS NEVADA 89109

I D NO 78062
PROJ NO 8901 A05
DRAWING NUMBER JS-005-020-E2.2

Section 11: Map B EODU Features

Not available for public viewing

Section 12: Aerial Views

Figure A: Aerial View of the HWSU

Section 12 Figure A.
Hazardous Waste Storage Unit - Aerial View
Area 5, Nevada Test Site

Figure B: Aerial View of the EODU

Not available for public viewing

DOE/NV/25946--1015

RCRA Part B
Permit Application
Hazardous Waste Storage Unit
Nevada Test Site

May 2010

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the U.S. Government or any agency thereof.

Table of Contents

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List of Figures

List of Tables

Acronyms

ac	Acre
BLM	Bureau of Land Management
CAU/CAS	Corrective Action Unit/Corrective Action Site
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm	Centimeter
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DQO	Data Quality Objectives
EODU	Explosive Ordnance Disposal Unit
EPA	U.S. Environmental Protection Agency
EPIP	Emergency Plan Implementing Procedure
ERP	Emergency Response Procedure
FFACO	Federal Facilities Agreement and Consent Order
FEMA	Federal Emergency Management Agency
FIRMS	Flood Insurance Rate Maps
ft	Feet
ft^3	Cubic Feet
gal	Gallon
HA	Hectare
HOC	Halogenated Organic Compounds
hr	Hour
HWSU	Hazardous Waste Storage Unit
in	Inch
kg	Kilogram
km	Kilometer
km^2	Square Kilometer
L	Liter
LANL	Los Alamos National Laboratory
LDR	Land Disposal Restrictions
lb	Pound
LLMW	Low-Level Mixed Waste
m	Meter
m^3	Cubic Meter
mcc	Maximum Concentration of Contaminants
mi	Mile
mi^2	Square Mile
mi^3	Cubic Mile
MOU	Memorandum of Understanding
MSDS	Material Safety Data Sheet
MWDU	Mixed Waste Disposal Unit
NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection
NFPA	National Fire Protection Agency
NNSA/NSO	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
NSTec	National Security Technologies LLC
NTS	Nevada Test Site
NTTR	Nevada Test and Training Range
ORM	Other Regulated Materials
PCB	Polychlorinated Biphenyls
PLO	Public Land Order
PPB	Parts Per Billion
PPE	Personal Protective Equipment
PPM	Parts Per Million
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RWMS	Radioactive Waste Management Site
SARA	Superfund Amendments and Reauthorization Act
SWMU	Solid Waste Management Unit
TCLP	Toxicity Characteristic Leaching Procedure
TSDF	Treatment, Storage, and Disposal Facility
UR	Use Restriction
yd	Yard
yd^3	Cubic Yard

B.1 Hazardous Waste Storage Unit Permit Application [40 CFR 270.14(b)(1)]

The Area 5 Hazardous Waste Storage Unit (HWSU) was established to support testing, research, and remediation activities at the Nevada Test Site (NTS), a large-quantity generator of hazardous waste. The HWSU, located adjacent to the Area 5 Radioactive Waste Management Site (RWMS), is a prefabricated, rigid steel-framed, roofed shelter used to store hazardous nonradioactive waste generated on the NTS. No offsite generated wastes are managed at the HWSU.

Waste managed at the HWSU includes the following categories:

- Flammables/Combustibles
- Acid Corrosives
- Alkali Corrosives
- Oxidizers/Reactives
- Toxics/Poisons
- Other Regulated Materials (ORMs)

A list of the regulated waste codes accepted for storage at the HWSU is provided in Section B.2.

Hazardous wastes stored at the HWSU are stored in U.S. Department of Transportation (DOT) compliant containers, compatible with the stored waste. Waste transfer (between containers) is not allowed at the HWSU and containers remain closed at all times. Containers are stored on secondary containment pallets and the unit is inspected monthly.

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

Table 1 Metric Conversion Factors

Unit	Equals
1 hectare	2.471 acres
1 in	2.54 cm
1 kg	2.205 lb
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-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-1079	Septic System, Area 12 (U12g Tunnel)
NY-1080	Septic System, Area 23, Building 1103
NY-1081	Septic System, Area 6, CP-170
NY-1082	Septic System, Area 22, Building 22-1
NY-1083	Septic System, Area 5, Radioactive Material Management Site (RWMS)
NY-1084	Septic System, Area 6, Device Assembly Facility
NY-1085	Septic System, Area 25, Central Support Area
NY-1086	Septic System, Area 25, Reactor Control Point
NY-1087	Septic System, Area 27, Able Compound
NY-1089	Septic System, Area 12 Camp
NY-1090	Septic System, Area 6, LANL Construction Campsite
NY-1091	Septic System, Area 23, Gate 100
NY-1103	Septic System, Area 22, Desert Rock Airport
NY-1106	Septic System, Area 5, Building 5-8
NY-1110-HAA-A	Individual Sewage Disposal System, A-12, Bldg. 12-910
NY-1112	Commercial Sewage Disposal System, U1a, Area 1
NY-1113	Commercial Sewage Disposal System, Area 1, Building 121
NY-1124	Commercial Individual Sewage Disposal System, Area 6
NY-1128	Area 6 Yucca Lake Project
NY-17-06839	Septic Tank Pumping Contractor (5 units)
GNEV93001	Water Pollution Control General Permit
NEV96021	Water Pollution Control for E-Tunnel Waste Water Disposal System and Monitoring Well ER-12-1
2287-5146	NTS Hazardous Materials Permit
2287-5147	Nonproliferation Test and Evaluation Complex Hazardous Materials Permit
NEVHW0021	NTS Hazardous Waste Management Permit (RCRA)
AP9711-2557	NTS Class II Air Quality Operating Permit
09-30	Open Burn Variance, Various Locations on the NTS
09-31	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
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

B.1.a NTS General Facility Description

The NTS is a U.S. Department of Energy National Nuclear Security Administration (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. The 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 the U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office (NNSA/NSO).

National Security Technologies LLC (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 WSI Security for 24-hour security services (armed patrol, access control) and the Nye County Sheriff's Office for law enforcement support on the NTS.

In addition to RCRA requirements, the HWSU is subject to U.S. Department of Energy (DOE) Orders and other applicable state and federal regulations.

The following four figures and one photograph [not available for public viewing] are provided to further depict the features and uses of the NTS.

- Figure 1, General Location Map
- Figure 2, Topographic Features and Infrastructure Map
- Figure 3, Area 5 HWSU Topographic Map/1,000-Foot Boundary
- Figure 4, Land Use Map
- Figure 5, Aerial View of the HWSU

Exhibit 1 contains the construction drawings for the HWSU [not available for public viewing].

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Figure 1 General Location Map
Not Available for Public Viewing

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Figure 2 Topographic Features and Infrastructure Map
Not Available for Public Viewing

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Figure 3 Area 5 HWSU Topographic Map/1,000-Foot Boundary
Not Available for Public Viewing

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Figure 4 NTS Land Use Map
Not Available for Public Viewing

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Figure 5 Aerial View of the HWSU
Not Available for Public Viewing

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Exhibit 1 HWSU Construction Drawings

Not Available for Public Viewing

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B.1.b RCRA Permit Application History

The HWSU was used from April 1990 to May 1995 as a 90-day storage area for hazardous waste. The Nevada Division of Environmental Protection (NDEP) issued a RCRA Part B Permit (Permit NEV HW009) for this facility on May 1, 1995, which was subsequently renewed in November 2000 and November 2005. Since 1995, the HWSU has been used for the storage of hazardous waste for a period not to exceed one year before offsite shipment to a treatment and disposal facility. There have been no reported releases at the Area 5 HWSU that have required reporting under RCRA; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); or the Superfund Amendments and Reauthorization Act (SARA).

B.1.c 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 Mixed Waste Disposal Unit (MWDU), Area 11 Explosive Ordnance Disposal Unit (EODU), and the Area 5 HWSU can be found in the:

1. RCRA Part B Permit Application, Volumes 1, 4, and 5 (DOE/NV--1053, May 2005) and
2. Volume 3 (DOE/NV-25956--262, August 2005), the NDEP Permit for a Hazardous Waste Management Facility (NEV-HW0021, December 2005) and
3. 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 low-level mixed waste (LLMW) 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 [lb]) of waste. The process design capacity of the EODU is 45 kg/hour (kg/hr) (100 lb/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.d General Dimensions and Structural Design

The HWSU structure is a prefabricated, rigid steel-framed roofed shelter. The unit is a monolithic pour cell type unit with a coating applied to the exposed surfaces. The columns that support the roof are bolted to the foundation. The storage area floor is

31 m (100 ft) long by 9.1 m (30 ft) wide. Integral 15-cm (6-in) curbs are provided above the 15-cm (6-in) concrete floor slab, around the exterior of the structure, and between the five segregated storage cells. The structure is built on a compacted earth pad.

Access to the HWSU is provided by a locked double gate. The facility is locked at all times, except during container management, inspection, or maintenance operations. Ramps along the south side of the Area 5 HWSU allow for access to storage cells A, B, C, D, and F. The perimeter of the Area 5 HWSU is surrounded by a chain-link cyclone fence. Figure 7 depicts the access to the Area 5 HWSU.

The general HWSU and pallet layout, shown in Figure 6, provides an example of a typical waste segregation scheme. Because a flexible inventory of waste may be stored at the Area 5 HWSU, container segregation is consistent with the requirements of **40 CFR 264.177(c)** and may not conform to the specific configuration depicted in Figure 6.

B.1.d.1 Secondary Containment Basic Design, Materials of Construction, Capacity, Container Management

Secondary containment for hazardous wastes that could be released from containers is provided by the poly-spill pallet. The concrete surface is covered with a coating that is resistant to materials that may be stored on the HWSU. This coating serves as a cosmetic feature, although the coating material is chemical-resistant. Figure 7 provides the HWSU facility drawing.

The storage cells have no drainage sumps or piping. The concrete floor is level. Containers of both liquid and non-liquid waste are placed on spill pallets (except when consolidation is in progress) to minimize the potential for contact between the container and any incidental precipitation ponding on the storage cells. The poly-spill pallets, which meet the secondary containment requirements for liquid waste specified in **40 CFR 264.175(b)(3)**, can collect 10 percent of the volume of all the containers on the pallet or the volume of the largest container, whichever is greater. Spills from containers collect in the sump, preventing contamination of the HWSU floor. Furthermore, the poly-spill pallets offer excellent chemical resistance. The HWSU’s maximum capacity consists of a total volume of approximately 61,600 L (16,280 gal).

Figure 6 Area 5 HWSU and Pallet Layout

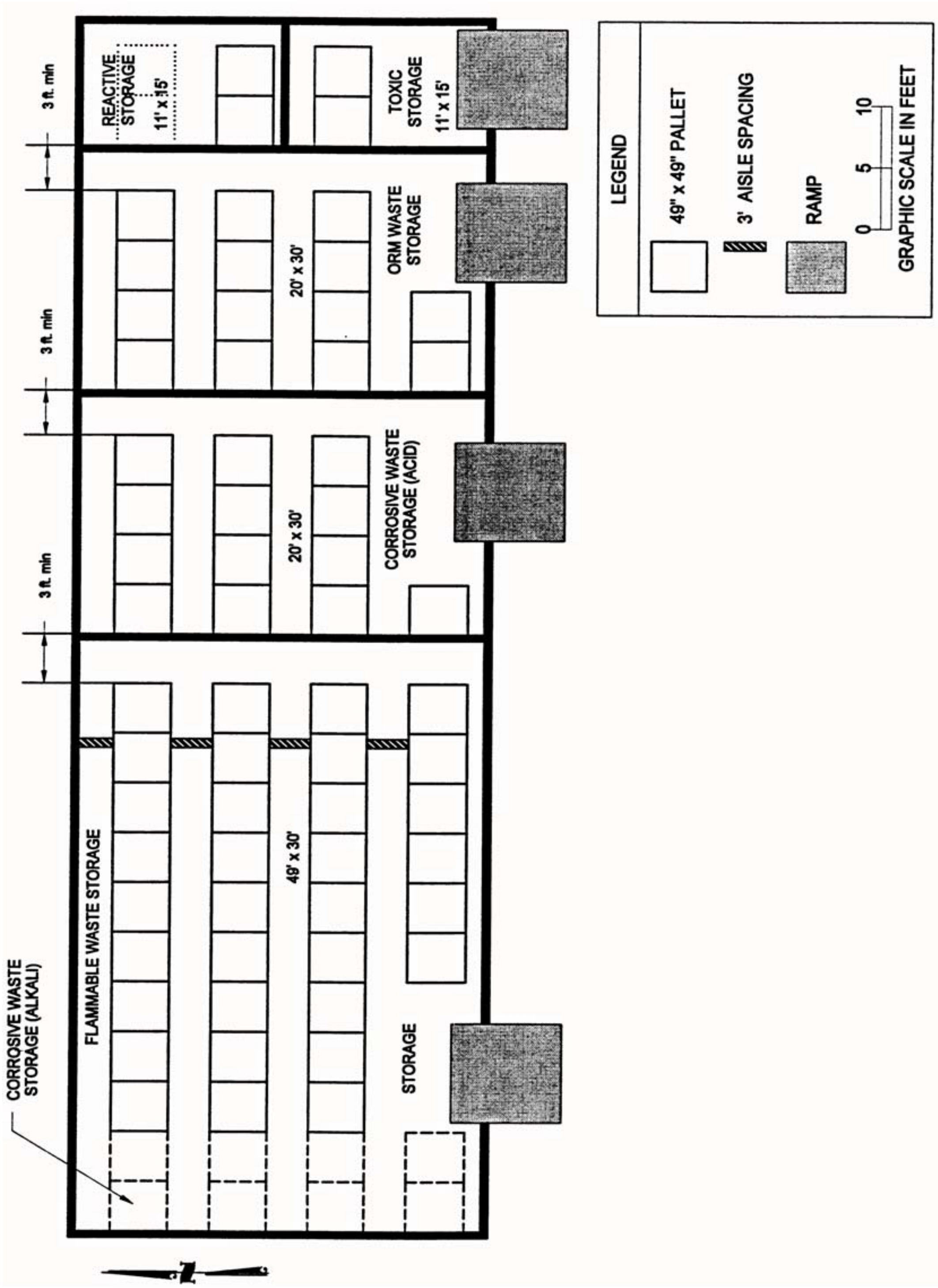

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Figure 7 HWSU Access and Utilities

KEY NOTES

1. HWSU CELL A&B NOMINAL SIZE: 30' x 50'
   HWSU CELL C&D NOMINAL SIZE: 30' x 20'
   HWSU CELL E&F NOMINAL SIZE: 15' x 10'
2. MATERIAL STORAGE
   TRANSPORTAINER &
   HWSU OFFICE NOMINAL SIZE: 20' x 8'
3. ALL HWSU CELLS HAVE 6" CONCRETE CURBS

HAZARDOUS WASTE STORAGE UNIT

LEGEND

	PAVED ROAD
	GRAVEL ROAD
— x — x —	CHAIN LINK FENCE
—o—o—	T-POST FENCE
	CONCRETE FOUNDATION
	PORTABLE METAL STRUCTURE
•	BOLLARD

--SEWER AND STORM--

------- 8"SS -------	SANITARY SEWER LINE (SIZE AS SHOWN)
○	SEWER MANHOLE
◄— ∘ ∘ ∘ —◄	STORM DRAINAGE FLOW LINE

--WATER--

-·-·- 8"W -·-·-	WATER LINE (SIZE AS SHOWN)
FH	FIRE HYDRANT
PIV	POST INDICATOR VALVE
⋈	GATE VALVE

--UTILITIES--

—— POH ——	OVERHEAD POWER LINE
-------- E --------	UNDERGROUND POWER LINE
▽	TRANSFORMER
▭	ELECTRICAL PANELBOARD
○	ELECTRICAL POWER POLE
—— COMM ——	SURFACE LAID COMMUNICATION LINE
-·-·- FD -·-·-	FIRE DETECTION LINE

Reviewed and determined to be UNCLASSIFIED. This review does not constitute clearance for public release.
Derivative Classifier: JC Anderson/EN16 (Name/Organization)
Date: 01/13/2010

FIGURE 7

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
HWSU FIGURES

HWSU ACCESS AND UTILITIES

DRAWN	PREPARER	CHECKER	PROJECT ENGINEER	APPROVER / USER
S. Barrett 1-13-10	[signature] 1/13/10	NA	[signature] 1/13/10	NA

National Security Technologies LLC — Vision • Service • Partnership
NEVADA OPERATIONS, P.O. BOX 98521 LAS VEGAS, NV 89193-8521
ENGINEERING NO. 10007 — ORIGINAL SIGNATURES ON FILE
DRAWING NUMBER / WORK ORDER NUMBER: SK-10007-C-1007
REVISION 0

1/12/2010 4:31:59 PM durretsa
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B.2 Chemical and Physical Analysis [40 CFR 270.14(b)(2)]

B.2.a Introduction

Hazardous, nonradioactive waste managed at the HWSU is generated within the NTS at numerous locations. Solid wastes that are not regulated under Subtitle C of RCRA (and do not meet the acceptance criteria of permitted NTS landfill disposal sites or sewage lagoons) may also be stored at the HWSU before offsite shipment.

Waste must be fully characterized to identify all hazardous waste codes before storage at the HWSU. Laboratory services, if required for waste characterization analyses, are provided by an offsite laboratory certified under Nevada Administrative Code (NAC) 445A.0552 through 445A.0665.

The NTS is a testing facility and maintains the capability to accept and manage a number of diverse hazardous waste streams that have the potential to be generated. The maximum annual volume of hazardous waste generated from these activities, for ultimate storage at the HWSU, is not anticipated to exceed 246,500 liters (L) (65,120 gallons [gal]).

B.2.b Hazardous Waste Characteristics

Hazardous waste at the NTS is generated from a variety of sources, including routine and non-routine activities such as maintenance, construction, testing, laboratory, and research activities. Wastes include both characteristic and listed hazardous waste such as metals, expired chemicals and products, solvent waste, paint waste, aerosol products, expired medical products, compressed gases, soil and other media, contaminated personal protective equipment (PPE), and abandoned products.

Processes generating wastes include laboratory operations, fleet maintenance, site maintenance, custodial services, photographic processing, construction and demolition activities, experimental research, remediation activities, and medical support operations.

Occasionally, the hazardous wastes are shipped directly offsite to a contracted treatment, storage, and disposal facility (TSDF). Remediation wastes may be managed at the HWSU if they conform to the acceptance criteria.

B.2.c Chemical Compatibility

Wastes stored at the HWSU are fully characterized and containerized before transfer to the unit. This is done to ensure that all wastes are stored in the proper DOT container that is compatible with the stored waste.

Table 4 lists waste codes applicable to the HWSU and the design capacity of the unit.

Table 4 General Information – Area 5 HWSU

Process Code	S01 (Container Storage)
Waste Codes	D001 through D043
	F001 F002 F003 F004 F005 F006 F007 F009 F027, F039
	P001 through P018; P020 through P024; P026 through P032, P033, P034, P036 through P051; P054, P056 through P060, P062 through P078; P081[1], 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 through U103; 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 Polychlorinated biphenyls (PCBs) - state hazardous waste
Estimated Annual Quantity of Waste	246,500 L (65,120 gal)
Process Design Capacity	61,600 L (16,280 gal)
[1] Nitroglycerin – nonreactive medical waste	

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

B.3.a Waste Analysis Plan

This Waste Analysis Plan describes the procedures that must be instituted to comply with **40 CFR 264.13**. When a waste is generated, a waste determination is made to ascertain if the waste is hazardous according to **§262.11**. The hazardous waste is accumulated in a container with the appropriate marking, labeling, container compatibility, and management requirements. If the waste is to be subsequently managed at the HWSU, the generator, at a minimum, must provide acceptable knowledge information for storage, treatment, or disposal of the waste according to **§264** and **§268**.

B.3.a.1 Acceptable Knowledge

Acceptable knowledge information may include: (1) sufficient process knowledge, (2) a detailed chemical and physical analysis of a representative sample of the waste to confirm the presence or absence of constituents regulated in **40 CFR 261**; or (3) a combination of both. For wastes whose hazardous constituents are either listed on the container, noted on Material Safety Data Sheet (MSDS) or manufacturer's information, or available through process knowledge, sampling and analysis is not required. This acceptable knowledge information is considered sufficient for identifying and managing the waste on site according to state and federal regulations. MSDSs and process knowledge information can be used to characterize wastes for which sampling is impractical (i.e., batteries, aerosol cans).

B.3.a.2 Chemical Analysis and Rationale

If sufficient information cannot be derived from generator knowledge or MSDS, sampling and analysis is performed on a waste to fulfill the characterization requirements. The test methods employed for each waste stream depend upon the type of waste and the quantity of information available from the generator. Table 5 presents each parameter, the rationale for the parameter selection, and the corresponding U.S. Environmental Protection Agency (EPA) SW-846 analytical methods, but is not intended to present an all-inclusive list of the test methods that can be used. Other EPA test methods may be employed as necessary. The volume of waste obtained for waste analysis depends upon the method of analysis requested and the specific requirements of the analytical laboratory.

Table 5 Waste Parameter Information

EPA Method[1]	Parameter	Rationale for Parameter Selection
9014, 9034	Reactivity	Identify reactive wastes
1010 or 1020	Ignitability	Identify ignitable wastes (only if liquid is present) by testing and comparison with definitions in 40 CFR 261.21
9095 or (1311 Pressure Test)	Free Liquids	Identify free liquids prohibited by Land Disposal Restrictions (LDR)
9040 or 9041	Corrosivity	Identify corrosive wastes (only if liquid) by testing and comparison with definitions in 40 CFR 261.22
1311[2]	Toxicity Characteristic Leaching Procedure (TCLP)	Identify EPA-regulated toxic wastes by testing and comparison with definitions in 40 CFR 261.24
6010, 6020, or 7000 series	TCLP Metals analysis	Identify EPA-regulated characteristic metals in waste
8000 series	TCLP Volatiles analysis	Identify EPA-regulated characteristic or listed volatile compounds in waste
8000 series	TCLP Semivolatiles analysis	Identify EPA-regulated characteristic or listed semivolatile compounds in waste
8000 series	Halogenated Organic Compounds (HOCs)[3]	Determine LDR compliance for HOC > 1,000 ppm [parts per million]
8082	PCBs	Determine compliance with LDR treatment standard
Atomic Absorption Spectroscopy methods listed in 40 CFR 261, Appendix III	Inorganics	Determine compliance with LDR treatment standard. Detection limit range is low ppb [parts per billion] to low ppm [parts per million].
Inductively Coupled Plasma-Atomic Emission Spectroscopy	Inorganics	Determine compliance with LDR treatment standard. Detection limit range is low to high ppb.

[1]Referenced methods are from Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846.
[2]An alternative to performing Method 1311 is to perform total contaminant concentration analysis and assume all contaminants to be leachable using the TCLP method. In this case, the total concentration in the waste is compared to a Maximum Concentration of Contaminants (MCC), which is 20 times higher than the MCCs for the leachate.
[3]As specified in 40 CFR 268.2(a) and Appendix III to 40 CFR 268.

B.3.a.3 Waste Analysis Frequency

All waste streams offered for storage are evaluated and characterized before pickup and transport to the HWSU.

Any noted changes in the characteristics of the waste are evaluated with regard to the adequacy and conformance to packaging and labeling specifications. In addition, a significant change in characteristics may render the waste unsuitable for storage at the HWSU. In this case, the waste would continue to be managed in either a satellite or 90-day accumulation location until a permit modification is approved by NDEP, or it may be transported directly offsite. Waste container exteriors are radiologically assayed before being transported for storage at the HWSU, unless acceptable knowledge precludes the possibility of radioactive contamination.

B.3.b Waste Sampling

If sufficient information for a waste determination cannot be derived from characterization activities including process knowledge, sampling and analysis is performed on a waste to fulfill the waste acceptance requirements.

(1) Sampling Devices

Commonly used sampling equipment is shown in Table 6.

Table 6 Sampling Devices

Liquid Waste These devices are used to sample aqueous and liquid materials.	Coliwasa	A Coliwasa sampler consists of an adjustable sampling tube made of plastic or glass. The tube has a closure-locking mechanism to trap liquid samples. The sampler is lowered into the liquid waste. When it reaches the bottom of the waste container, the sampler is closed to trap the waste sample.
	Dipper	A dipper consists of a telescoping fiberglass or aluminum pole to which a glass or beaker is attached by a clamp. The telescoping pole serves as a handle to dip the beaker into the waste.
	Weighted Bottle	The weighted bottle sampler is a plastic or glass bottle with a sinker and a stopper. The bottle is attached to a line which is used to raise, lower, and open the stopper.
Solid Waste These devices are used to sample solid and soil-like materials.	Thief	A thief sampler consists of a stainless steel tube with an inner tube that opens and closes. The device has a pointed tip that allows penetration into solid materials. The thief is inserted into the waste and the tube is rotated to open the inner tube to retrieve the waste sample and to close the inner tube to retain the waste sample.
	Trier	A trier is a device used to sample loosened soil or moist or sticky solid materials. The device is a long tube-like scoop with a sharpened end for cutting a core of the waste.
	Scoops and Shovels	These devices are used to obtain a cross-section of the waste.
	Auger	An auger consists of spiral blades attached to a metal shaft. The device bores into the soil or solid to be sampled until the desired depth is reached.
	Veihmeyer Soil Sampler	The device consists of a chromium-molybdenum tube with a drive head. A drive hammer is used to pound the device to the desired soil depth. The sample can be removed from the tube for analysis.

(2) Sampling Techniques

(a) Grab Sample

Grab samples represent a sample collected at a particular time and place, and represent only the composition of the source at that time and place. The representativeness of grab samples is defined by the nature of the material being sampled. Grab samples are useful when a source is known to be reasonably constant (homogeneous) over time and location. In general, as sources vary over time and location, the representativeness of grab samples will decrease.

(b) Composite Samples

Composites are non-discrete samples composed of more than one specific aliquot collected at various sampling locations and/or different points in time. Analysis of this type of sample produces an average value and can, in certain instances, be used as an alternative to analyzing a number of individual grab samples and calculating an average value.

(3) Sampling Methodologies

(a) Random Sampling

When a batch of waste is completely homogeneous with regard to the chemical properties of concern and that chemical homogeneity is constant (uniform) over time (from batch to batch), a single sample collected from the waste at an arbitrary location and time theoretically generates an accurate and precise estimate of the chemical properties.

(b) Simple Random Sampling

If a batch of wastes is randomly heterogeneous with regard to its chemical characteristics and that random chemical heterogeneity remains constant from batch to batch, accuracy and appropriate precision can usually be achieved by this method. For this type of sampling, all units in the population (essentially all locations or points in all batches of waste from which a sample could be collected) are identified and a suitable number of samples is randomly selected from the population.

(c) Stratified Random Sampling

This method is appropriate if a batch of waste is known to be non-randomly heterogeneous in terms of its chemical properties and/or nonrandom chemical heterogeneity is known to exist from batch to batch. In such cases, the population is stratified to isolate the known sources of nonrandom chemical heterogeneity. After stratification, which may occur over space (locations or points in a batch of waste) and/or time (each batch of waste), the units in each stratum are numerically identified and a simple random sample is taken from each stratum.

B.3.c Quality Assurance (QA) and Quality Control (QC)

QA/QC samples are obtained to confirm that accurate waste characterization information is collected; ensuring that the waste managed at each operational unit possesses the chemical and physical properties ascribed by the permit. The QA/QC procedures that are used conform to the technical aspects and specific test methods described in the current edition of EPA SW-846 (Test Methods for Evaluating Solid Waste, Physical/Chemical Methods).

The type of QA/QC samples depend upon the Data Quality Objectives (DQOs) relevant to the type of waste stream to be analyzed. The type of QA/QC samples depend upon the DQOs relevant to the type of waste stream to be analyzed. DQOs are qualitative and quantitative statements that specify the quality of the data required (overall level of uncertainty that a decision-maker is willing to accept in results). They are based on the end uses of the data to be collected. This uncertainty is used to specify the quality of the measurement data required, usually in terms of objectives for precision, bias, representativeness, comparability, and completeness. DQOs are often determined by the nature of the test being performed. The purpose and goals of the project are to be defined before any sampling activities begin, with the understanding that not all environmental programs require the same quality of data. Defining DQOs specific to a program by tailoring requirements (e.g., QA, QC, analytical methods) to the specific project can eliminate unnecessary requirements, while still achieving accurate analytical results that are up to date. The DQOs developed for the project are translated into performance objectives (i.e., data quality requirements) that reflect certain requirements to meet **40 CFR 262.13**.

Analyzing waste destined for management at each operational unit is crucial to determine proper packaging, labeling, marking, segregating, and waste code assignment. Treatment technologies may require a more accurate determination of contaminant concentration levels to aid in the treatment process. In this event, additional QA/QC samples may be required to validate the concentration levels or the presence of certain analytes.

(1) Sampling QA/QC

Procedures are implemented for QA/QC during sampling as specified in SW-846. A “set of samples” is any group of 20 or fewer samples of the same matrix, collected at a specific point in time, and transported together from the sampling site. QA/QC samples will be collected at frequencies based on the prescribed DQOs. The following provides a description of the QA/QC samples that may be used based on the DQOs.

(a) Trip Blank

A trip blank is usually taken when samples for volatile organic analysis are required. The trip blank is usually prepared in an analyte-free environment, from analyte-free media (such as distilled water) before leaving for the sampling site. The trip blank is taken to the sampling site and returned to the laboratory unopened. The trip blank serves to identify and document cross-contamination of volatile organic compounds during sample handling, transportation, and storage.

(b) Field Duplicate

The sample and its field duplicate are two independent samples taken from the same source, at the same point in time, stored in separate containers, and independently analyzed. The field duplicate is used to document the precision of the sampling process (variance in waste composition and/or sampling technique).

(c) Equipment Rinsate

An equipment rinsate/field blank consists of analyte-free aqueous aliquots that contact sampling equipment under field conditions. This blank is used to document adequate decontamination of sampling equipment, cross-contamination from previously collected samples, or contamination from conditions during sampling. An equipment rinsate/field blank is collected at specified frequencies according to the probability of contamination or cross-contamination.

(d) Matrix Spike

A matrix spike sample is an independent sample collected to document the bias of a method in a given sample matrix. This sample is spiked (in the laboratory) with a known concentration of target analytes before sample preparation and analysis.

(e) Matrix Spike Duplicate

A matrix spike duplicate is an independent sample collected to document precision and bias of a method in a given sample matrix. This sample is spiked (in the laboratory) with a known concentration of target analytes before sample preparation and analysis.

(2) Laboratory QA/QC

Any laboratory that analyzes waste managed at the NTS must prepare and implement a QA/QC program to ensure that analytical data are reliable. Laboratory QA/QC activities will include:

- Use of EPA-recommended sample preparation and analytical methods.
- Calibration of laboratory instruments.
- Periodic inspection, maintenance, and servicing of instrumentation and standards.
- Use of spikes, blanks, and duplicates.
- Use of statistical procedures to monitor precision and accuracy.
- Continuous review of results to identify and correct problems.
- Participation in external laboratory evaluations.
- Use of formal chain-of-custody procedures.
- Maintenance and storage of records, charts, and logs of pertinent laboratory calibration, analytical, and QC activities and data.
- Documenting the performance of systems and operators.

B.3.d Land Disposal Restrictions Storage Provisions

Hazardous waste is stored at the HWSU solely for the purpose of accumulating sufficient quantities of waste to facilitate offsite shipment for recycling, treatment, or disposal. Because no treatment is associated with the HWSU, NNSA/NSO complies with the notification requirements set forth in **40 CFR 268.7** for wastes that are restricted from land disposal. NNSA/NSO provides LDR notifications to disposal facilities on forms that are provided by the individual facility.

Although these forms differ from one facility to another, in general they include the following information:

- The manifest number associated with the wastes
- EPA hazardous waste codes
- Waste stream or profile number
- Underlying hazardous constituents
- Waste certification statement and signature.

The information for completing LDR forms is derived from the acceptable knowledge or from chemical analysis of the waste.

B.3.e Recordkeeping

HWSU records generated from characterization and management of hazardous waste are located in Mercury at Building 132 as part of the HWSU Facility Operating Record **[40 CFR 264.73]**. Records are archived after three years.

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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 HWSU and other properties. Land administered by the BLM 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 24-hour s a day, including holidays.

B.4.b HWSU Access

The HWSU is surrounded on all four sides by a chain-link cyclone fence. The perimeter of the site is routinely checked for signs of intrusion or fence deterioration. The entrance is on the west side of the facility and is guarded by a locked double gate that swings outward to open. The facility is locked at all times except during container management, inspection, or maintenance operations. Immediately inside the gate to the north is an office trailer where an access register is kept for personnel to sign in before going onto the HWSU. The access register is also annotated with the time personnel leave the HWSU. Signs visible from 7.6 m (25 ft) are posted at the entrance stating, **“DANGER - UNAUTHORIZED PERSONNEL KEEP OUT.”** For authorized personnel entering the area, warning signs visible from 7.6 m (25 ft) are posted concerning PPE requirements, prohibition on smoking, and a number to call in case of any emergency.

A protect-o-wire fire detection system is installed in the HWSU roof. In the event of a fire, the wire shorts and automatically triggers the fire alarm system at the NTS Fire Department. The fire alarm system can also be activated from two pull stations located at the HWSU and fire extinguishers are maintained at the unit. The HWSU has telephone and radio communications and vehicles are equipped with two-way radios.

B.5 HWSU Inspection Requirements [40 CFR 270.14(b)(5)]

The inspection program targets spill response equipment, safety equipment, fire extinguishers, signage, waste containers and secondary containment, leaking containers, and adequate aisle space. Inspections address the need to maintain inventories of materials necessary to operate the facility, testing and maintenance of safety devices, frequent visual inspection of areas where wastes are handled, and damage or water accumulation related to heavy wind and rain events. Inspection frequencies are based upon the rate of possible deterioration of the equipment and the probability of a human health or environmental incident if the deterioration, malfunction, or operator error goes undetected between inspections.

B.5.a HWSU Inspection Schedule

Inspections at the HWSU are conducted weekly and monthly (see Table 7). Inspections are required daily when loading, unloading, or consolidating operations take place. During these operations individual containers are inspected for deterioration, leakage, and damage. In addition, labels and markings must be legible and intact and spill pallets are inspected for overall structural integrity. Weekly inspections include the examination of containers, signs, gates, fences, and aisle space. Monthly inspections cover spill response equipment, safety equipment, fire protection, and respiratory equipment.

Table 7 Area 5 HWSU Inspection Schedule

Inspection	Description	Frequency
Aisle Space	Verify that 0.9-m (3 ft.) spacing is maintained between rows of pallets.	Weekly
Container Condition	Verify that deterioration, leaks, or damage are not present. Ensure lids, bolts, and rims are secured.	Weekly
Container Label and Markings	Ensure labels and markings are intact and legible.	Weekly
Secondary Containment	Verify that liquids are stored on poly-spill pallets that are in good condition.	Weekly
Cell curbing, fences, and gates	Verify that cell curbing, fences, and gates are intact.	Weekly
Safety/Emergency Equipment	Ensure that equipment, including spill kits, eyewash, and showers are present and in good condition.	Weekly
Signs	Required signs must be present and legible (i.e., hazardous class storage and No Smoking).	Weekly
Fire Alarms	Verify the alarm pull stations are accessible and in working condition.	Monthly
Fire Extinguishers[1]	Verify that hoses are in good condition and pressure gauges are in the appropriate range.	Monthly
Supply Inventories	Verify the availability and condition of safety and emergency equipment.	Monthly

[1] Fire extinguishers are inspected monthly by Area 5 HWSU personnel and certified annually by trained personnel according to National Fire Protection Association (NFPA) requirements.

Copies of completed inspection checklists are maintained at the HWSU (original copies are stored in Mercury, Building 23-132). Examples of inspection checklists are provided in Exhibit 2 (forms FRM-0387 and FRM-0388).

B.5.b Corrective Actions

When an inspection reveals the deterioration or malfunction of equipment or structures, the problem is noted on the inspection form, a schedule is developed to correct the problem, and corrective actions are tracked on the original inspection form. When a hazard is imminent or has already occurred, corrective action is taken immediately. If a leak is noted during an inspection, remedial action is performed according to the HWSU operating procedures.

Exhibit 2 Forms FRM-0387 and FRM-0388

NSTec Form FRM-0387	WEEKLY/DAILY INSPECTION WORKSHEET – AREA 5 HAZARDOUS WASTE STORAGE UNIT (HWSU)	08/17/09 Rev. 02 Page **1** of **1**

DAILY INSPECTION DUE TO: ☐ **LOADING** ☐ **UNLOADING** ☐ **CONSOLIDATION**

Inspector (Print Name): ____________________ Date: __________ Time: __________

	Yes	No	
1.	☐	☐	Are the following signs present and readable? Authorized entry; No Smoking; Hazard Class Storage (Flammable, ORM, Toxic, Reactive, Corrosive [Acid/Alkali]); Emergency Shower; Handwash Station; Eyewash station; No Entry *(Spanish)*
2.	☐	☐	Is the integrity of the section divisions, gates, and fences being adequately maintained?
3.	☐	☐	Is a three-foot aisle space maintained between pallet rows?
4.	☐	☐	Are container labels and markings intact, legible and readable from aisle?
5.	☐	☐	Are all the EPA waste numbers described on the containers listed in the Permit?
6.	☐	☐	Are containers free from leaks, deterioration, or other damage?
7.	☐	☐	Are container lids, rims, and bolts securely tightened?
8.	☐	☐	Do containers have a volume capacity of 55 gallons or less (if an overpack, then 85 gallons or less)?
9.	☐	☐	Are all containers placed completely on spill pallets?
10.	☐	☐	Are spill pallets in good condition and able to support up to 220 gallons (container volume)?
11.	☐	☐	Is the HWSU free form spills, leaks, or releases?
12.	☐	☐	Is the following safety equipment in good condition and ready for use? Absorbents; Shovels; Ratchets/Bung wrenches; Overpack containers; Tyvek Coveralls; Face Shields; Safety glasses; Hard hats; Gloves (Latex type & Liners); Rubber boots; Basestation Radio; Telephone; Eyewash station; Handwash station; Emergency shower
13.	☐	☐	Are waste containers currently stored in the HWAA? (If “Yes”, complete FRM-0868.)

Number of containers (circle one) Added / Removed: __________ Total Containers at the HWSU only: __________

Total number of HWO containers assigned to storage areas: __________

Annual quantity of waste (gallons) (Jan-Dec) __________

14. ☐ ☐ Is annual total < 65,120 gallons?

List Condition for each box checked “No”: ____________________

Corrective Action required for each box checked “No”: ____________________

Completed by Signature: ____________________ Date: __________

Reviewed by Signature: ____________________ Date: __________

Corrective Action Completed:

Signature: ____________________ Date: __________

NSTec Form FRM-0388	MONTHLY INSPECTION WORKSHEET – AREA 5 HAZARDOUS WASTE STORAGE UNIT (HWSU)	08/17/09 Rev. 02 Page **1** of **2**

Inspector (Print Name): ______________________

Date: ______________________ Time: ______________________

ITEM	RECOMMENDED QUANTITY	ACTUAL QUANTITY	IN GOOD CONDITION	
1. SPILL RESPONSE EQUIPMENT			**YES**	**NO**
Absorbent pillows	**5**	___	☐	☐
Shovels	**2**	___	☐	☐
Bung Wrench	**1**	___	☐	☐
Overpack containers	**5**	___	☐	☐
DOT approved containers	**10**	___	☐	☐
Sand bags	20 Bags	___	☐	☐
Absorbent materials	55 Gallon Equivalent	___	☐	☐
2. SAFETY EQUIPMENT			**YES**	**NO**
Face shields	**1**	___	☐	☐
Tyvek suits	**5**	___	☐	☐
Poly tyvek suits	**3**	___	☐	☐
Latex gloves	**1 Box**	___	☐	☐
Inner liner gloves	**1 Box**	___	☐	☐
Safety glasses	**5 pair**	___	☐	☐
Rubber boots	**1 pair**	___	☐	☐
Hard hats	**3**	___	☐	☐

			YES	NO
Eyewash station	---	______	☐	☐
Emergency shower	---	______	☐	☐
Handwash station	---	______	☐	☐
Alarm system	---	______	☐	☐
3. RESPIRATORY EQUIPMENT			**YES**	**NO**
Large	---	______	☐	☐
Medium	---	______	☐	☐
Small	---	______	☐	☐
4. Have fire extinguishers been inspected?		______	☐	☐
5. Is clear access to the Alarm System maintained?		______	☐	☐
6. Has the alarm system been tested by Radio Services?		______	☐	☐

List Condition for each box checked “No”:

Corrective Action required for each box checked “No”:

Completed by Signature: ______________________ Date: __________

Reviewed by Signature: ______________________ Date: __________

Corrective Action Completed:

Signature ______________________ Date: __________

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

HWSU 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 BLM, 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 3 is a copy of the Emergency Plan Implementing Procedure (EPIP) for the HWSU. 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

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

Exhibit 3 is a copy of the HWSU-HWAA-EPIP-01, “Facility Emergency Response Actions,” Area 5 Hazardous Waste Storage Unit and Hazardous Waste Accumulation Area.

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Exhibit 3 HWSU-HWAA-EPIP-01, “Facility Emergency Response Actions,” Area 5 Hazardous Waste Storage Unit and Hazardous Waste Accumulation Area

Not Available for Public Viewing

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

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

B.8.a Hazards Prevention for Loading and Off-Loading Operations

Specific precautions to be taken during loading, off-loading, and consolidation operations include preventative measures and monitoring activities to safely manage hazardous waste.

- The HWSU cells are designed to contain any releases that occur within the unit.
- Appropriate personal protective equipment is used.
- Applicable personnel training requirements have been met.
- 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.
- Inspections are required daily when loading, unloading, or consolidating operations take place.
- During container handling operations, only required personnel will be allowed into the HWSU.

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

Runoff and run-on to waste handling areas are not anticipated because of the location, grading elevation, roof, and the presence of a 15-centimeter (cm) (6-inch) curb surrounding the unit.

The storage cells have no drainage sumps or piping. The concrete surface is covered with a coating that is resistant to materials that may be stored on the HWSU. Secondary containment is provided by poly-spill pallets. Unit construction drawings are provided in Section B.1.

B.8.c Contamination of Water Supplies

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

- There is no surface water near the HWSU.
- The average annual rainfall is approximately 13 cm (5 inches) and the average annual evaporation rate is very high.
- The depth from the land surface to the ground water in the uppermost aquifer is approximately 255 m (835 ft).
- Secondary containment for wastes that could be released from accumulated containers is provided by the poly-spill pallets.
- The nearest drinking water well (Well 5b) is located approximately 6.5 km (4.0 mi) away from the HWSU.

- The HWSU 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.

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

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

- Majority of waste containers will be moved and placed by equipment. Failed equipment can be replaced or activities can be delayed until the equipment is repaired.
- HWSU emergency communication equipment (telephone and radio) are available and inspected regularly. Hand-held radios are tested daily for proper function.
- Normal operations will be limited to daylight hours.

B.8.e Exposure of Personnel to Hazardous Waste

Personnel exposures to hazardous waste at the storage unit are managed as follows:

- Waste stored at the HWSU is fully characterized before acceptance at the unit; increasing awareness of potential hazards.
- Waste is stored in DOT specification packaging or containers with secured lids.
- Containers are always kept closed during storage, except during repackaging.
- HWSU personnel are trained in the proper procedures for handling drums, equipment, and emergency response.
- Frequent inspections of the facility and equipment assist in minimizing undue exposure, accidents, and injuries.
- Applicable personal protective equipment is used by all personnel working at the HWSU.

B.8.f Aisle Space

Aisle space will be maintained at 0.9 m (3 ft) to allow for accurate container, label, and marking inspections and to facilitate access to containers in emergency situations.

B.8.g Releases to the Atmosphere

Wastes will be containerized according to **40 CFR 264 Subpart CC Air Emissions Standards**, preventing the release of contaminants to the atmosphere. Hazardous wastes are stored in DOT specification packaging or containers with secured lids.

Packages are kept closed except during repacking, consolidation, or inspection operations. Repacking and consolidation of waste is limited to waste that is in a container. Bulk liquid or bulk solid hazardous wastes are not repacked or consolidated at the HWSU.

B.9 Ignitable, Reactive, and Incompatible Wastes [40 CFR 270.14(b)(9)]

Hazardous waste containers are segregated and stored in such a manner that unintended release of their contents and consequent mixing thereof does not result in a dangerous evolution of heat or gas (see Figure 6). The unit is divided by hazard type using a 15-cm (6-inch) curb.

Only compatible wastes are stored together without a separating barrier. Separation and segregation of hazardous waste is according to **40 CFR 264.177**. Each storage cell of the HWSU is identified by a conspicuously posted sign describing the waste type as Flammable, Corrosive, Other Regulated Material, Reactive, and/or Toxic. All containers of hazardous waste are stored on poly-spill pallets that provide the additional segregation.

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

Mercury Highway is the main entrance to the NTS off U.S. Highway 95 and serves as the major traffic route, connecting the primary support area in Mercury with the other areas. Major traffic flow into the HWSU is via the 5-01 Road, as shown in Figure 7. Direct access off the 5-01 Road to the HWSU is provided by a large parking and turnaround area located on the southwest side of the HWSU.

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 sub-grade material (i.e., types of sub-grade 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.

Vehicles delivering or picking up waste are allowed inside the fenced compound. A loading/off loading ramp is located outside the fenced area to facilitate transfer of waste containers off of or onto transporter vehicles when necessary.

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

The center of the HWSU is located at N 766382.52 and E 709865.40 (based on Nevada State Plane Grid – Central Zone, North American Datum, 1983).

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]**. In the NTS region, natural seismic risk is moderate.

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 8).

No known surface cutting faults that have had displacement during Holocene time are present within 915 m (3,000 ft) of the HWSU.

B.11.b Flood Hazard

The HWSU is located outside the 100-year flood plain. Figure 9 presents the 100-year flood zone delineation for the HWSU. 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 4) evaluated the 100-year flood hazard.

Washes that drain toward the HWSU are normally dry and flow only in response to intense rainfall. Flow from the watersheds above the RWMS is diverted around the HWSU by flood control structures located on three upstream sides of the RWMS. These structures are engineered to maintain a run-on control system capable of preventing flow onto the HWSU during peak discharge from at least a 25-year, 24-hour storm. The HWSU also rests on an earthen pad; the floor is raised approximately 0.6 to 0.9 m (2 to 3 ft) above the surrounding grade. The storage cells of the HWSU are protected from direct precipitation by the metal roof, which extends 2.4 m (8 ft) beyond the outer edge of the containment curb. Onsite precipitation is the only run-on that may enter the HWSU. The storage cells are designed and constructed to collect and control this localized run-on, thus preventing runoff. The average annual precipitation in the vicinity of the HWSU is five inches per year.

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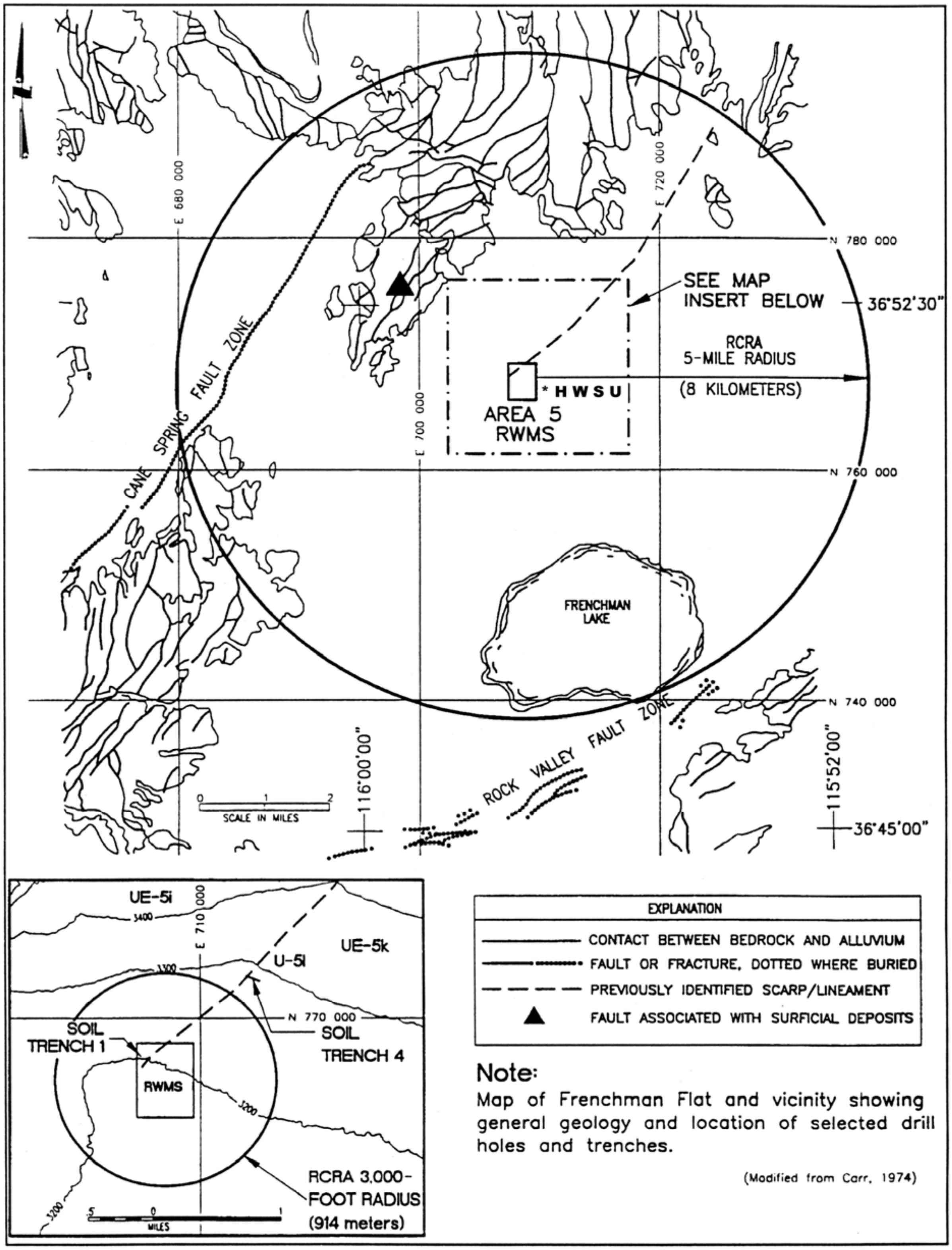
Figure 8 Structural Pattern of Frenchmen Flat and Vicinity



Note:
Map of Frenchman Flat and vicinity showing general geology and location of selected drill holes and trenches.

(Modified from Carr, 1974)

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Figure 9 100-Year Flood Zone Delineation

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Exhibit 4 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.

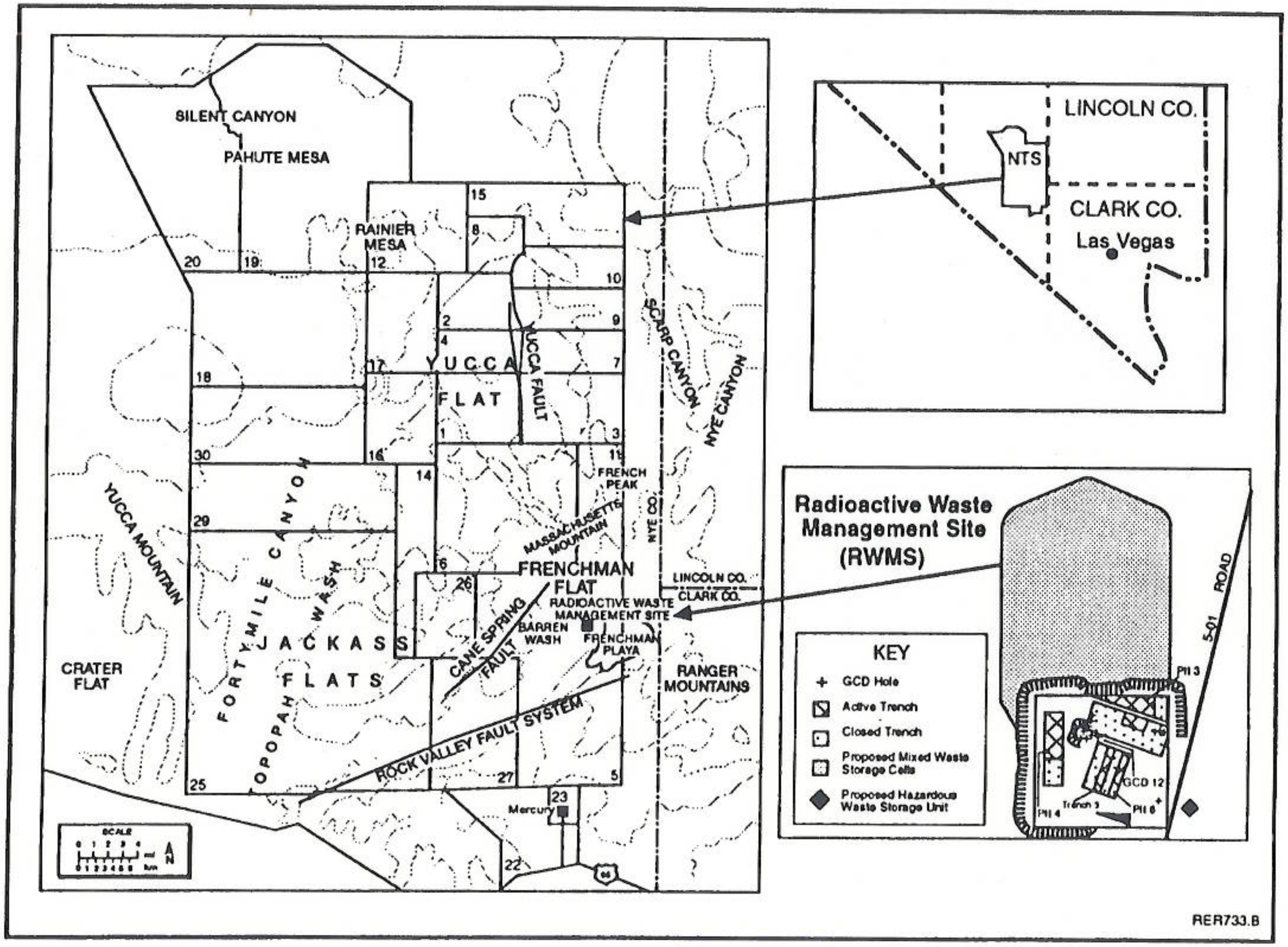


Figure 1. Location Map and Physiographic Features of the Nevada Test Site and the Area 5 Radioactive Waste Management Site

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).

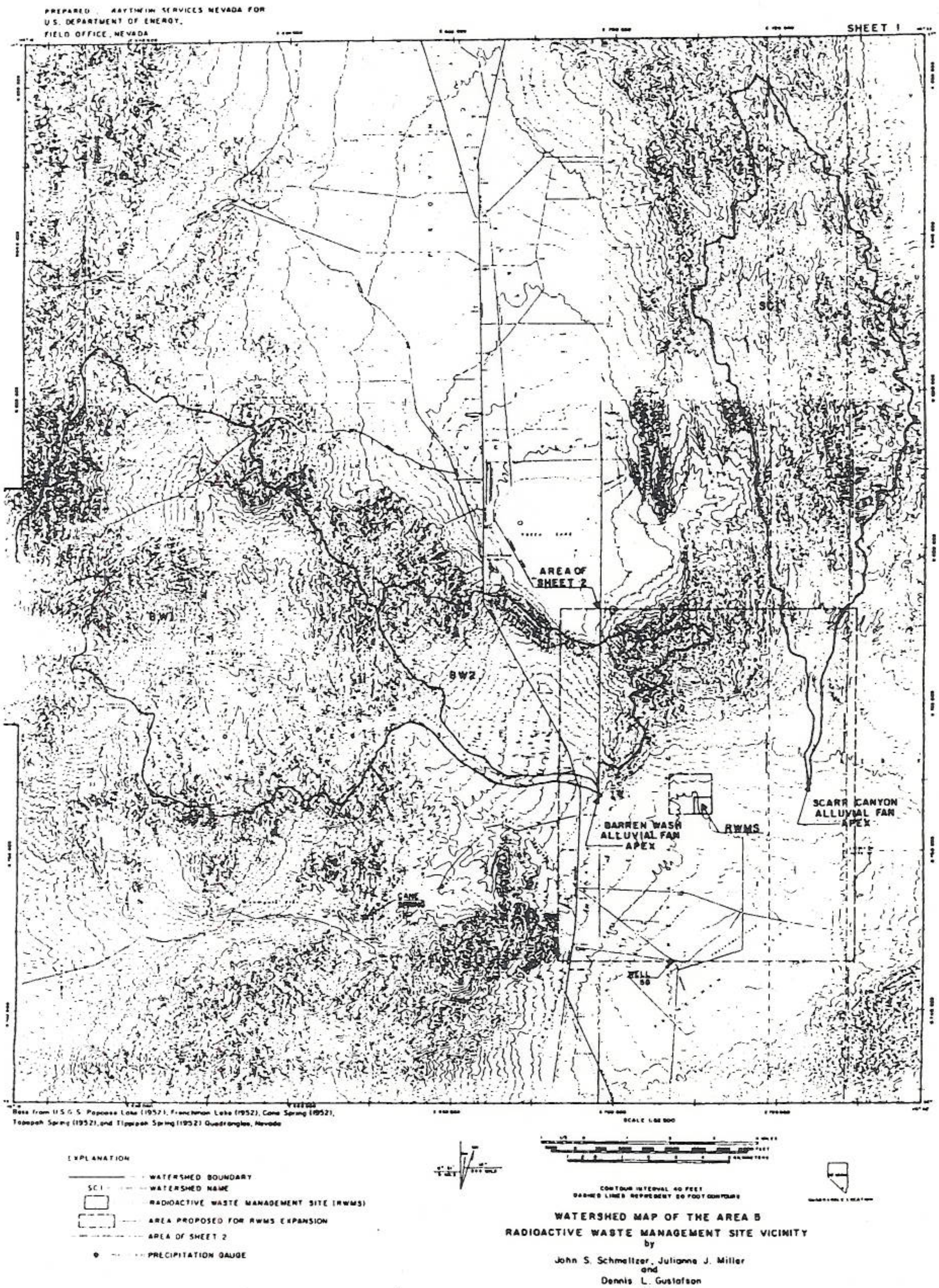
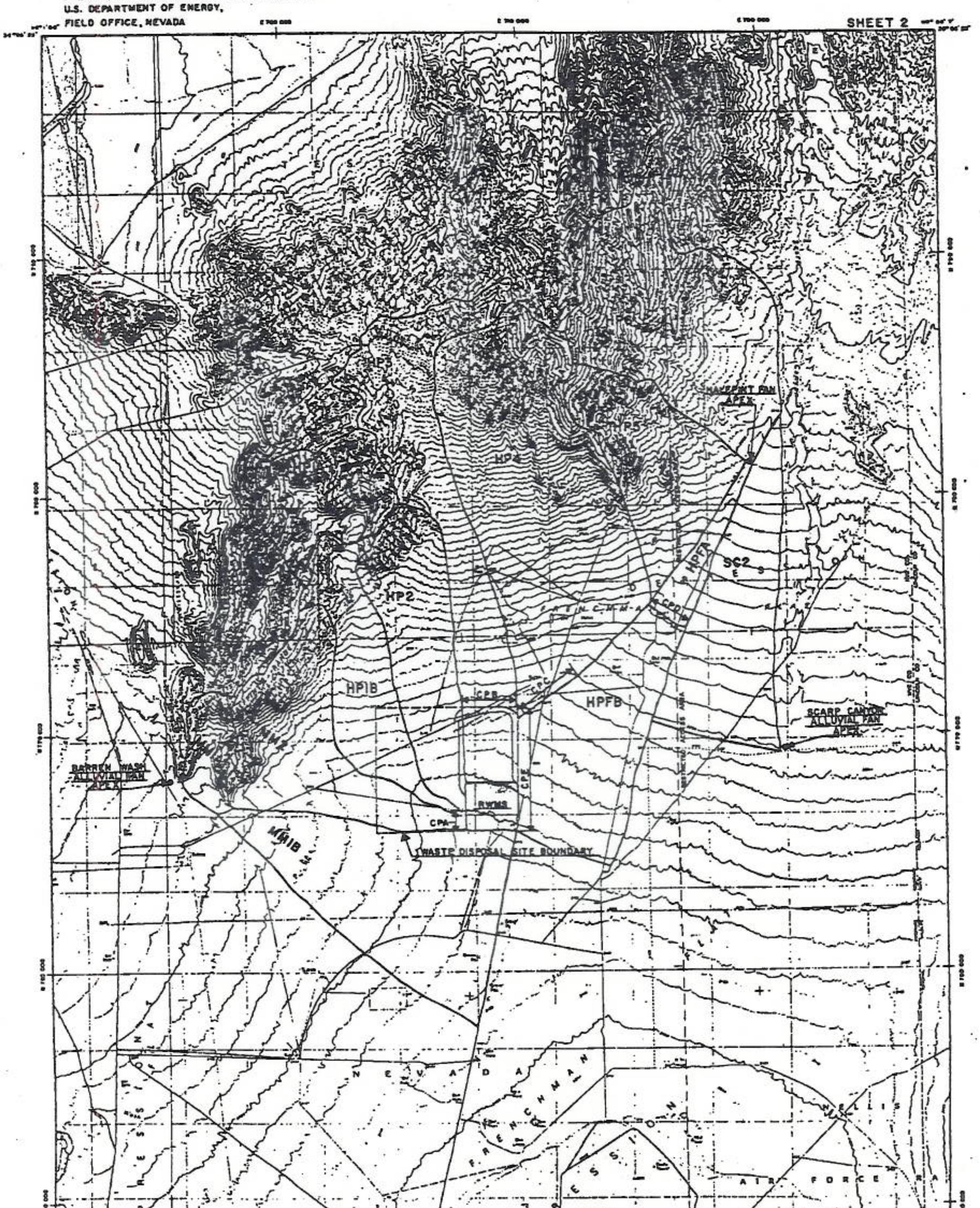


Figure 2. **Watershed Map of the Area 5 Radioactive Waste Management Site Vicinity (Sheet 1).** The overall watershed is divided into 16 subbasins; 13 are shown here, with the remainder shown on Figure 3 (Sheet 2).

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



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

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.

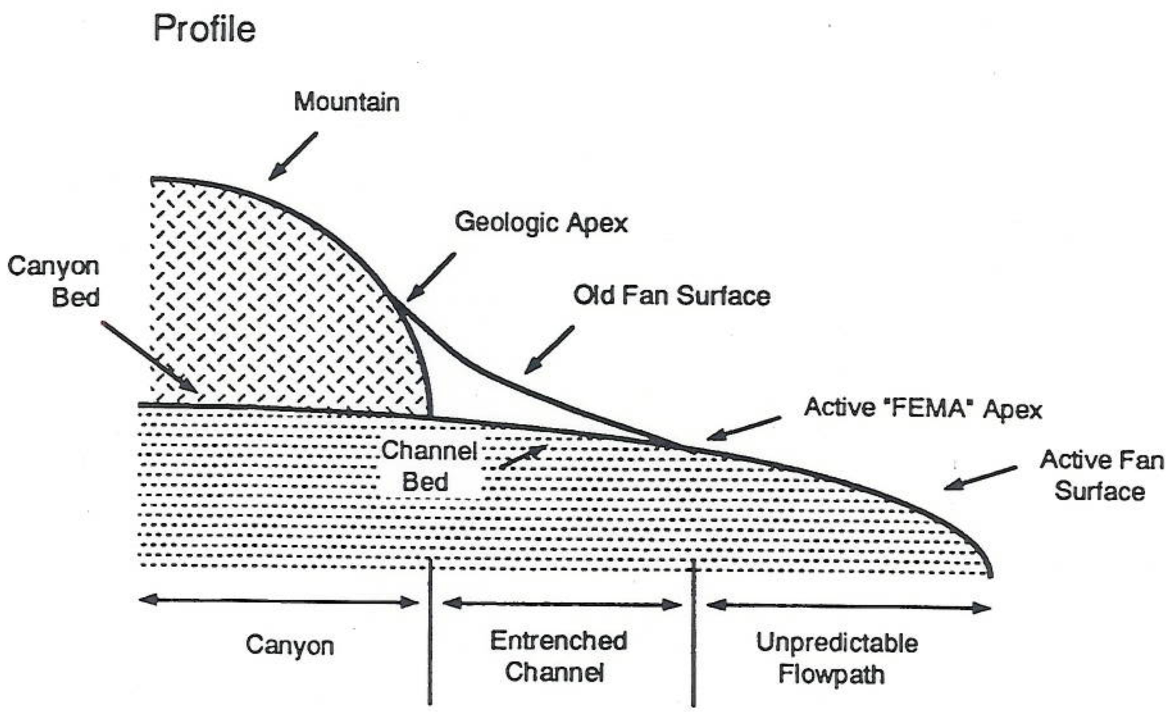


Figure 4. **Idealized Alluvial Fan Profile.** The geologic apex is the intersection of the mountain front and the piedmont plain. The active "FEMA" apex is the point below which the flow of the main channel becomes unpredictable.

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*.

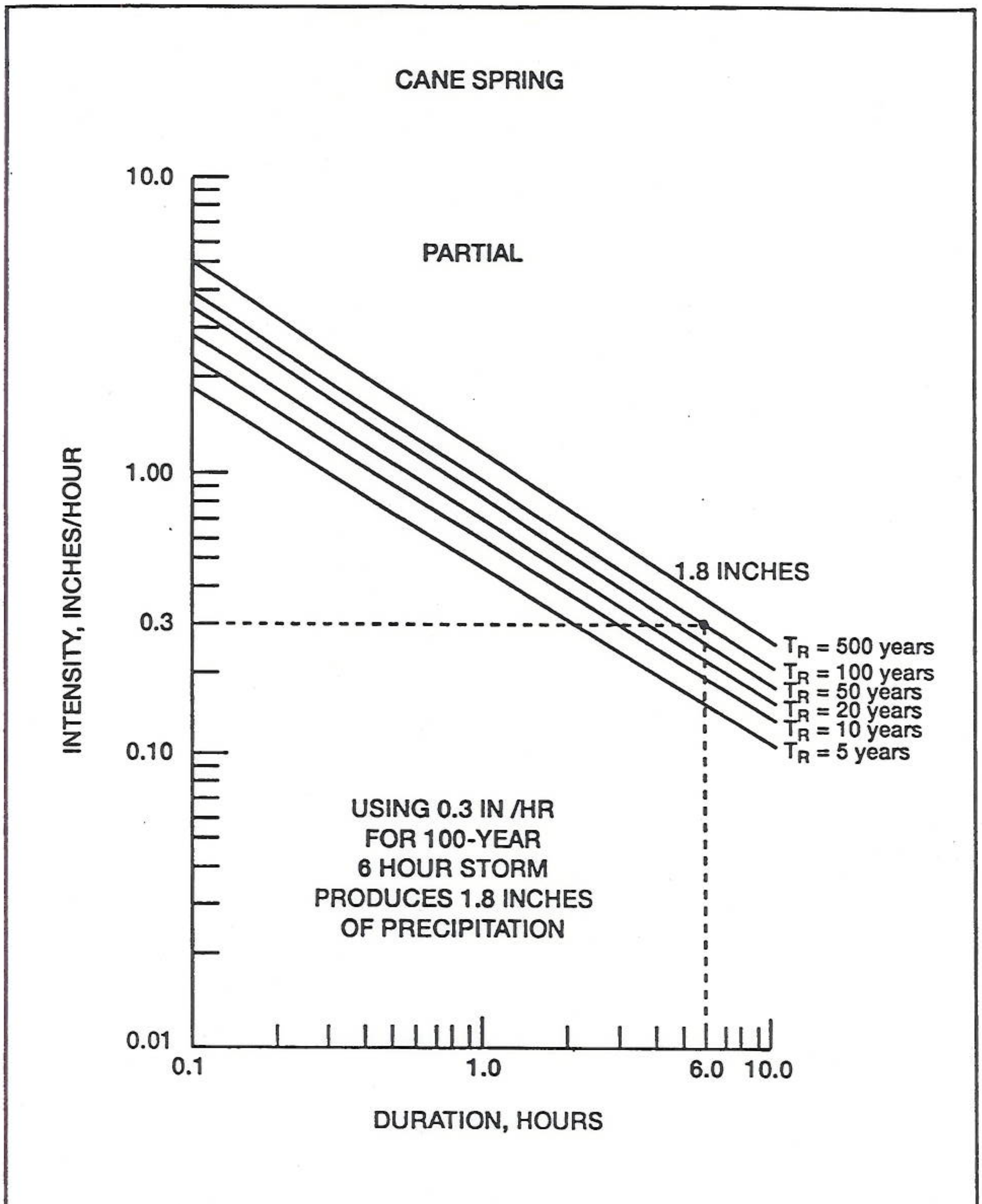


Figure 5. Intensity Duration Relationships for Various Return Periods, Cane Springs, Nevada Test Site, Nevada (modified from French, 1983). The 100–year, 6–hour point precipitation value of 1.6 inches compares well with the value from French, 1983.

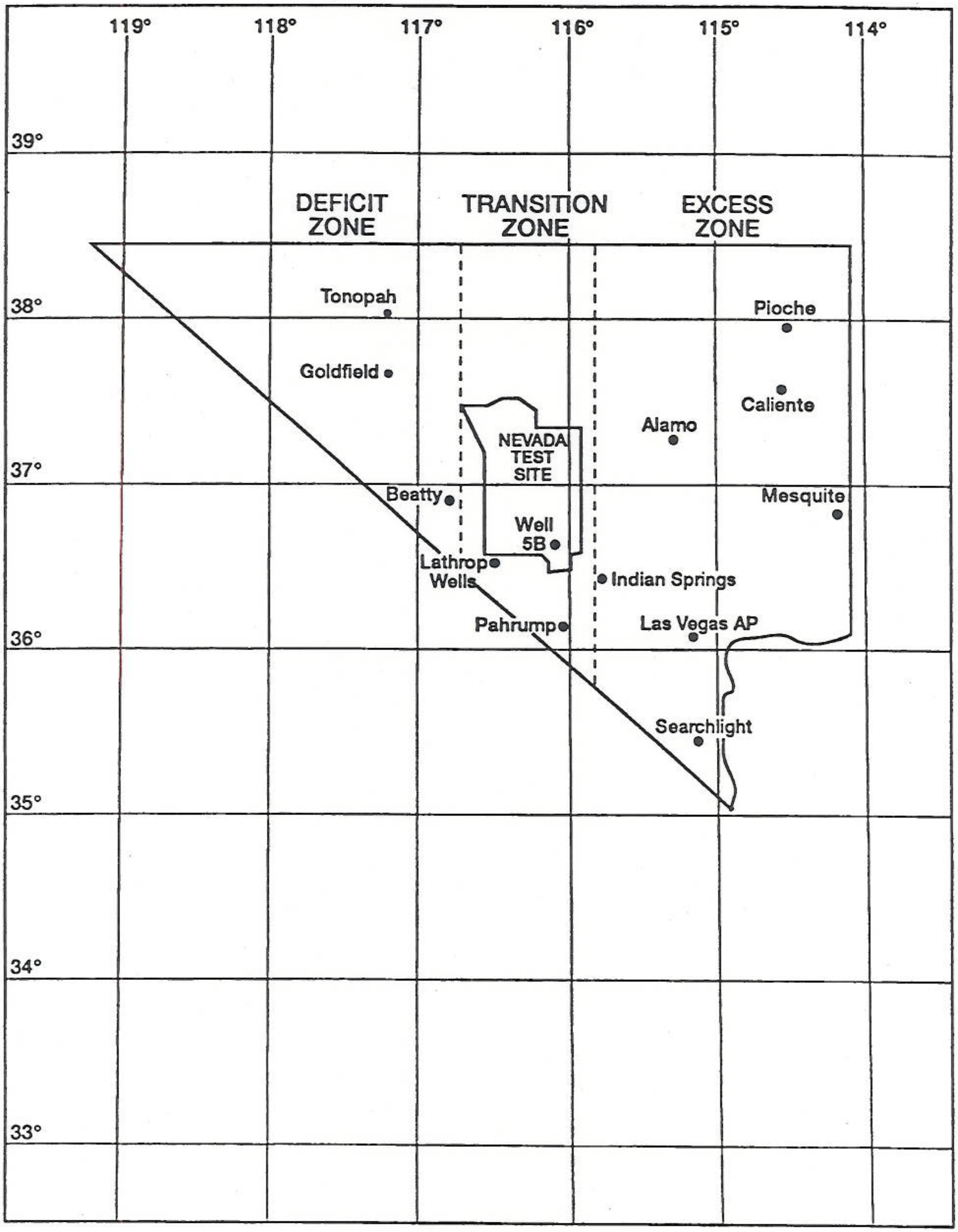


Figure 6. Hypothesized Zones of Precipitation in Southern Nevada (modified from French, 1983). The NTS is located in the transition zone of precipitation.

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)

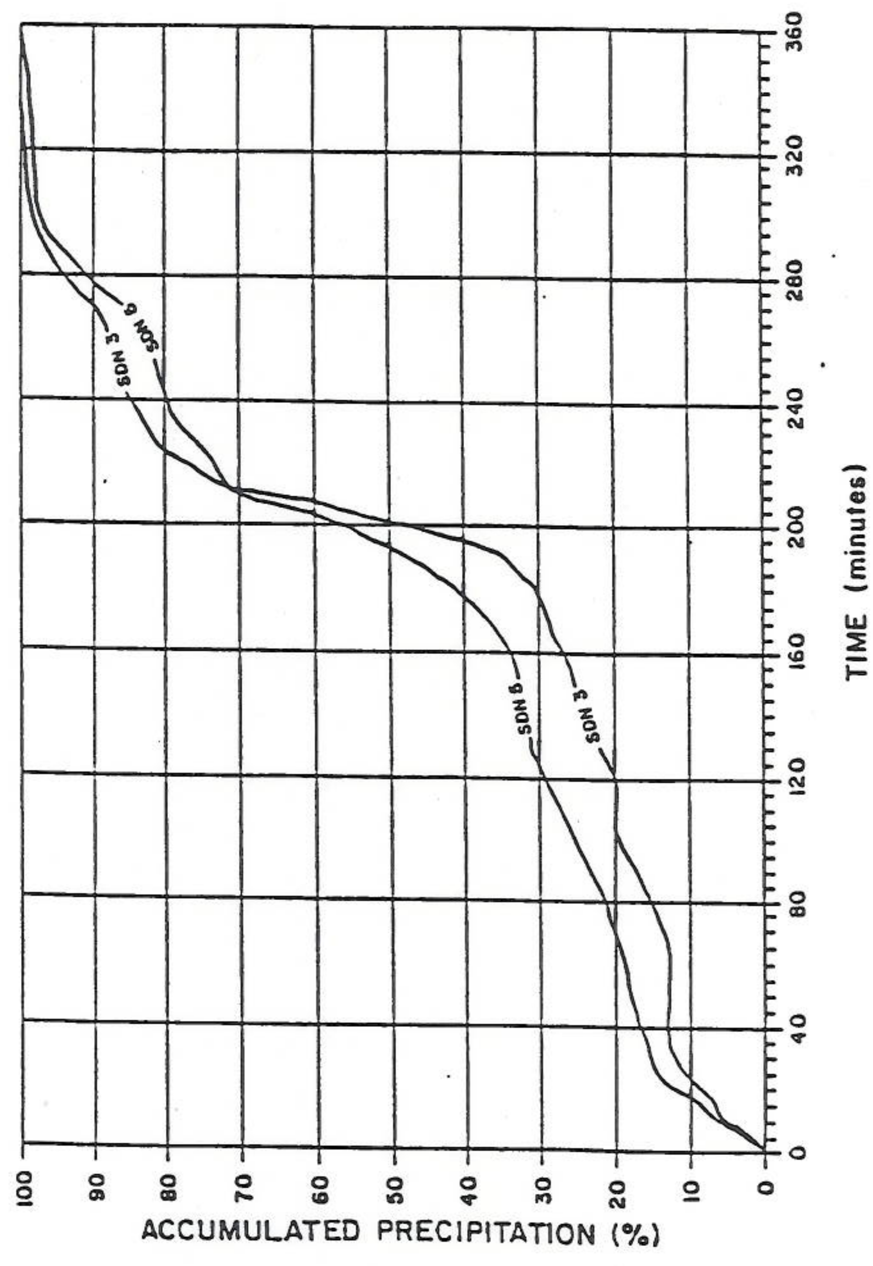
7.5-minute Topographic Quadrangles (USGS):

- 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.

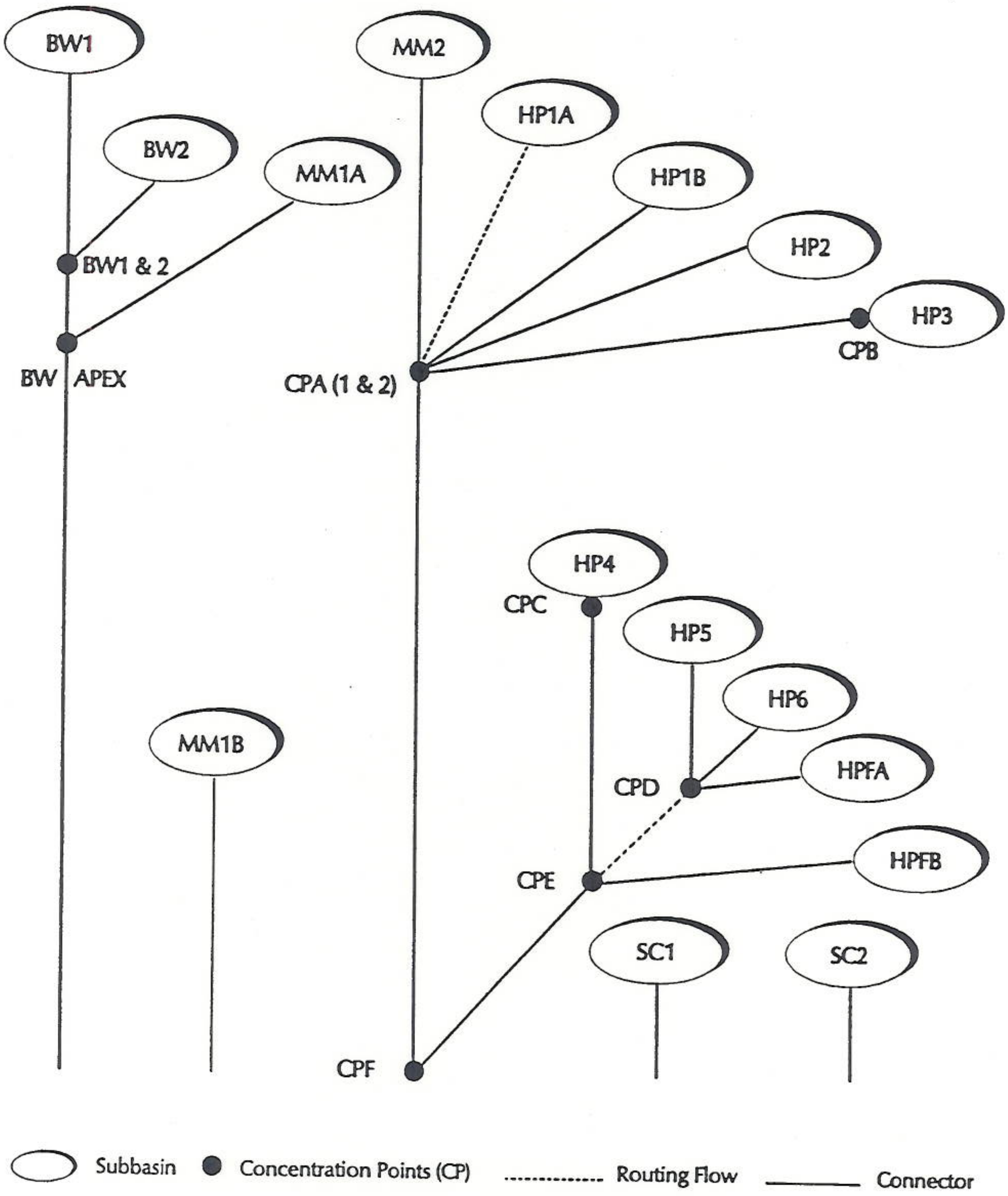


Figure 8. Schematic Diagram of Stream Network. This diagram shows how the 16 subbasins were combined in the HEC-1 models.

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

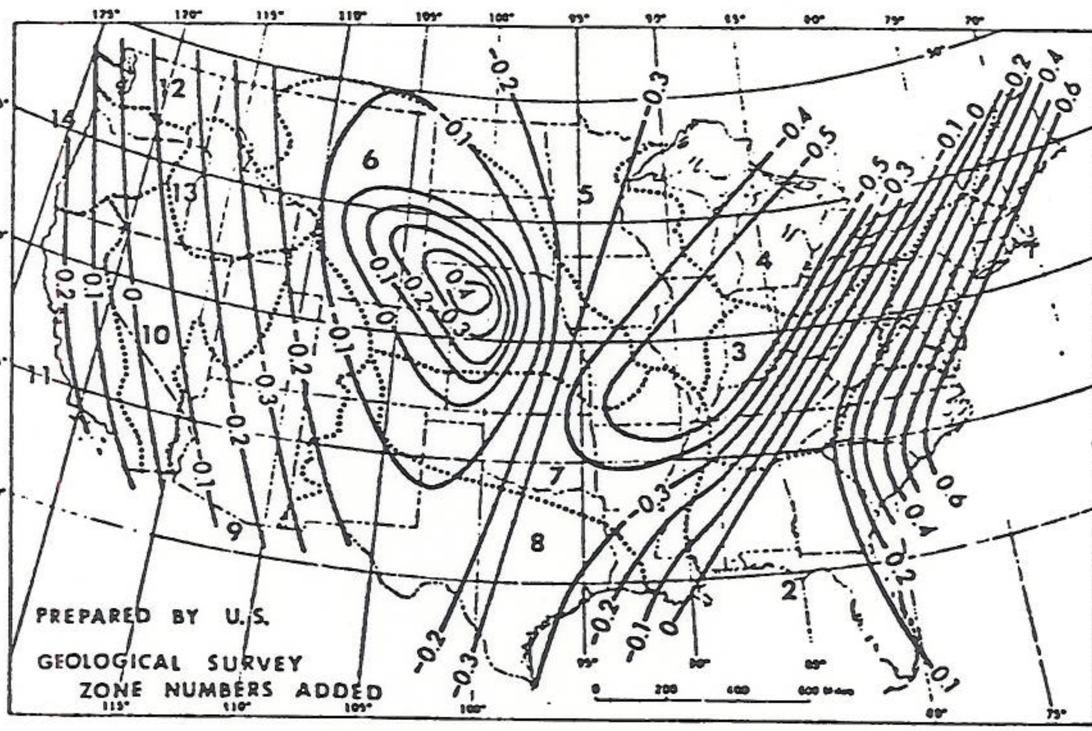


Figure 9. Generalized U.S. Skew Coefficients (WRC [1981]). The Nevada Test Site is located in an area with a zero skew coefficient value.

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.

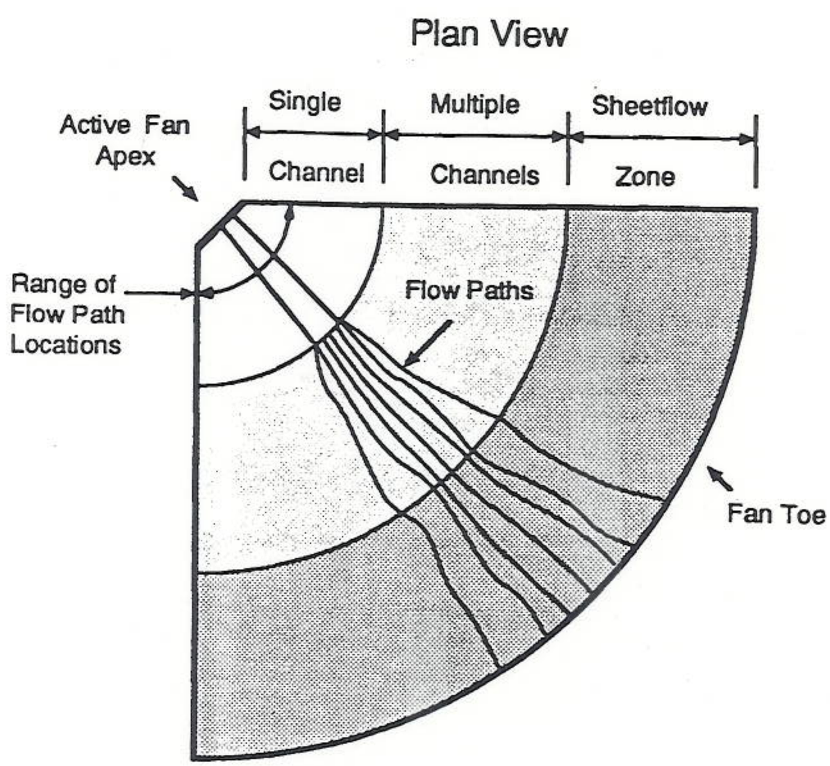


Figure 10. Alluvial Fan Plan View (modified from French, 1989). Plan view of an idealized alluvial fan showing the single channel, multiple channel, and sheetflow regions.

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

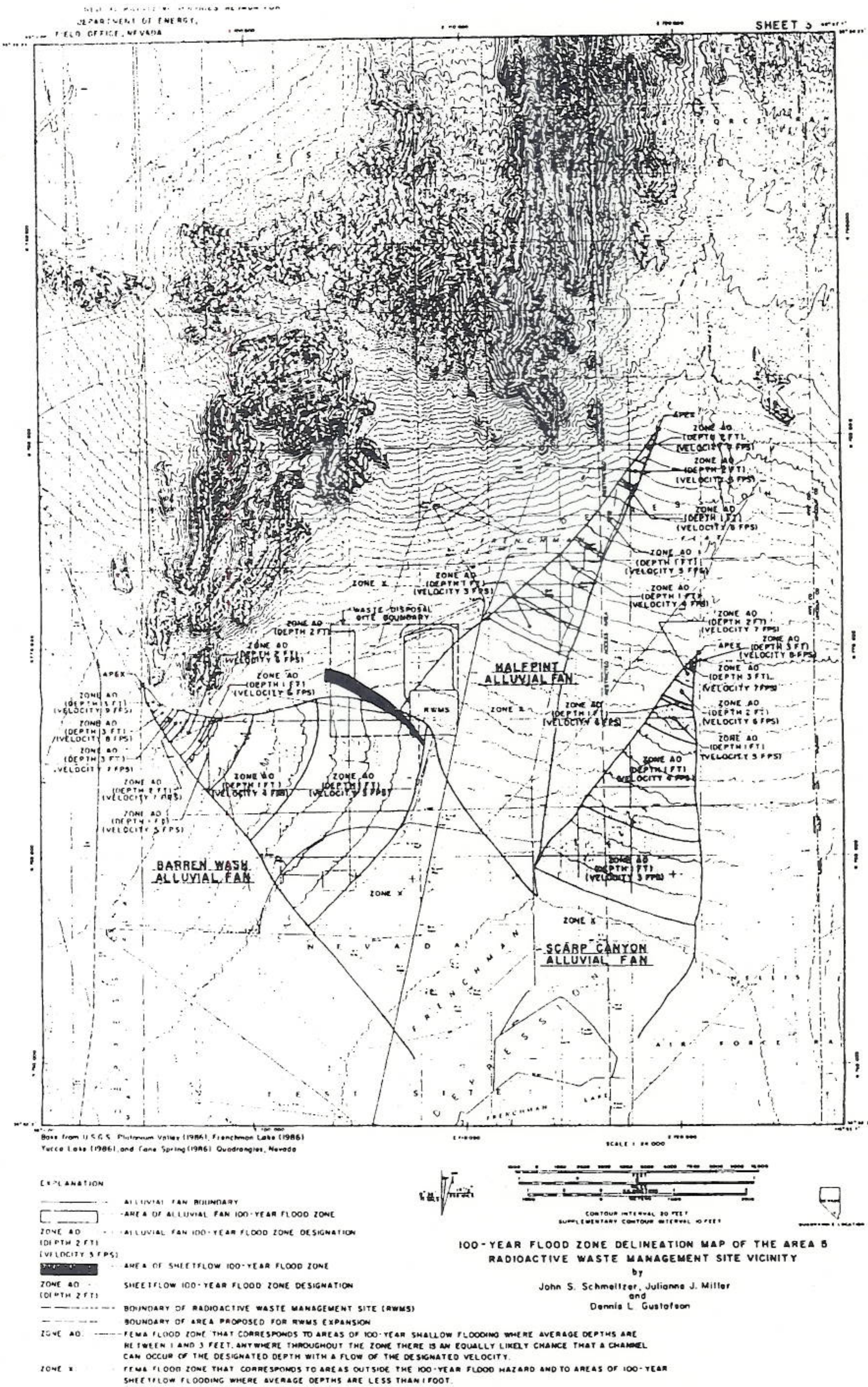


Figure 11. 100-Year Flood Zone Delineation Map of the Area 5 Radioactive Waste Management Site Vicinity (Sheet 3)

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.

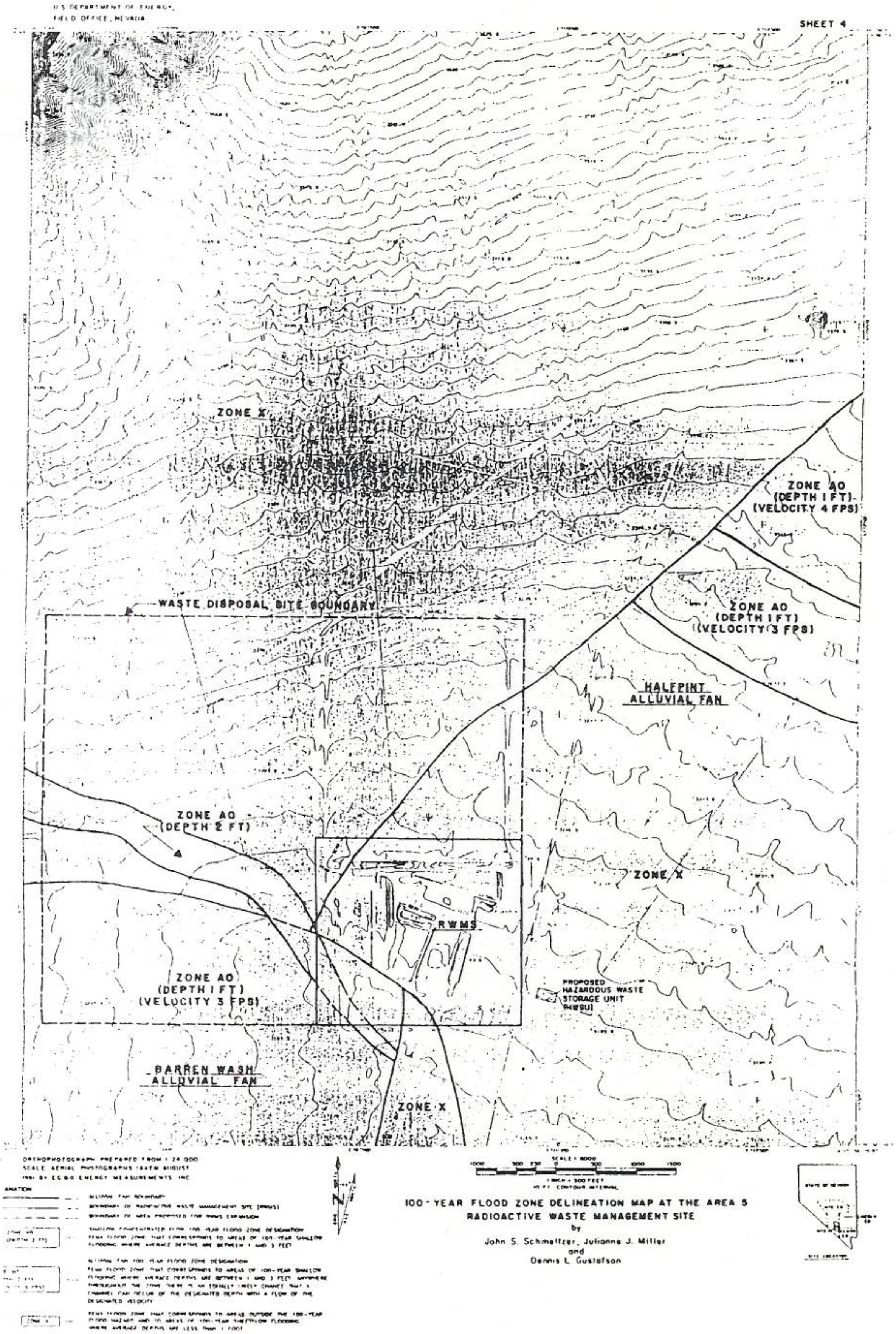


Figure 12. Orthophoto With Fans (Sheet 4)

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               *
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*  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

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

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

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

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

KK   BW1&2
KM   Combined BW1 and BW2
HC       2

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

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

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

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

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

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

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

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

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

KK    CPA2
KM    Combine HP3 with flow from CPA1
HC       2

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

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

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

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

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

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

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

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

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

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

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

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

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

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

  37        MM1A
              .
  42          .       BW1
              .        .
  47          .        .        BW2
              .        .         .
  52          .      BW1&2.......
              .        .
  55        BW APX.....
              .
  58          .      MM1B
              .        .
  63          .        .        MM2
              .        .         .
  68          .        .         .       HP1A
              .        .         .         V
  73          .        .         .         V
              .        .         .       RTCPA
  76          .        .         .         .
              .        .         .         .       HP1B
  81          .        .         .         .         .
              .        .         .         .         .       HP2
  86          .        .       CPA1........................... .
              .        .         .
  89          .        .         .       HP3
              .        .         .         .
  94          .        .       CPA2........
              .        .         .
  97          .        .         .       HP4
              .        .         .         .
 102          .        .         .         .       HP5
              .        .         .         .         .
 107          .        .         .         .         .       HP6
              .        .         .         .         .         V
 112          .        .         .         .         .         V
              .        .         .         .         .       RTCPD
 115          .        .         .         .         .         .
              .        .         .         .         .         .       HPFA
 120          .        .         .         .         .         .         .
              .        .         .         .       CPD..................
 123          .        .         .         .         V
              .        .         .         .         V
              .        .         .         .       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 21:56:35

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

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

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

COMPUTATION INTERVAL .05 HOURS
TOTAL TIME BASE 14.95 HOURS

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

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

14 PI PRECIPITATION PATTERN

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

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

0 PI PRECIPITATION PATTERN

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

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

0 PI PRECIPITATION PATTERN

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

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

25 PI PRECIPITATION PATTERN

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

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

0 PI PRECIPITATION PATTERN

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

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

0 PI PRECIPITATION PATTERN

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

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

0 PI PRECIPITATION PATTERN

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

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

 0 PI             PRECIPITATION PATTERN
```

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

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

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	MM1A	174.	3.80	30.	12.	12.	.90		
+	HYDROGRAPH AT	BW1	1786.	6.35	961.	405.	405.	60.50		
+	HYDROGRAPH AT	BW2	1016.	5.40	389.	156.	156.	20.80		
+	2 COMBINED AT	BW1&2	1848.	5.95	1003.	421.	421.	81.30		
+	2 COMBINED AT	BW APX	1841.	5.95	1004.	421.	421.	82.20		
+	HYDROGRAPH AT	MM1B	200.	4.05	47.	19.	19.	2.10		
+	HYDROGRAPH AT	MM2	184.	4.00	41.	16.	16.	1.40		
+	HYDROGRAPH AT	HP1A	200.	3.95	42.	17.	17.	.80		
+	ROUTED TO	RTCPA	190.	4.40	42.	17.	17.	.80		
+	HYDROGRAPH AT	HP1B	116.	4.05	27.	11.	11.	1.00		
+	HYDROGRAPH AT	HP2	136.	4.05	32.	13.	13.	1.20		
+	4 COMBINED AT	CPA1	459.	4.15	120.	48.	48.	4.40		
+	HYDROGRAPH AT	HP3	263.	4.10	64.	26.	26.	1.70		
+	2 COMBINED AT	CPA2	659.	4.15	170.	68.	68.	6.10		
+	HYDROGRAPH AT	HP4	360.	4.05	86.	35.	35.	3.30		
+	HYDROGRAPH AT	HP5	206.	3.80	36.	14.	14.	1.20		
+	HYDROGRAPH AT	HP6	277.	4.10	67.	27.	27.	2.20		
+	ROUTED TO	RTCPD	268.	4.35	67.	27.	27.	2.20		
+	HYDROGRAPH AT	HPFA	41.	3.85	8.	3.	3.	.30		
+	3 COMBINED AT	CPD	333.	4.25	99.	40.	40.	3.70		
+	ROUTED TO	RTCPE	326.	4.65	99.	40.	40.	3.70		
+	HYDROGRAPH AT	HPFB	167.	4.00	37.	15.	15.	1.60		
+	3 COMBINED AT	CPE	603.	4.20	191.	77.	77.	8.60		
+	2 COMBINED AT	CPF	878.	5.15	301.	121.	121.	14.70		
+	HYDROGRAPH AT	SC1	1251.	6.35	673.	283.	283.	39.40		
+	HYDROGRAPH AT	SC2	151.	4.05	35.	14.	14.	1.50		

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

HEC-1 MODEL OUTPUT

FILENAME: RWMS.OUT

(100-YEAR MODEL)

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

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

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

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

38   KK    MM1A
39   KM   Basin runoff calculation for Mass. Mountains 1A
40   BA      .9
41   LS              85
42   UD     .31

43   KK     BW1
44   KM     Basin runoff calculation for Barren Wash 1
45   BA    60.5
46   LS              88
47   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

```
1
     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)

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

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

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

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

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

           COMPUTATION INTERVAL     .05 HOURS
                TOTAL TIME BASE   14.95 HOURS

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

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

15 PI PRECIPITATION PATTERN

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

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

0 PI PRECIPITATION PATTERN

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

24 JD INDEX STORM NO. 3
STRM 2.09 PRECIPITATION DEPTH
TRDA 9.99 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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

25 JD INDEX STORM NO. 4
STRM 2.09 PRECIPITATION DEPTH
TRDA 10.01 TRANSPOSITION DRAINAGE AREA

26 PI PRECIPITATION PATTERN

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

34 JD INDEX STORM NO. 5
STRM 1.92 PRECIPITATION DEPTH
TRDA 20.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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

35 JD INDEX STORM NO. 6
STRM 1.80 PRECIPITATION DEPTH
TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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

36 JD INDEX STORM NO. 7
STRM 1.65 PRECIPITATION DEPTH
TRDA 50.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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

37 JD INDEX STORM NO. 8

STRM 1.46 PRECIPITATION DEPTH

TRDA 100.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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

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

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	MM1A	467.	3.75	77.	31.	31.	.90		
+	HYDROGRAPH AT	BW1	4883.	6.15	2699.	1141.	1141.	60.50		
+	HYDROGRAPH AT	BW2	2778.	4.40	1133.	456.	456.	20.80		
+	2 COMBINED AT	BW1&2	5498.	5.75	3049.	1282.	1282.	81.30		
+	2 COMBINED AT	BW APX	5488.	5.75	3060.	1287.	1287.	82.20		
+	HYDROGRAPH AT	MM1B	644.	4.00	136.	55.	55.	2.10		
+	HYDROGRAPH AT	MM2	526.	3.95	108.	44.	44.	1.40		
+	HYDROGRAPH AT	HP1A	444.	3.95	92.	37.	37.	.80		
+	ROUTED TO	RTCPA	420.	4.40	92.	37.	37.	.80		
+	HYDROGRAPH AT	HP1B	346.	4.00	75.	30.	30.	1.00		
+	HYDROGRAPH AT	HP2	407.	4.00	89.	36.	36.	1.20		
+	4 COMBINED AT	CPA1	1297.	4.05	317.	127.	127.	4.40		
+	HYDROGRAPH AT	HP3	661.	4.05	156.	63.	63.	1.70		
+	2 COMBINED AT	CPA2	1827.	4.10	442.	177.	177.	6.10		
+	HYDROGRAPH AT	HP4	1060.	4.00	233.	94.	94.	3.30		
+	HYDROGRAPH AT	HP5	582.	3.75	94.	38.	38.	1.20		
+	HYDROGRAPH AT	HP6	766.	4.05	174.	70.	70.	2.20		
+	ROUTED TO	RTCPD	741.	4.30	174.	70.	70.	2.20		
+	HYDROGRAPH AT	HPFA	125.	3.80	21.	9.	9.	.30		
+	3 COMBINED AT	CPD	945.	4.15	266.	107.	107.	3.70		
+	ROUTED TO	RTCPE	927.	4.55	266.	107.	107.	3.70		
+	HYDROGRAPH AT	HPFB	533.	3.95	107.	43.	43.	1.60		
+	3 COMBINED AT	CPE	1898.	4.10	537.	215.	215.	8.60		
+	2 COMBINED AT	CPF	2462.	4.05	854.	343.	343.	14.70		
+	HYDROGRAPH AT	SC1	3438.	6.15	1900.	804.	804.	39.40		
+	HYDROGRAPH AT	SC2	478.	4.00	101.	41.	41.	1.50		

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

HEC-1 MODEL OUTPUT

FILENAME: RWMS10.OUT

(10-YEAR MODEL)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

  37       MM1A
              .
              .
  42          .       BW1
              .         .
              .         .
  47          .         .       BW2
              .         .         .
              .         .         .
  52          .     BW1&2..........
              .         .
              .         .
  55     BW APX..........
              .
              .
  58          .      MM1B
              .         .
              .         .
  63          .         .       MM2
              .         .         .
              .         .         .
  68          .         .         .      HP1A
              .         .         .         V
              .         .         .         V
  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  22:05:10 *                    *         (916) 756-1104                *
*                                       *                    *                                       *
*****************************************                    *****************************************



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

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

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

                COMPUTATION INTERVAL     .05 HOURS
                     TOTAL TIME BASE   14.95 HOURS

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

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

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

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

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

23 JD INDEX STORM NO. 3
STRM .95 PRECIPITATION DEPTH
TRDA 9.99 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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

24 JD INDEX STORM NO. 4
STRM .95 PRECIPITATION DEPTH
TRDA 10.01 TRANSPOSITION DRAINAGE AREA

25 PI PRECIPITATION PATTERN

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

33 JD INDEX STORM NO. 5
STRM .87 PRECIPITATION DEPTH
TRDA 20.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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

34 JD INDEX STORM NO. 6
STRM .81 PRECIPITATION DEPTH
TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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

35 JD INDEX STORM NO. 7
STRM .75 PRECIPITATION DEPTH
TRDA 50.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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

36 JD INDEX STORM NO. 8

STRM	.66	PRECIPITATION DEPTH
TRDA	100.00	TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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

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

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

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

HEC-1 MODEL OUTPUT

FILENAME: RWMS10C.OUT

(10-YEAR MODEL)

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

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

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

```
  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
```

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

```
                  FLOOD ASSESSMENT FOR RWMS JOB #:51056         FILE: RWMS10C.DAT
                  10-YEAR 6-HOUR STORM 1.1 INCHES
                  POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
                  ADJUSTED RAINFALL PER CORRECTION FACTOR IN CLARK COUNTY MANUAL TABLE 501
                  DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
                  CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
                  CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
                  LAG TIMES DETEMINED USING METHOD IN SECITON 606.3 IN CCRFCD, 1990
                  DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
                  THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS

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

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

                COMPUTATION INTERVAL    .05 HOURS
                     TOTAL TIME BASE  14.95 HOURS

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

14 JD          INDEX STORM NO. 1
                    STRM        1.36  PRECIPITATION DEPTH
                    TRDA         .01  TRANSPOSITION DRAINAGE AREA

15 PI            PRECIPITATION PATTERN
```

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

```
23 JD          INDEX STORM NO. 2
                    STRM        1.32  PRECIPITATION DEPTH
                    TRDA        1.00  TRANSPOSITION DRAINAGE AREA

 0 PI            PRECIPITATION PATTERN
```

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

24 JD INDEX STORM NO. 3
STRM 1.17 PRECIPITATION DEPTH
TRDA 9.99 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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

25 JD INDEX STORM NO. 4
STRM 1.17 PRECIPITATION DEPTH
TRDA 10.01 TRANSPOSITION DRAINAGE AREA

26 PI PRECIPITATION PATTERN

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

34 JD INDEX STORM NO. 5
STRM 1.07 PRECIPITATION DEPTH
TRDA 20.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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

35 JD INDEX STORM NO. 6
STRM 1.01 PRECIPITATION DEPTH
TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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

36 JD INDEX STORM NO. 7
STRM .92 PRECIPITATION DEPTH
TRDA 50.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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

37 JD INDEX STORM NO. 8

STRM .82 PRECIPITATION DEPTH

TRDA 100.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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

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

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

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

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

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

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	MM1A	108.	3.85	20.	8.	8.	.90		
+	HYDROGRAPH AT	BW1	1083.	6.40	574.	242.	242.	60.50		
+	HYDROGRAPH AT	BW2	653.	5.45	232.	93.	93.	20.80		
+	2 COMBINED AT	BW1&2	1083.	6.10	581.	244.	244.	81.30		
+	2 COMBINED AT	BW APX	1078.	6.10	581.	244.	244.	82.20		
+	HYDROGRAPH AT	MM1B	110.	4.10	28.	11.	11.	2.10		
+	HYDROGRAPH AT	MM2	110.	4.05	26.	10.	10.	1.40		
+	HYDROGRAPH AT	HP1A	139.	4.00	30.	12.	12.	.80		
+	ROUTED TO	RTCPA	132.	4.40	30.	12.	12.	.80		
+	HYDROGRAPH AT	HP1B	68.	4.10	17.	7.	7.	1.00		
+	HYDROGRAPH AT	HP2	79.	4.10	20.	8.	8.	1.20		
+	4 COMBINED AT	CPA1	278.	4.25	76.	31.	31.	4.40		
+	HYDROGRAPH AT	HP3	170.	4.15	43.	17.	17.	1.70		
+	2 COMBINED AT	CPA2	399.	4.20	108.	43.	43.	6.10		
+	HYDROGRAPH AT	HP4	210.	4.10	54.	21.	21.	3.30		
+	HYDROGRAPH AT	HP5	123.	3.85	23.	9.	9.	1.20		
+	HYDROGRAPH AT	HP6	168.	4.10	43.	17.	17.	2.20		
+	ROUTED TO	RTCPD	164.	4.40	43.	17.	17.	2.20		
+	HYDROGRAPH AT	HPFA	23.	3.90	5.	2.	2.	.30		
+	3 COMBINED AT	CPD	199.	4.30	62.	25.	25.	3.70		
+	ROUTED TO	RTCPE	196.	4.70	62.	25.	25.	3.70		
+	HYDROGRAPH AT	HPFB	93.	4.05	23.	9.	9.	1.60		
+	3 COMBINED AT	CPE	335.	4.25	116.	46.	46.	8.60		
+	2 COMBINED AT	CPF	576.	5.20	182.	73.	73.	14.70		
+	HYDROGRAPH AT	SC1	769.	6.40	408.	172.	172.	39.40		
+	HYDROGRAPH AT	SC2	84.	4.10	21.	9.	9.	1.50		

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

HEC-1 MODEL OUTPUT

FILENAME: RWMS2.OUT

(2-YEAR MODEL)

```
*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*          SEPTEMBER 1990               *
*            VERSION 4.0                *
*                                       *
*  RUN DATE  01/29/1993  TIME  22:08:57 *
*                                       *
*****************************************
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```
*****************************************
*                                       *
*  U.S. ARMY CORPS OF ENGINEERS         *
*  HYDROLOGIC ENGINEERING CENTER        *
*       609 SECOND STREET               *
*     DAVIS, CALIFORNIA 95616           *
*         (916) 756-1104                *
*                                       *
*****************************************
```

```
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
                                                RTCPA
  73         .           .           .            .
             .           .           .            .          HP1B
  76         .           .           .            .            .
             .           .           .            .            .          HP2
  81         .           .           .            .            .           .
             .           .           .            .            .           .
  86         .           .         CPA1.......................................
             .           .           .
  89         .           .           .          HP3
             .           .           .            .
  94         .           .         CPA2...........
             .           .           .
  97         .           .           .          HP4
             .           .           .            .          HP5
 102         .           .           .            .            .
             .           .           .            .            .          HP6
 107         .           .           .            .            .           V
                                                                           V
                                                                         RTCPD
 112         .           .           .            .            .           .
             .           .           .            .            .           .          HPFA
 115         .           .           .            .            .           .           .
             .           .           .            .          CPD......................
 120         .           .           .            .            V
                                                                 V
                                                              RTCPE
 123         .           .           .            .              .
             .           .           .            .              .         HPFB
 126         .           .           .            .              .           .
             .           .           .          CPE..........................
 131         .           .           .            .
             .           .         CPF.............
 134         .           .           .
             .           .           .          SC1
 137         .           .           .            .
             .           .           .            .           SC2
 142         .           .           .            .

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

```
*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE   (HEC-1)   *
*           SEPTEMBER 1990              *
*             VERSION 4.0               *
*                                       *
*  RUN DATE  01/29/1993  TIME  22:08:57 *
*                                       *
*****************************************
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```
*****************************************
*                                       *
*   U.S. ARMY CORPS OF ENGINEERS        *
*   HYDROLOGIC ENGINEERING CENTER       *
*        609 SECOND STREET              *
*     DAVIS, CALIFORNIA 95616           *
*         (916) 756-1104                *
*                                       *
*****************************************
```

```
          FLOOD ASSESSMENT FOR RWMS JOB #:51056          FILE: RWMS2.DAT
           2-YEAR 6-HOUR STORM 0.7 INCHES
          POINT RAINFALL FROM NOAA ATLAS 2 VOL VII (NO ADJUSTMENT NECESSARY)
          DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
          CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCFRCD, 1990)
          CURVE NUMBERS DETERMINED USING TABLE 602 IN CCFRCD, 1990
          LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCFRCD, 1990
          DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
          THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS

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

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

              COMPUTATION INTERVAL     .05 HOURS
                   TOTAL TIME BASE   14.95 HOURS

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

13 JD         INDEX STORM NO. 1
                    STRM        .70  PRECIPITATION DEPTH
                    TRDA        .01  TRANSPOSITION DRAINAGE AREA

14 PI          PRECIPITATION PATTERN
```

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

```
22 JD         INDEX STORM NO. 2
                    STRM        .68  PRECIPITATION DEPTH
                    TRDA       1.00  TRANSPOSITION DRAINAGE AREA

 0 PI          PRECIPITATION PATTERN
```

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

```
23 JD      INDEX STORM NO. 3
             STRM         .60   PRECIPITATION DEPTH
             TRDA        9.99   TRANSPOSITION DRAINAGE AREA

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

24 JD      INDEX STORM NO. 4
             STRM         .60   PRECIPITATION DEPTH
             TRDA       10.01   TRANSPOSITION DRAINAGE AREA

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

33 JD      INDEX STORM NO. 5
             STRM         .55   PRECIPITATION DEPTH
             TRDA       20.00   TRANSPOSITION DRAINAGE AREA

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

34 JD      INDEX STORM NO. 6
             STRM         .52   PRECIPITATION DEPTH
             TRDA       30.00   TRANSPOSITION DRAINAGE AREA

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

35 JD      INDEX STORM NO. 7
             STRM         .48   PRECIPITATION DEPTH
             TRDA       50.00   TRANSPOSITION DRAINAGE AREA

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

36 JD INDEX STORM NO. 8

STRM	.42	PRECIPITATION DEPTH
TRDA	100.00	TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+ HYDROGRAPH AT	MM1A	6.	5.00	1.	0.	0.	.90		
+ HYDROGRAPH AT	BW1	22.	7.10	11.	4.	4.	60.50		
+ HYDROGRAPH AT	BW2	7.	6.00	2.	1.	1.	20.80		
+ 2 COMBINED AT	BW1&2	22.	7.10	11.	4.	4.	81.30		
+ 2 COMBINED AT	BW APX	9.	7.10	4.	2.	2.	82.20		
+ HYDROGRAPH AT	MM1B	2.	5.30	0.	0.	0.	2.10		
+ HYDROGRAPH AT	MM2	5.	5.15	1.	0.	0.	1.40		
+ HYDROGRAPH AT	HP1A	16.	4.15	4.	2.	2.	.80		
+ ROUTED TO	RTCPA	15.	4.55	4.	2.	2.	.80		
+ HYDROGRAPH AT	HP1B	3.	5.25	0.	0.	0.	1.00		
+ HYDROGRAPH AT	HP2	3.	5.25	1.	0.	0.	1.20		
+ 4 COMBINED AT	CPA1	15.	5.40	4.	2.	2.	4.40		
+ HYDROGRAPH AT	HP3	14.	5.20	4.	2.	2.	1.70		
+ 2 COMBINED AT	CPA2	23.	5.30	6.	3.	3.	6.10		
+ HYDROGRAPH AT	HP4	8.	5.25	2.	1.	1.	3.30		
+ HYDROGRAPH AT	HP5	6.	5.00	1.	0.	0.	1.20		
+ HYDROGRAPH AT	HP6	10.	5.25	2.	1.	1.	2.20		
+ ROUTED TO	RTCPD	10.	5.50	2.	1.	1.	2.20		
+ HYDROGRAPH AT	HPFA	1.	5.10	0.	0.	0.	.30		
+ 3 COMBINED AT	CPD	10.	5.40	2.	1.	1.	3.70		
+ ROUTED TO	RTCPE	9.	5.75	2.	1.	1.	3.70		
+ HYDROGRAPH AT	HPFB	2.	5.25	0.	0.	0.	1.60		
+ 3 COMBINED AT	CPE	9.	5.55	2.	1.	1.	8.60		
+ 2 COMBINED AT	CPF	25.	5.50	6.	3.	3.	14.70		
+ HYDROGRAPH AT	SC1	15.	7.10	7.	3.	3.	39.40		
+ HYDROGRAPH AT	SC2	2.	5.30	0.	0.	0.	1.50		

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

FEMA FAN MODEL OUTPUT

BARREN WASH ALLUVIAL FAN

(Model Sets 1, 2, 3 & 4)

Barren Wash Alluvial Fan: Model Set 1

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	22	22
10	510	511
100	1848	1845

MEAN = 1.042752
STANDARD DEVIATION = 1.533850
SKEW = -1.2

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 511
50-YEAR DISCHARGE = 1440
100-YEAR DISCHARGE = 1845
500-YEAR DISCHARGE = 2633

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.6502+0.5415 LOG(Q)

MEAN OF Z = 2.214841
STANDARD DEVIATION = 0.830596
SKEW = -1.200000
TRANSFORMATION CONSTANT = 4.989660

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY:		WIDTH (FT)
			Q	$44.6869\ Q^{0.5415}$	
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:		WIDTH (FT)
			Q	$44.6869\ Q^{0.5415}$	
3.5	0.4	68	0.35475	0.72986	5139
4.5	0.6	238	0.18938	0.50031	3523
5.5	0.9	649	0.07853	0.25818	1818
6.5	1.3	1496	0.01847	0.07781	548

MULTIPLE-CHANNEL REGION

SLOPE = 0.0120000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	44.6869 Q 0.5415	WIDTH (FT)
0.5	0.4	429	0.12044	0.35977	9627

..OCITY .FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	44.6869 Q 0.5415	WIDTH (FT)
3.5	0.5	1046	0.03859	0.14838	3970

Barren Wash Alluvial Fan: Model Set 2

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	22	22
10	510	508
100	3513	3523

MEAN = 1.220155
STANDARD DEVIATION = 1.237478
SKEW = -0.6

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 508
50-YEAR DISCHARGE = 2234
100-YEAR DISCHARGE = 3523
500-YEAR DISCHARGE = 8018

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.3608+0.7454 LOG(Q)

MEAN OF Z = 2.270321
STANDARD DEVIATION = 0.922428
SKEW = -0.600000
TRANSFORMATION CONSTANT = 5.221557

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$22.9512\ Q^{0.7454}$	WIDTH (FT)
0.5	0.3	49	0.38603	0.75342	5552
1.5	1.0	756	0.07282	0.27335	2014
2.5	1.7	2712	0.01575	0.08826	650

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$22.9512\ Q^{0.7454}$	WIDTH (FT)
3.5	0.4	68	0.33839	0.70932	5227
4.5	0.6	238	0.17753	0.49364	3637
5.5	0.9	649	0.08326	0.30011	2211
6.5	1.3	1496	0.03427	0.16404	1209
7.5	1.7	3059	0.01310	0.07724	566

MULTIPLE-CHANNEL REGION

SLOPE = 0.0120000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY:		WIDTH (FT)
			Q	$22.9512\ Q^{0.7454}$	
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:		WIDTH (FT)
			Q	$22.9512\ Q^{0.7454}$	
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

VELOCITY (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:		WIDTH (FT)
			Q	$37.5951\ Q^{0.5415}$	
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:		WIDTH (FT)
			Q	$37.5951\ Q^{0.5415}$	
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

LOCITY (.T/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$16.1400\ Q^{0.8628}$	WIDTH (FT)
3.5	0.4	68	0.27964	0.64926	4263
4.5	0.6	238	0.13909	0.43758	2873
5.5	0.9	649	0.06377	0.27117	1780
6.5	1.3	1496	0.02760	0.16044	1051
7.5	1.7	3059	0.01232	0.08785	565

MULTIPLE-CHANNEL REGION

SLOPE = 0.0148000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$16.1400\ Q^{0.8628}$	WIDTH (FT)
0.5	0.4	443	0.08692	0.33143	8269

ELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$16.1400\ Q^{0.8628}$	WIDTH (FT)
3.5	0.4	805	0.05067	0.23920	5968
4.5	0.6	2293	0.01738	0.11285	2774

Scarp Canyon Alluvial Fan: Model Set 4

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	15	15
10	769	779
100	3438	3406

MEAN = 0.751408
STANDARD DEVIATION = 2.011177
SKEW = -1.3

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 779
50-YEAR DISCHARGE = 2597
100-YEAR DISCHARGE = 3406
500-YEAR DISCHARGE = 4925

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=2.0997+0.4540 LOG(Q)

MEAN OF Z = 2.440823
STANDARD DEVIATION = 0.913058
SKEW = -1.300000
TRANSFORMATION CONSTANT = 5.305945

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	0.4540 125.8027 Q	WIDTH (FT)
0.5	0.3	49	0.38263	0.81739	6120
1.5	1.0	756	0.10286	0.37538	2811
2.5	1.7	2712	0.01841	0.09197	689

LOCITY rT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	0.4540 125.8027 Q	WIDTH (FT)
3.5	0.4	68	0.34751	0.78692	5892
4.5	0.6	238	0.21491	0.61188	4582
5.5	0.9	649	0.11751	0.41056	3074
6.5	1.3	1496	0.05029	0.21689	1624
7.5	1.7	3059	0.01396	0.07173	537

MULTIPLE-CHANNEL REGION

SLOPE = 0.0148000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	0.4540 125.8027 Q	WIDTH (FT)
0.5	0.4	443	0.15397	0.49326	14035

:LOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	0.4540 125.8027 Q	WIDTH (FT)
3.5	0.4	805	0.09752	0.36091	10269
4.5	0.6	2293	0.02578	0.12522	3563

FEMA FAN MODEL OUTPUT

HALFPINT ALLUVIAL FAN

(Model Sets 1, 2, 3 & 4)

Halfpint Alluvial Fan: Model Set 1

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	10	10
10	168	170
100	603	598

MEAN = 0.759609
STANDARD DEVIATION = 1.328618
SKEW = -1.1

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 170
50-YEAR DISCHARGE = 464
100-YEAR DISCHARGE = 598
500-YEAR DISCHARGE = 876

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.2765+0.5980 LOG(Q)

MEAN OF Z = 1.730742
STANDARD DEVIATION = 0.794495
SKEW = -1.100000
TRANSFORMATION CONSTANT = 3.392134

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$18.9020\,Q^{0.5980}$	WIDTH (FT)
0.5	0.3	49	0.26742	0.59475	2847

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$18.9020\,Q^{0.5980}$	WIDTH (FT)
3.5	0.4	68	0.21876	0.52204	2499
4.5	0.6	238	0.06832	0.21587	1033

MULTIPLE-CHANNEL REGION

SLOPE = 0.0196000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$18.9020\ Q^{0.5980}$	WIDTH (FT)
0.5	0.3	449	0.02168	0.08480	1543

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$18.9020\ Q^{0.5980}$	WIDTH (FT)
3.5	0.4	566	0.01212	0.04847	882

Halfpint Alluvial Fan: Model Set 2

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	10	10
10	168	169
100	1180	1176

MEAN = 0.928731
STANDARD DEVIATION = 1.055311
SKEW = -0.4

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 169
50-YEAR DISCHARGE = 731
100-YEAR DISCHARGE = 1176
500-YEAR DISCHARGE = 2890

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.0090+0.8374 LOG(Q)

MEAN OF Z = 1.786716
STANDARD DEVIATION = 0.883714
SKEW = -0.400000
TRANSFORMATION CONSTANT = 3.569505

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	10.2094 Q 0.8374	WIDTH (FT)
0.5	0.3	49	0.24808	0.57142	2878
1.5	1.0	756	0.01928	0.09924	500

VELOCITY T/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	10.2094 Q 0.8374	WIDTH (FT)
3.5	0.4	68	0.20017	0.50667	2552
4.5	0.6	238	0.07596	0.26560	1338
5.5	0.9	649	0.02353	0.11884	599

MULTIPLE-CHANNEL REGION

SLOPE = 0.0196000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$10.2094\ Q^{0.8374}$	WIDTH (FT)
0.5	0.3	449	0.03741	0.16695	3196

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$10.2094\ Q^{0.8374}$	WIDTH (FT)
3.5	0.4	566	0.02835	0.13656	2614

Halfpint Alluvial Fan: Model Set 3

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	10	10
10	168	168
100	1819	1821

MEAN = 1.016033
STANDARD DEVIATION = 0.935309
SKEW = 0.1

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 168
50-YEAR DISCHARGE = 970
100-YEAR DISCHARGE = 1821
500-YEAR DISCHARGE = 6634

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=0.7953+1.0450 LOG(Q)

MEAN OF Z = 1.857036
STANDARD DEVIATION = 0.977359
SKEW = 0.100000
TRANSFORMATION CONSTANT = 3.728261

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$6.2420\ Q^{1.0450}$	WIDTH (FT)
0.5	0.3	49	0.23709	0.56316	2963
1.5	1.0	756	0.02605	0.15414	802

VELOCITY T/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	$6.2420\ Q^{1.0450}$	WIDTH (FT)
3.5	0.4	68	0.19242	0.50416	2653
4.5	0.6	238	0.07866	0.29407	1546
5.5	0.9	649	0.03085	0.16909	883
6.5	1.3	1496	0.01313	0.09258	462

MULTIPLE-CHANNEL REGION

SLOPE = 0.0196000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY:		WIDTH (FT)
			Q	$6.2420 Q^{1.0450}$	
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:		WIDTH (FT)
			Q	$6.2420 Q^{1.0450}$	
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

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**********************************************
* HEC-2 WATER SURFACE PROFILES               *
*                                            *
* Version   4.6.2;  May 1991                 *
*                                            *
* RUN DATE    29JAN93    TIME    15:20:50    *
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****************************************
* U.S. ARMY CORPS OF ENGINEERS         *
* HYDROLOGIC ENGINEERING CENTER        *
* 609 SECOND STREET, SUITE D           *
* DAVIS, CALIFORNIA 95616-4687         *
*        (916) 756-1104                *
****************************************
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X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                        X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX   XXXXX             XXXXXXX
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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

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     .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

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    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
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HEC-2 MODEL OUTPUT

CROSS SECTIONS

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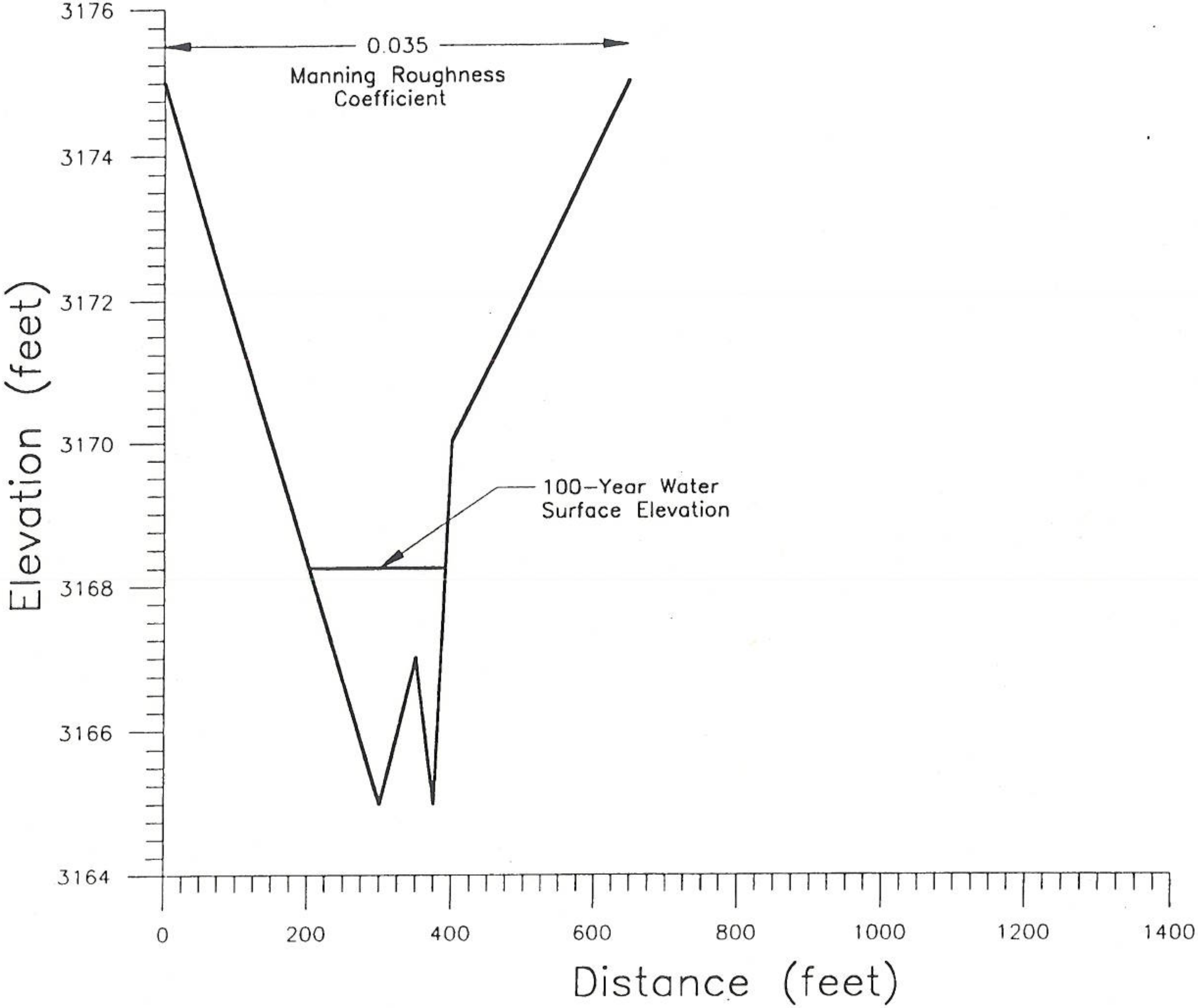

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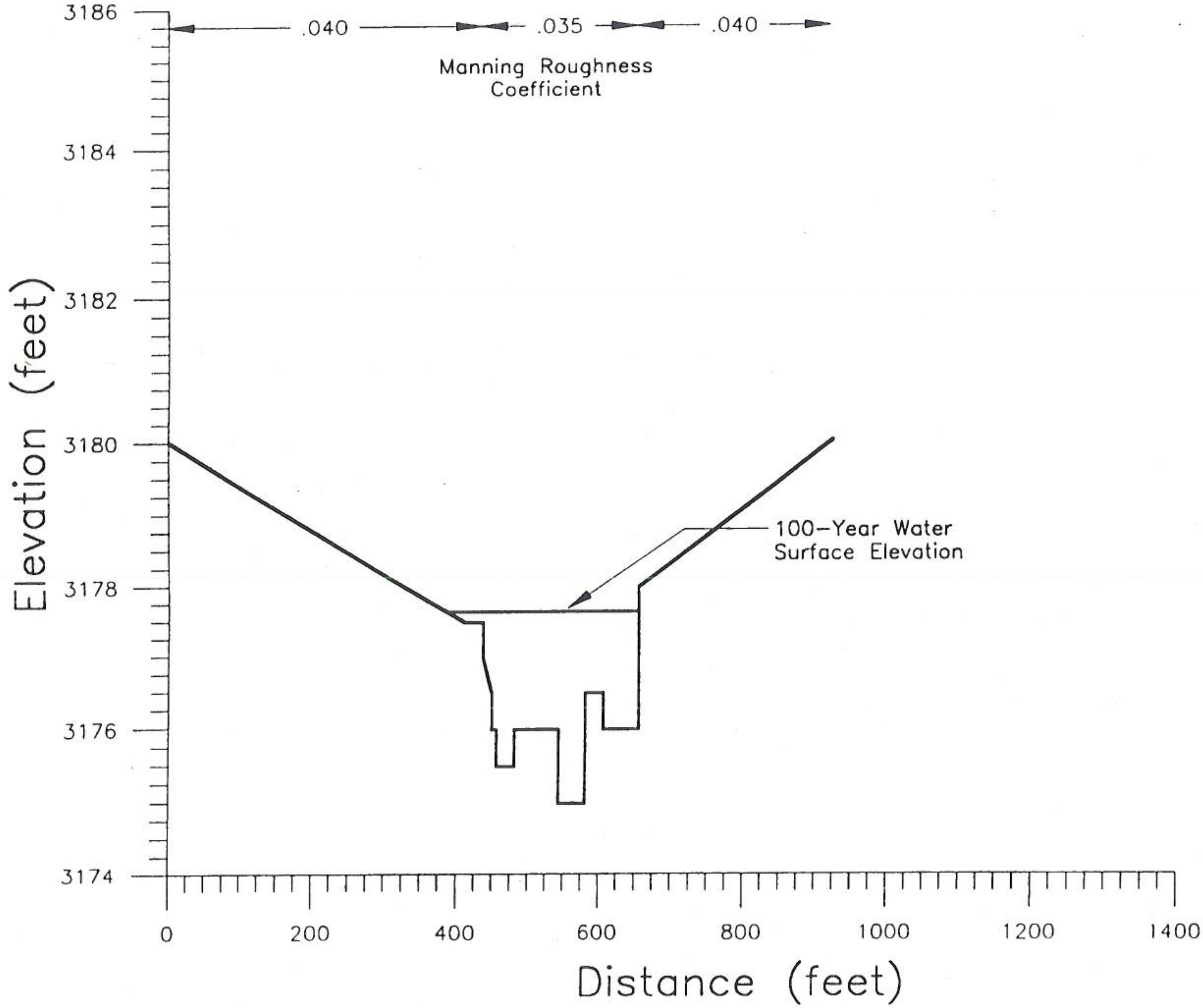

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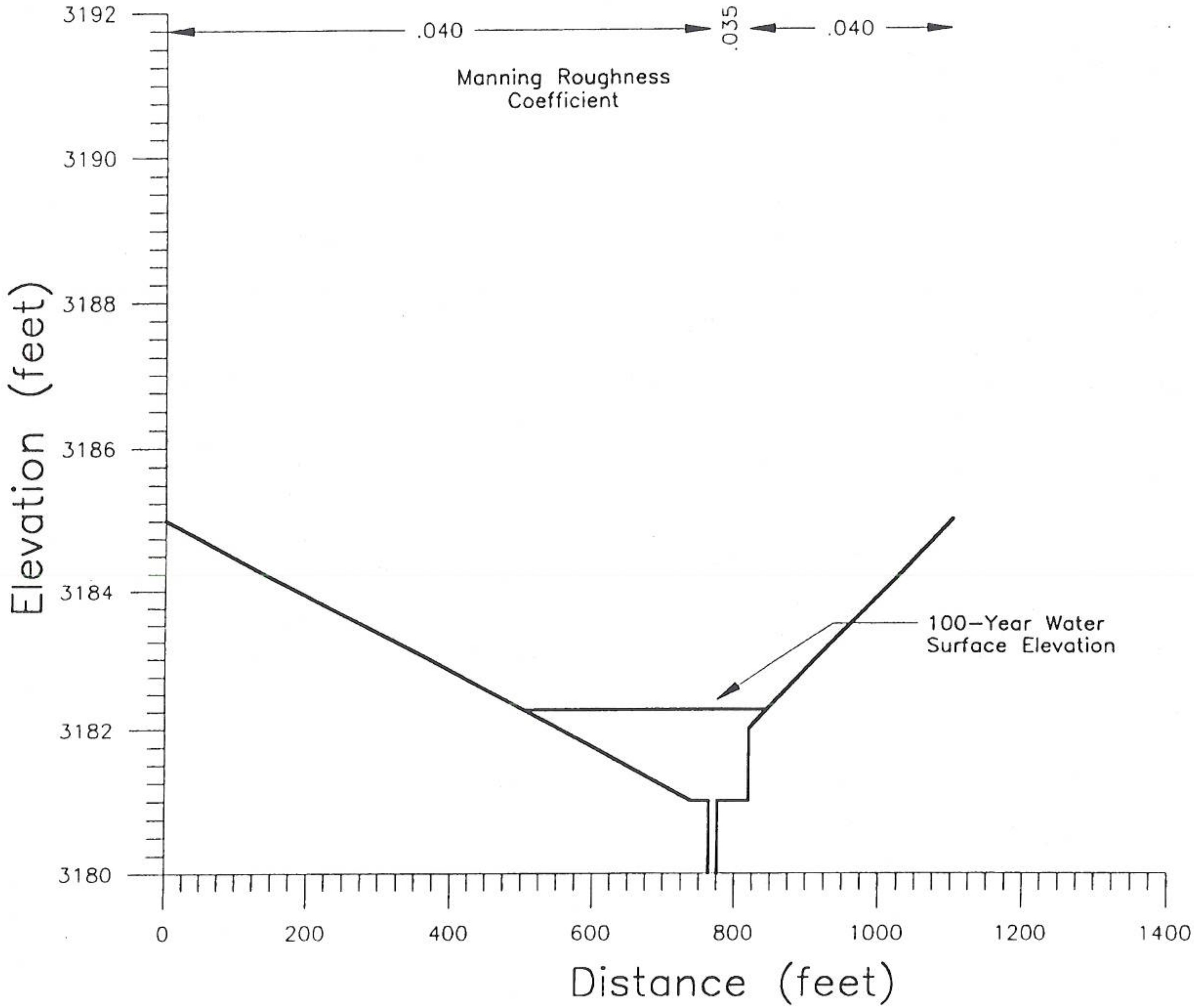

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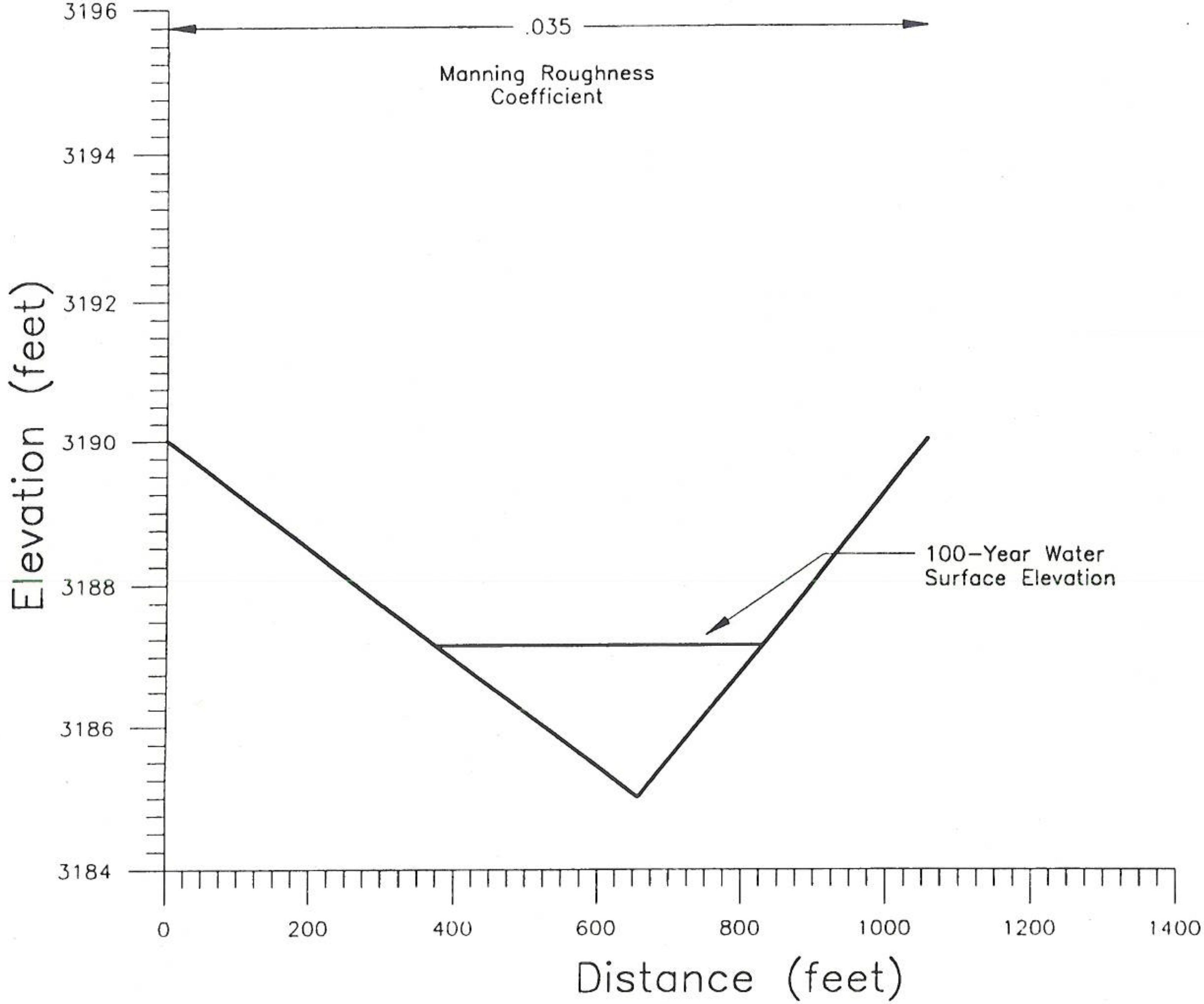

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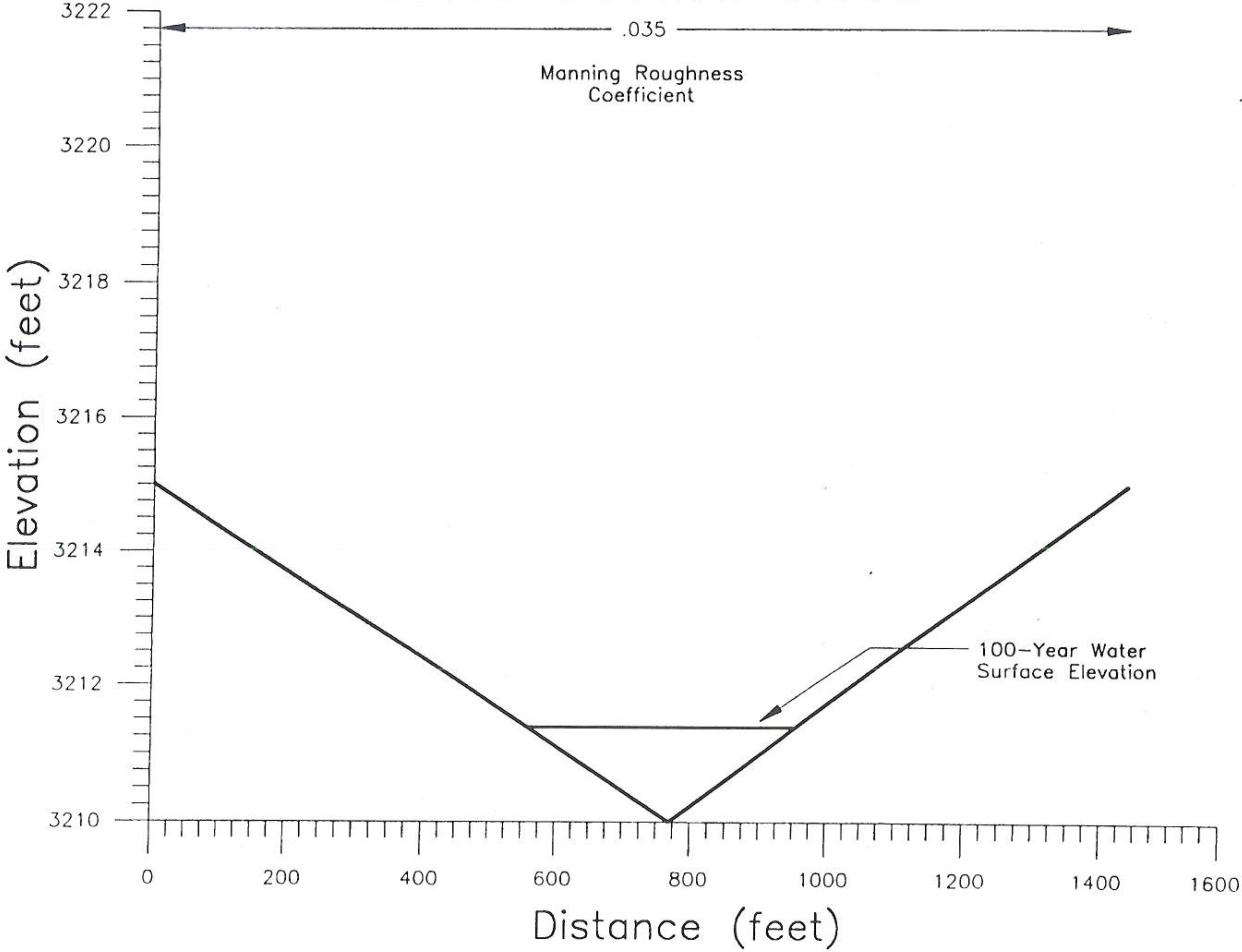

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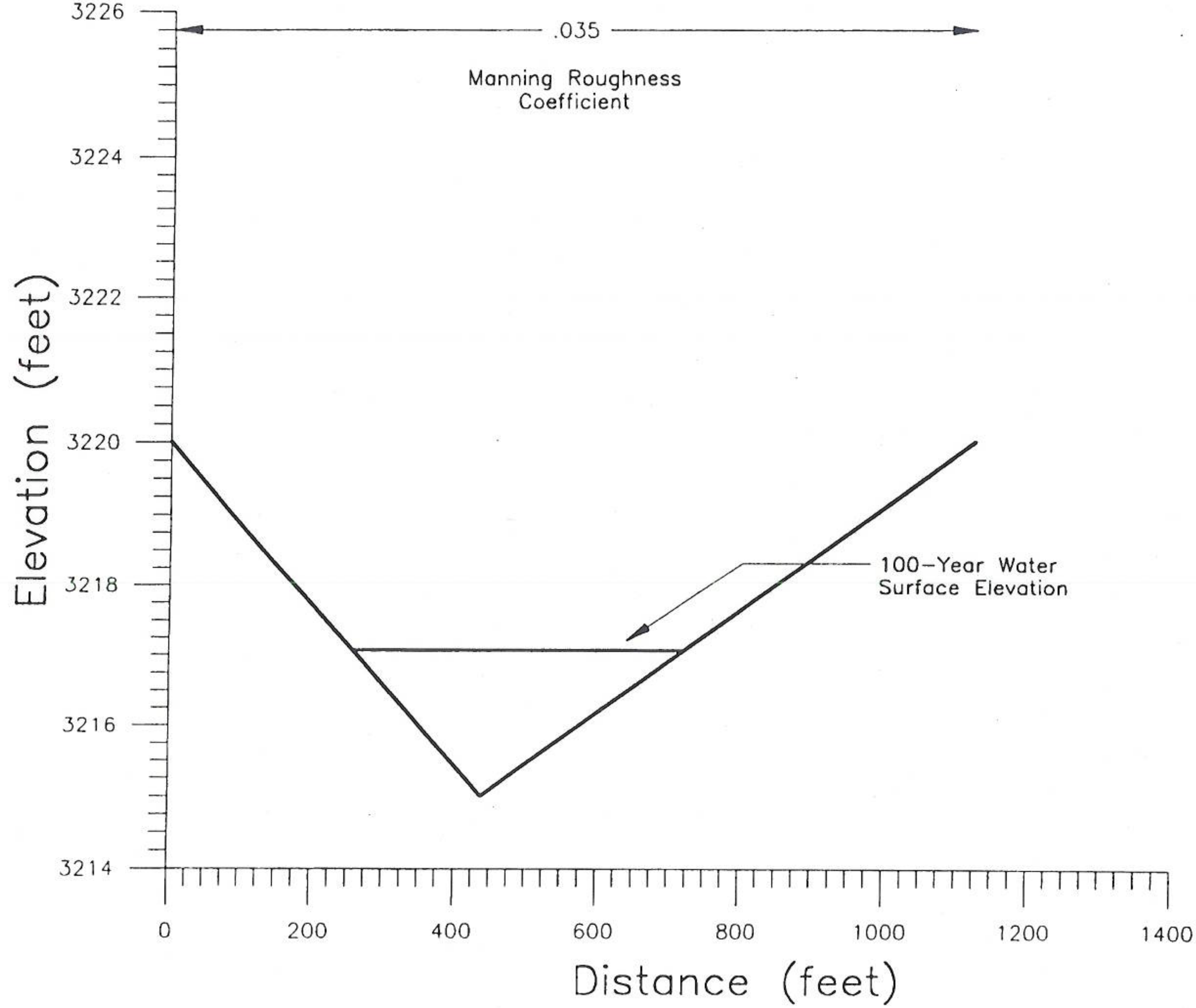

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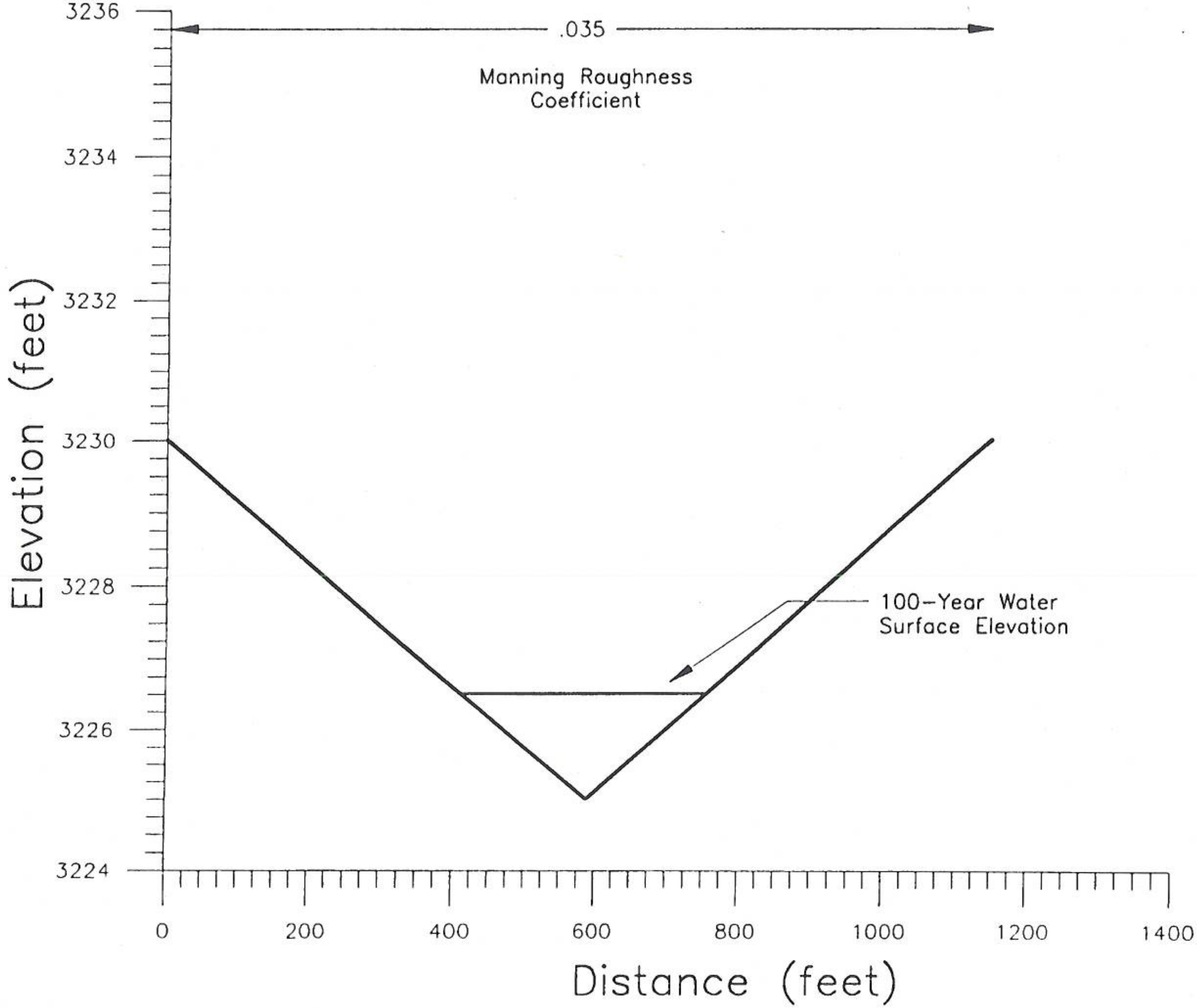

SHEETFLOW CALCULATIONS FOR THE NORTH SIDE OF THE AREA 5 RWMS

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:

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

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

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

DEPTH CALCULATION:

FLOW DEPTH = 0.22 ft

SHEETFLOW CALCULATIONS FOR THE WEST SIDE OF THE AREA 5 RWMS

CHANGE IN ELEVATION (ft)	REACH LENGTH (ft)	MANNING COEFFICIENT	SLOPE (ft/ft)	WIDTH (ft)	DISCHARGE (ft^3/sec)
100	3500	0.035	0.029	2780	450

Q=DISCHARGE (ft^3/sec)
V=VELOCITY (ft/sec)
A=AREA (ft^2) (For a rectangular channel, area = depth * width)
R=HYDRAULIC RADIUS (ft) (For a shallow channel, assume R=depth)
S=SLOPE (ft/ft)
n=MANNING COEFFICIENT
W=WIDTH (ft)
d=DEPTH (ft)

EQUATIONS:

$$Q=VA$$

$$V=\frac{1.49}{n}R^{2/3}S^{1/2}$$

$$Q=\frac{1.49}{n}R^{2/3}S^{1/2}A$$

CALCULATIONS:

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

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

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

DEPTH CALCULATION:

FLOW DEPTH = 0.10 ft

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

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

B.12.a HWSU Training Program

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 Generator Services 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 HWSU personnel that document completion of the assigned training program for their functional title. Annual reviews of training programs and qualification status for HWSU 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 Waste Generator Services office via the contractor's training database. The Waste Generator Services Manager also maintains a List of Qualified Individuals at the HWSU to ensure personnel training and qualification are current.

B.12.b Training Matrix

The information provided in Table 8, HWSU Training Matrix, includes functional title and required training for personnel assigned to perform work at the HWSU. Current functional titles and job descriptions are maintained in the Waste Generator Services Training Records.

Table 8 HWSU Training Matrix

Functional Title	Outline of Required Training
Waste Generator Services Manager (Qualification HWSO001)	Hazard Communication Hazardous Waste Site General Worker/Refresher Basic RCRA and Hazardous Waste Manifest Site-Specific Emergency Management Plan Briefing
Operations Supervisor (Qualification HWSO002)	Hazard Communication Hazardous Waste Site General Worker/Supervisor (8 hr) Basic RCRA and Hazardous Waste Manifest/Refresher Hazardous Waste Site General Worker/Refresher Site-Specific Emergency Management Plan Briefing
Field Engineer (Qualification HWSO003)	Hazard Communication Hazardous Waste Site General Worker Basic RCRA and Hazardous Waste Manifest/Refresher Hazardous Waste Site General Worker/Refresher Site-Specific Emergency Management Plan Briefing
Waste Handler (Qualification HWSO004)	Hazard Communication Hazardous Waste Site General Worker/Refresher Basic RCRA Site-Specific Emergency Management Plan Briefing

B.12.c Visitors

Visitors are not permitted within the boundaries of the HWSU without an escort or the appropriate PPE. Training requirements for HWSU visitors are reviewed on a case-by-case basis by the HWSU training director or project manager. The amount of training required for a visitor is dependent upon the task the visitor is performing, type of operations occurring at the HWSU at the time of visitation, and whether exposure to waste or hazardous constituents could occur. Visitors include inspectors, auditors, consultants, and TSDF contractors. In addition, visitors could include personnel not assigned to perform normal day-today operations at the HWSU.

Visitors will receive a facility indoctrination briefing which, at a minimum, includes the following:

- Elements of the Contingency Plan and Emergency Procedures (alarms, evacuation routes, emergency equipment, etc.)
- Hazards Communication
- Hazard Awareness and PPE Requirements

Visitors or non-assigned personnel who are performing work within the boundaries of the HWSU must receive approval from the operations supervisor because of possible exposure to waste. At a minimum, these visitors must present credentials certifying that they have successfully completed Hazardous Waste General Site Worker Training/Refresher (**29 CFR 1910.120**). They must also receive a detailed facility indoctrination briefing specific to the task to be performed, including additional hazard communication if required.

Visitors may include inspectors, auditors, vendors, consultants, and subcontractors. Visitors must sign in and out each day they are visiting.

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. [frequency - one time]

- Hazardous Waste Site General Worker/Annual Refresher **[29 CFR 1910.120 and 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. [frequency – annual refresher]

- 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 procedures and techniques; and the legal aspects of supervising when conducting hazardous waste operations. [frequency – one time]

- Basic RCRA and Hazardous Waste Manifest **[40 CFR 260 through 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. [frequency – annual refresher]

- Site-Specific Emergency Plan Briefing **[40 CFR 264.16]** – This course is locally presented and covers the emergency plan implementation for the HWSU. The briefing identifies local emergency coordinators, emergency equipment, evacuation/shelter-in-place procedures, and notification requirements for credible emergencies. Training is required annually.

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B.13 Closure and Post-Closure Care Plan [40 CFR 270.14(b)(13)]

This information presents the Closure and Post-Closure Care Plan for the HWSU. A description of the waste managed at the operational unit can be found in Section B.2 and the Facility Operating Record. Closure activities are subject to the requirements of **40 CFR Part 264**. A copy of this closure plan will be maintained in the Facility Operating Record. The receipt of new information concerning this proposed closure system's performance or constructability or the development of new technologies applicable to the NTS may warrant an amendment to this plan. In such instances, NNSA/NSO will amend this plan according to **40 CFR 264.112**.

Closure of the HWSU will include the following considerations:

- Use of engineering and administrative controls during closure to minimize or eliminate, to the extent necessary, the release of hazardous substances from the unit.
- Minimization of the need for maintenance.
- Protection of human health and environment during and after closure activities.

B.13.a Description of Closure

The HWSU will be clean-closed by removal of existing hazardous waste inventories and decontamination or removal of contaminated facility structures and equipment **(40 CFR 264.178)**.

Closure of the HWSU will involve the following activities:

- Containers of hazardous waste that are present at the time of closure will be removed from the unit and transported to an offsite permitted TSDF.
- The storage pad and equipment will be evaluated for the presence of hazardous waste residue. This will include a review of the HWSU Facility Operating Record to determine if documented hazardous waste releases have occurred and if adequate corrective actions were performed at the time of the release. In addition, the integrity of the concrete pad and the sealant will be visually inspected for indications of spills or contamination (discoloration, staining, etc.).
- If the HWSU Facility Operating Record or inspections of the pad and container management areas indicate possible hazardous waste contamination, samples will be collected from the suspect areas. Samples will be analyzed for volatiles, semi-volatiles, and TCLP [Toxicity Characteristic Leachate Procedure] metals. The selection of the analytical parameters mentioned above is based on the majority of the waste types that are managed at the HWSU. If sampling and analysis demonstrate the presence of any hazardous contaminant, NNSA/NSO and NDEP will agree on a cleanup standard.

B.13.a.1 Maximum Waste Inventory

The maximum amount of hazardous waste in storage at the HWSU during the operational life of the unit is estimated not to exceed 7,395,000 L (1,954,000 gal). This estimate is based on the maximum annual quantities over a 30-year period. At the time of closure, this estimate will be based on the Area 5 HWSU Facility Operating Record.

B.13.a.2 Removal of Contamination

At closure, all hazardous waste and hazardous waste residue will be removed from the unit. Any media resulting from decontamination of the HWSU equipment or the facility will be tested and disposed in compliance with the regulations in effect at the time of closure.

B.13.a.3 Closure Schedule

Table 9 depicts a closure activity schedule for the unit. Closure of the unit is anticipated to be a clean closure.

(1) Notification of Closure
The NDEP will be notified in writing 45 days before commencing closure activities and within 30 days of shipment/removal of the last known volume of hazardous waste.

Table 9 Area 5 HWSU Closure Activity Schedule

Closure Activity	Duration (days)
(1) Notify NDEP of closure	Within 45 days before commencement of closure activities and within 30 days of shipment/removal of the last known volume of hazardous waste
(2) Closure of the unit	Initiated 45 days after notification of closure and completed within 180 days of receiving the final volume of hazardous waste
(3) Certification of closure submitted to NDEP	Within 60 days after completion of closure activities

(2) Time Allowed for Closure
The final volume of hazardous waste will be shipped off site within 90 days of notification of closure. The unit will be closed within 180 days after receiving the final volume of hazardous waste.

(3) Disposal or Decontamination of Equipment, Structures, and Soils
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.

(4) Certificate of Closure
Within 60 days after closure of the unit, NNSA/NSO will certify that closure was performed according to the approved Closure Plan. This certification will be submitted to the NDEP.

B.13.a.4 Amendment to Closure Plan

An amended closure plan will be submitted to the 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 that has affected 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.

It is anticipated that if hazardous waste 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.a.5 Post-Closure Care

The HWSU will be clean-closed by removal of all hazardous waste and hazardous waste constituents; therefore, this unit will not be subject to the post-closure care requirements.

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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 (May 2005) (DOE/NV--1053-Vol 1).

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 restriction (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 Corrective Action Unit/Corrective Action Site (CAU/CAS) files, and in the U.S. Air Force Geographical Information System.

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B.15 Closure Cost Estimate [40 CFR 270.14(b)(15)]

The federal government is exempt from the financial requirements according to **40 CFR 264.140(c)**.

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B.16 Post-Closure Cost Estimate [40 CFR 270.14(b)(16)]

The federal government is exempt from the financial requirements according to **40 CFR 264.140(c)**.

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B.17 Liability Requirements [40 CFR 270.14(b)(17)]

The federal government is exempt from the financial requirements according to **40 CFR 264.140(c)**.

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

B.19.a HWSU Topographic Maps and Facility Location

Figure 3 is a topographic map with a scale of 2.5 cm (1 inch) equal to 61 m (200 ft) that illustrates the HWSU boundaries and extends a distance of 305 m (1,000 ft) outside the unit boundaries. This figure also depicts access and internal roads, fences, gates, and existing facilities. Potential surface water flows are illustrated by the 0.3m (1 ft) contour interval.

Figure 7 indicates the area utilities, including the location of water, sewer, and electrical site plans. Figure 7 also illustrates the waste loading and unloading areas; access control fencing, office trailer, material storage freight containers, and fire alarm pull box.

B.19.b Land Use

Several public land orders (PLO) withdrew land from the public domain to establish the NTS. PLO 805, issued in 1952, withdrew the land where the HWSU is located. Since then, the land has been used for national defense and energy-related testing and research purposes. In 2009 the BLM determined that a portion of the land withdrawn in Area 5 was unsuitable for return to the public domain and transferred custody to the DOE under Public Law 107-217. The NTS is not open to public entry for any purposes (agriculture, mining, recreation). Due to the nature of land use at the NTS, it is doubtful that the area will be returned to public use in the future. Certain areas in and adjacent to the Area 5 were used for atmospheric and underground nuclear weapons testing. Current land uses in the vicinity of the HWSU include low-level radioactive waste disposal, low-level mixed waste disposal, non-proliferation testing and evaluation, and hazardous material spill testing.

B.19.c Wind Rose

Wind speed and direction are provided in Figure 10, Wind Rose for HWSU. 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.

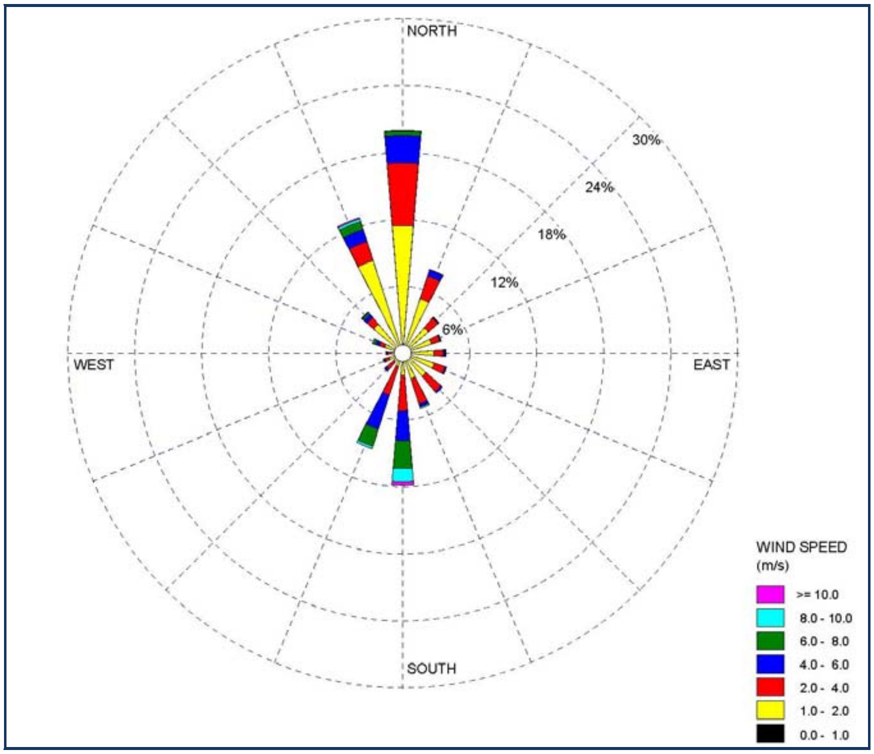

Figure 10 Wind Rose Diagram for the Area 5 RWMS Meteorology Station

B.19.d Well Locations

Figure 11, HWSU Overall Location is a drawing showing the HWSU location and the surrounding area, including nearby well locations.

B.19.e Utility Characteristics

Utilities at the HWSU are shown in Figure 7.

(1) Potable Water, Wastewater, and Fire Protection
The potable and fire protection water system for the HWSU is served by Public Water System Permit NY-0360-12NTNC. The HWSU does not generate domestic wastewater.

HWSU fire alarm pull boxes are located on the southeast and southwest corners of the storage pad. Personnel working in the HWSU have access to vehicle radio, base station 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. Power is provided to the HWSU through an underground power line.

(3) Storm Water Drainage

Precipitation from storm events that deposit water on the HWSU storage pad is allowed to evaporate. The storage pad is protected from run-on and runoff by a raised curb.

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Figure 11 Overall Location

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B.20 Additional Information [40 CFR 270.14(b)(20)]

B.20.a Operations

No wastes are accepted at the HWSU before characterization. Waste determinations are made by HWSU personnel as described in Section B.3. Wastes are containerized before shipping to the HWSU.

When conducting unloading operations of the HWSU, personnel may be required to wear the PPE specified in the HWSU operating procedures. The facility is locked at all times, except during container management, inspection, or maintenance operations. Upon entry, HWSU personnel sign the access register and containers are inspected for proper packaging, labeling, marking, and integrity; then the containers are weighed. Containers may be staged outside the chain-link cyclone fence during unloading and loading operations.

Light containers may be moved manually or with the aid of a drum dolly to the appropriate storage cell. The containers are always kept closed during storage, except during repackaging. Heavier packages may require the use of mobile cranes or forklifts.

Spill pallets provide secondary containment for both liquid and non-liquid wastes (except when consolidation is in progress). This minimizes the potential for contact between the container and any incidental precipitation ponding on the storage cells. The rows of pallets are separated by a 0.9-m (3-ft) aisle space to allow for accurate container, label, and marking inspections. Hazardous waste is stored in DOT-specification packaging or containers that meet shipping/disposal requirements of the offsite TSDF. Repackaging and consolidation occur to maximize efficiency in transportation to the TSDF. Offsite shipments are accompanied by an EPA Uniform Hazardous Waste Manifest, LDR forms, and Underlying Hazardous Constituent information.

In preparation for offsite transportation to a TSDF, HWSU personnel may consolidate and then reweigh the consolidated containers of compatible material. This information is documented in the HWSU Facility Operating Record. The Uniform Hazardous Waste Manifest **[40 CFR 262.11]**, LDR documents **[40 CFR 268 (Underlying Hazardous Constituents)]**, and each container are evaluated to ensure that EPA and DOT guidelines have been followed. Containers of hazardous waste may be secured to a pallet and then loaded into a contractor’s vehicle. The appropriate placarding is placed on the vehicle.

HWSU inspections are performed according to the inspection schedule in Section B.5 and maintained in the HWSU Facility Operating Record.

B.20.b RCRA Hazardous Waste

Hazardous waste is stored in DOT-specification packaging or containers with secured lids. Hazardous waste containers are segregated and stored in such a manner that unintended release of their contents and consequent mixing thereof does not result in a dangerous evolution of heat or gas. Packages are clearly labeled and marked according to EPA and DOT regulations. The storage unit is divided by type of hazard using a

15-cm (6-in) curb (see Section B.9). Only compatible wastes are stored together without a separating barrier **[40 CFR 264.177]**. Each storage cell of the pad is identified by a conspicuously posted sign describing the waste as **FLAMMABLE, CORROSIVE, OTHER REGULATED MATERIAL, REACTIVE,** and/or **TOXIC**. In addition, liquid and non-liquid hazardous wastes are stored on poly-spill pallets, which provide secondary containment and a supplemental segregation barrier for incompatible wastes.

Hazardous waste destined for storage at the HWSU is packaged, marked, and labeled before transport to the HWSU. If it is determined that a container does not meet the shipping or disposal requirement of the transporter or the offsite TSDF, it may be repackaged at the HWSU. Typically, compliant containers are provided at the accumulation point by HWSU personnel.

B.20.b.1 State of Nevada Hazardous Waste

PCBs must be managed as a hazardous waste if stored in a permitted storage unit. PCBs may be stored in containers of 55 gallons or less and managed as described in **40 CFR 761.65(b)(2)**. The accumulation time may not exceed one year.

B.20.c Container Management [40 CFR 270.15]

Containers that are used for the storage of hazardous waste range in size from 4 to 208 L (1 to 55 gal); any non-bulk container (less than 450 L [119 gal]) may be used as an overpack. Hazardous waste is stored in DOT-specification packaging or containers with secured lids. The type and size of container used depends upon the amount and type of waste being stored. Packages are clearly labeled and marked according to EPA and DOT regulations.

Wastes are stored in containers that are in good condition. Waste containers are inspected weekly according to the inspection schedule provided in Section B.5. If the container integrity has been compromised by a structural defect or other physical damage, the contents of the defective container are transferred to another container that is in good condition. Containers are stored on poly-spill pallets for secondary containment **[40 CFR 270.15(a)(1 and 2)]**. In the event of a breach in a package, the spillage is collected in the sump of the poly-spill pallet and a potential emergency situation is minimized.

The 0.9-m (3-ft) aisle provides adequate space for the movement of an over-pack or container is lifted and over-packed into a larger container. Any remaining spilled waste is removed from the sump of the poly-spill pallet and properly containerized. The containers are kept closed at all times except during repacking, consolidation, or inspections.

As illustrated in Figure 6, rows of pallets may be aligned and butted up to one another in a manner that maintains sufficient space for conducting inspections and accessing labels and markings from the aisle. Containers along the north edge of the pad are placed at least 0.9 m (3 ft) from the outside edge of the curb to allow for unobstructed movement. Containers on the south edge of the pad are accessible from that side; therefore, no specified aisle space is needed for access or inspection. The labels and markings of containers that cannot be moved easily are placed visibly outward facing the aisle. However, the labels and markings of containers that can be moved easily do not need to be visibly accessible from the aisle. A 0.9-m (3-ft) aisle space also exists between pallets in different segregation areas. For example, pallets in the Flammable Waste cell are located at least 0.9 m (3 ft) from the pallets in the Acid and Alkali Corrosive Waste cells.

Containers are handled with care to prevent accidents and to avoid rupture. Light containers may be moved manually or with the aid of a drum dolly and heavier packages may require the use of mobile cranes or forklifts.

Forklifts, drum lift attachments, slings, and drum dollies may be used at the HWSU to aid in the movement of containers and/or pallets. A list of emergency equipment available for use at the HWSU is provided in Section B.7.

Containers are stored within the curbed storage area; however, they may be staged outside the chain-link cyclone fence during loading and unloading operations. The requirements specified in the **Subpart CC Air Emission Standards** are met because hazardous waste is stored in DOT-specification packaging or containers with secured lids. The containers are kept closed at all times, except during repackaging, consolidation, or inspections.

B.20.d Wind Dispersal

Containers of hazardous waste stored at the HWSU are kept closed, except during repackaging, consolidation, or inspection; therefore wind dispersal effects are minimal.

B.20.e Surface Water Run-On and Runoff Control [40 CFR 15(a)(4)]

(1) Run-On

As stated in Section B.11, the HWSU is located outside the 100-year flood zone and is adequately protected from at least a 100-year, 6-hour storm and a 25-year, 24-hour storm.

The HWSU rests on an earthen pad whose floor is raised approximately 0.6 to 0.9 m (2 to 3 ft) above the surrounding grade. The storage cells of the HWSU are protected from direct precipitation by the metal roof, which extends 2.4 m (8 ft) beyond the outer edge of the curb.

(2) Runoff

Runoff is prevented by the 15-cm (6-in) containment curbs. Precipitation falling on the pad, despite the cover, is minimal and is allowed to evaporate.

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

Other federal laws that apply to operations at the HWSU include:

- *Clean Water Act* – Containers stored at the HWSU are stored on spill pallets in a segregated, curbed area. Secondary containment on spill pallets minimizes release of waste that could affect surface or ground water.

- *Clean Air Act* – Containers are kept closed while stored on the HWSU. When necessary, containers may be opened to facilitate repackaging of contents. Closed containers minimize the release of airborne contaminants to the environment.

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

An exposure information report for this operational unit is not required.

C.1 HWSU Groundwater Protection [40 CFR 270(c)]

HWSU operations constitute storage, not treatment or land disposal; therefore, a groundwater monitoring plan is not required **[40 CFR 264.90(a)(2)]**.

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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 described in Volume 1 of the Permit Application for 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.

DOE/NV/25946--1015

RCRA Part B Permit Application

Nevada Test Site

for Waste Management Activities at the NTS Explosives Disposal Unit (EODU)

May 2010

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the U.S. Government or any agency thereof.

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Acronyms

ac	Acre
AQCR	Air Quality Control Region
BLM	Bureau of Land Management
CAU/CAS	Corrective Action Unit/Corrective Action Site
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EODU	Explosives Ordnance Disposal Unit
EPA	Environmental Protection Agency
ERP	Emergency Response Procedure
FFACO	Federal Facilities Agreement and Consent Order
ft	Feet
Gal	Gallon
HA	Hectare
HWSU	Hazardous Waste Storage Unit
in	Inch
km	Kilometer
l	Liter
lb	Pound
LLMW	Low Level Mixed Waste
LLW	Low-Level Waste
m	Meter
mi	Mile
MOU	Memorandum of Understanding
MSDS	Material Safety Data Sheet
MWDU	Mixed Waste Disposal Unit
NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection
NNSA/NSO	National Nuclear Security Administration Nevada Site Office
NSTec	National Security Technologies, LLC
NTTR	Nevada Test and Training Range
NTS	Nevada Test Site
OB	Open Burn
OD	Open Detonation
OBODM	Open Burn/Open Detonation Dispersion Model
PETN	Pentaerythritol Tetranitrate
PLO	Public Land Order
RCRA	Resource Conservation and Recovery Act
RDX	Cyclotrimethylenetrinitramine
RWMS	Radioactive Waste Management Site
SAA	Satellite Accumulation Area
SWMU	Solid Waste Management Unit
TCLP	Toxicity Characteristic Leachate Procedure
TNT	Trinitrotoluene
TSP	Total Suspended Particulate
UR	Use Restriction
UXO	Unexploded Ordnance

B.1 Explosives Ordnance Disposal Unit (EODU) Permit Application [40 CFR 270.14(b)(1)]

The Area 11 Explosive Ordnance Disposal Unit (EODU) is a miscellaneous unit regulated by **Title 40 CFR 264, Subpart X**.

B.1.a EODU General Description [40 CFR 270.14(b)(1)]

The EODU, located on the Nevada Test Site (NTS), is an explosive detonation unit for the treatment of onsite-generated waste explosives, which are hazardous wastes as defined under **40 CFR 261.23(a)(6)(7)** and **(8)**; and **265.382**. Additionally, live explosives training will be conducted to ensure proficiency of the EODU operations personnel, explosives handlers, and the firing system components. Training detonations will not include waste explosives and will be limited in respect to explosives volume and frequency (see Section B.20).

[Content of one paragraph removed from public view.]

The magazine contains a satellite accumulation area (SAA) for the accumulation of waste explosives. When waste is present, this magazine is operated in compliance with the SAA or 90-day accumulation requirements of **40 CFR 262.34**. The firing point is located approximately 1423 m 4,670 ft from the detonation area.

The unit is owned by the U.S. Department of Energy (DOE), National Nuclear Security Administration Nevada Site Office (NNSA/NSO) and operated by National Security Technologies, LLC (NSTec).

B.1.b 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 or 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 for 24-hour security services (armed patrol and access control) and the Nye County Sheriff’s Office for law enforcement support on the NTS.

In addition to Resource Conservation and Recovery Act (RCRA) requirements, the EODU is subject to DOE Orders and other applicable state and federal regulations.

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.

Table 1 Metric Conversion Factors

Unit	Equals
1 hectare	2.471 acres
1 in	2.540 cm
1 kg	2.205 lb
1 L	0.264 gal
1 m	3.281 ft
1 mi^3	35.32 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-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
NY-1086	Septic System, Area 25, Reactor Control Point
NY-1087	Septic System, Area 27, Able Compound
NY-1089	Septic System, Area 12 Camp
NY-1090	Septic System, Area 6, LANL Construction Campsite
NY-1091	Septic System, Area 23, Gate 100
NY-1103	Septic System, Area 22, Desert Rock Airport
NY-1110-HAA-A	Individual Sewage Disposal System, A-12, Bldg. 12-910
NY-1112	Commercial Sewage Disposal System, U1a, Area 1
NY-1113	Commercial Sewage Disposal System, Area 1, Building 121
NY-1124	Commercial Individual Sewage Disposal System, Area 6
NY-1128	Area 6 Yucca Lake Project
NY-17-06839	Septic Tank Pumping Contractor (5 units)
GNEV93001	Water Pollution Control General Permit
NEV96021	Water Pollution Control for E-Tunnel Waste Water Disposal System and Monitoring Well ER-12-1
2287-5146	NTS Hazardous Materials Permit
2287-5147	Nonproliferation Test and Evaluation Complex Hazardous Materials Permit
NEVHW0021	NTS Hazardous Waste Management Permit (RCRA)
AP9711-2557	NTS Class II Air Quality Operating Permit
09-30	Open Burn Variance, Various Locations on the NTS
09-31	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
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

[Content of one paragraph removed from public view.]

Figure 1 General Location Map
Not available for public viewing

Figure 2 Topographic Features and Infrastructure
Not available for public viewing

Figure 3 NTS Land Use Map
Not available for public viewing

Figure 4 Aerial View of the EODU
Not available for public viewing

B.1.c RCRA Permit Application History

The Nevada Division of Environmental Protection (NDEP) issued a RCRA Part B Permit (Permit No. NEV HW009) for this facility on May 1, 1995. In addition to the requirements of RCRA, the EODU is also subject to DOE Orders and other applicable state and federal regulations.

A description of the regulated waste codes accepted for treatment (detonation) at the EODU is provided in Table 4.

B.1.d 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 Mixed Waste Disposal Unit (MWDU), Area 11 EODU, and the Area 5 Hazardous Waste Storage Unit (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).

Table 3 Operational Unit Locations and Regulatory Status

Unit Name	Location	Regulatory Status	Permit	Volume
Mixed Waste Storage Unit	Area 5 RWMS	Part B permit application submitted to NDEP (May 2010)	Pending	N/A
P18 MWDU	Area 5 RWMS	Part B permit application submitted to NDEP (September 2009)	Pending	N/A
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

- **Pit 3 MWDU**

Pit 3 MWDU is an interim status landfill that disposes of onsite and offsite containerized low-level mixed waste (LLMW) from an approved DOE nexus. 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.

- **P18 MWDU**

A permit application was submitted to the NDEP in September 2009. NDEP issued a permit in December 2009 pending approval of final construction drawings. This unit will be a hazardous waste landfill that will dispose of onsite and offsite containerized LLMW that has an approved DOE nexus.

- **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 [Content of three sentences removed from public view].

- **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 Radioactive Waste Management Site (RWMS). The process design capacity of the HWSU is approximately 61,600 liters (L) (16,280 gallons [gal]).

B.1.e General Dimensions and Structural Description

The EODU detonation area is located on a ridge top in the Massachusetts Mountains at an elevation of 1335 m (4,380 ft). The 7.3 kilometer (km) (4.5 mile [mi]) access road from the Mercury Highway rises 250 m (825 ft), traversing an alluvial fan and its source drainage to the ridge top. The following elements described in **40 CFR 270.14(b)(19)** do not exist on or within 305 m (1,000 ft) of the EODU and require no further detail.

- Run off system
- Storm, sanitary, or process sewer systems
- Buildings
- Injection or withdrawal wells
- Surface waters or intermittent streams
- Potable supply wells

The cleared pad is elevated from the surrounding terrain and bermed thus preventing run-on during precipitation events. Runoff is also limited since the detonation pit sits in a depression on the pad. The detonation pit is approximately 1 m (3.3 ft) in diameter.

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

Past inventory of waste explosives detonated at the EODU consisted primarily of water-gel (pentaerythritol tetranitrate [PETN]) and slurry explosives. Other explosives included trinitrotoluene (TNT), cyclotrimethylenetrinitramine (RDX), small arms ammunition, solid rocket propellant, and black powder. Waste explosives are generated from construction operations, research projects for national laboratories, non-proliferation testing and evaluation projects supporting counter terrorism and homeland security, and other activities related to NTS operations. Continuous mining machines used in tunneling have significantly reduced the use of water gel and slurry explosives. Small arms ammunition, legacy explosives, and waste explosive from research and testing are more likely to be detonated at the EODU (Table 4).

Table 4 General Information – Area 11 EODU

Process Code:	X01
Waste Codes:	D001, D003, D034
Estimated Quantity:	1,875 kg/yr (4,130 lb/yr)
Process Design	N/A
Capacity:	45 kg/hr (100 lb/hr)

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

Explosives and explosive materials are declared waste if they have been damaged, are defective, have exceeded their shelf life, are the result of environmental restoration (legacy), or discarded explosive material from research or testing projects.

B.3.a Physical and Chemical Characteristics

Materials accumulated and detonated at the Area 11 EODU are hazardous by their explosive nature, as defined by **40 CFR 261.23(a)(6-8) and 265.382**. This includes the explosive chemical groups consisting of primary explosives; aliphatic nitrate esters; nitroamines; nitro-aromatics; ammonium nitrate; and binary, tertiary, and quaternary explosives produced by commercial manufacturers. The chemical constituents of detonation materials that could be treated at the EODU are provided in Exhibit 1, Material Safety Data Sheets.

B.3.b Acceptable Knowledge

The hazards associated with explosives and the unique applications of different types of explosive materials at the NTS; require that the EODU Operations Supervisor make waste determinations. The term “waste explosive” has the meaning as defined in **40 CFR 265.382** or is a waste that exhibits the characteristics of reactivity as defined in **40 CFR 261.23(a)(6-8)**.

Generators of potential waste explosives are required to supply the EODU Operations Supervisor with a description of the composition and hazardous characteristics of the waste material and a description of the products of detonation for this material. In most cases, this acceptable knowledge may be provided in the form of a Material Safety Data Sheet (MSDS). In some cases, the EODU Operations Supervisor will segregate explosives designated as “waste” and reassign usable explosive material as “product” for other uses. The type and the quantity of waste explosive is recorded in the unit’s operating record, along with the MSDS or written characterization.

In addition to the MSDS examples found in Exhibit 1, examples of reactive wastes that may be treated at the EODU include, but are not limited to, those explosives presented in Table 5.

Table 5 Explosives That May be Treated as D003 Wastes at the EODU

1. Primary Explosives Lead azides Mercury fulminate Diazodinitrophenol Lead styphnate (normal) Tetracene Potassium dinitrobenzofuroxane Lead mononitroresorcinate	**2. Aliphatic Nitrate Esters** BTN (1, 2, 4-butanetriol, trinitrate) DEGN (diethylene glycol, dinitrate) Nitrocellulose Nitroglycerin Nitrostarch PETN (pentaerythritol tetranitrate) TEGN (triethylene glycol, dinitrate) TMETN (metriol tribitrate)
3. Nitramines HMX (octogen) RDX (cyclonite) EDDN (ethylenediamine dinitrate) Haleite Nitroguanidine Tetryl (tetraitromethylamulene)	**4. Nitroaromatics** Ammonium picrate DATB (1, 3-diamino-2, 4, 6-trinitrobenzene) HNAB HNS TATB (triaminotrinitrobenzene) TNT (trinitrotoluene)
5. Ammonium Nitrate	**6. Propellants**
7. Binary, ternary, and quaternary combinations of the above materials including but not limited to such items as Composition A, B, C, and D formulations and various formulations of Ednatols, Octols, Pentolites, Picratols, Tetrytols, Tritonals, Amatexes, HBXs, HTAs, Minols, Amatols, Torpexes, Ammonals, and LXs.	**8.** Any other commercially manufactured explosive, as defined in 40 CFR 265.382 that is declared a waste.

The primary explosives contain materials that are easily detonated by heat, friction, spark, or impact. Other ingredients are added to the primary explosive materials to enhance the desired property of ignition (such as percussion or spark). The resulting product, commonly called a primer, is usually attached to an initiating mechanism such as a pair of electrical leads or a fuse. In typical blasting devices, a booster (a small amount of secondary explosive material) is encased adjacent to the primer to produce a detonator or blasting cap. This secondary explosive material is less sensitive than the primary explosive material, but is more energetic (the majority of the secondary explosive material is comprised of various combinations of carbon, hydrogen, nitrogen, and oxygen, and chemically forms aliphatic nitrate esters, nitramines, nitroaromatics, and ammonium nitrates, or binary, ternary, or quaternary combinations of the above chemical forms). The booster (also adjacent to the main charge) produces sufficient energy to ensure detonation of the main charge. The main charge, also a secondary explosive, is usually less sensitive than the booster and produces the bulk of the desired explosive energy. Propellants are also comprised of many of the same secondary explosive ingredients that are specially formulated and mixed with other ingredients to produce the desired qualities. Other materials such as ammonium perchlorate, gunpowder, and various other oxidizers, fuels, stabilizers, and inhibitors are used in many of the propellants. A primer is usually present to initiate the igniters to ignite the propellant.

Waste pyrotechnic devices such as ammunition tracers, fumers, delays, fuses, igniters, initiators, flares, smoke generators, and smoke pots are also energetic reactive wastes that may be treated at the Area 11 EODU. Many of these wastes have a primary explosive material associated with the ignition of the pyrotechnic material.

The most common explosives and explosive-related materials used at NTS that may become D003 wastes include cutting tape, shaped charges, composition C4, detonating cord, squibs, blasting caps (electric and nonelectric), igniters, and small arms ammunition. D001 waste could include gun powder, (smokeless and black), water-gel blasting products, boosters, ammonium nitrate, ammonium perchlorate, and fuse materials. D034 wastes are typically related to smoke generators and smoke pots.

Also, any of these explosives and/or materials may contain plasticizers, fuels, oxidizers, retardants, burn inhibitors, binding agents, waterproofing agents, dyes, or color intensifiers.

B.3.c Ignitable, Reactive, or Incompatible Wastes [40 CFR 264.17]

Precautions to prevent accidental ignition/reaction/incompatibility include:

- Ignition sources are not permitted beyond the lower gate.
- Vehicle/handheld radios and cell phones are turned OFF at the lower gate. The EODU Supervisor is exempt from this requirement in order to maintain emergency communications.
- Explosives/reactive wastes accumulated at the EODU will remain in the original packaging when appropriate or in Department of Transportation (DOT) approved containers that are compatible with the waste.
- Accumulation containers will remain closed except when adding more waste or transferring waste to the detonation area.
- Accumulated waste is locked in the explosives magazine.
- The DOE Explosives Safety Manual Compatibility Chart (DOE M 440.1-1A) is used to determine compatibility requirements for waste explosives.
- Reactive wastes are segregated and containerized during accumulation.
- The common waste explosives detonated at the EODU are not of the type that produces flammable fumes, or gases, or uncontrolled toxic mists, fumes, dusts or gases in sufficient quantities to threaten human health or the environment.
- Waste explosives that are heat sensitive may be accumulated in a more controlled environment and only brought to the EODU for detonation.

EXHIBIT 1 EXAMPLE MATERIAL SAFETY DATA SHEETS

Material Safety Data Sheet
(MSDS-TNT)

PRODUCT IDENTIFICATION	
Product Name	TNT
Trade Names and Synonyms	2,4,6 Trinitrotoluene
Manufacturer/Distributor	Various
Transportation Emergency	**800-255-3924 (24 hrs -- *CHEM • TEL*)**

PREVENTION OF ACCIDENTS IN THE USE OF EXPLOSIVES

The prevention of accidents in the use of explosives is a result of careful planning and observance of the best known practices. The explosives user must remember that he is dealing with a powerful force and that various devices and methods have been developed to assist him in directing this force. He should realize that this force, if misdirected, may either kill or injure both him and his fellow workers.

WARNING

All explosives are dangerous and must be carefully handled and used following approved safety procedures either by or under the direction of competent, experienced persons in accordance with all applicable federal, state, and local laws, regulations, or ordinances. If you have any questions or doubts as to how to use any explosive product, **DO NOT USE IT** before consulting with your supervisor, or the manufacturer, if you do not have a supervisor. If your supervisor has any questions or doubts, he should consult the manufacturer before use.

HAZARDOUS COMPONENTS			
Material or Component	**CAS No.**	**TLV**	**PEL**
TNT (Trinitrotoluene)	38082-89-2	1.5 MG/M^3	.5 MG/M^3
N/A = Not assigned NE = Not established			

PHYSICAL DATA	
Boiling Point	464° F
Vapor Pressure	.057 MPa @ 179° F
Vapor Density	N/A
Solubility in Water	Insoluble
Specific Gravity	1.5 - 1.6
Melting Point	176°F
Evaporation Rate	N/A
Appearance and Odor	Yellow Flakes, with bitter almond odor.

HAZARDOUS REACTIVITY	
Instability	Stable
Incompatibility	No data applicable
Hazardous decomposition	Nitrous Oxide
Polymerization	Polymerization will not occur

FIRE AND EXPLOSION DATA	
Flashpoint	Not applicable
Extinguishing media	None
Special fire fighting procedures	**ALL EXPLOSIVES: DO NOT FIGHT EXPLOSIVES FIRES.** Try to keep fire from reaching explosives. Isolate area. Guard against intruders. Division 1.1 Explosives: Evacuate the area for 5000 feet (1 mile). Consult *the 2000 Emergency Response Guidebook, G*uide 112 for further details.
Unusual fire and explosion hazards	Will detonate if suitably primed by heat or flame.

HEALTH HAZARDS	
General	TNT is a Division 1.1 explosive, and detonation may cause severe physical injury, including death. All explosives are dangerous and must be handled carefully and used following approved safety procedures under the direction of competent, experienced persons in accordance with all applicable federal, state, and local laws, regulations, and ordinances. Inhalation of explosives powders may cause nervous system irregularities including headaches and dizziness. Nitrogen oxides generated during use are skin, eye, and respiratory tract irritants.
Carcinogenicity	None of the components of TNT are listed as a carcinogen by NTP, IARC, or OSHA.

FIRST AID	
Inhalation	If detonation fumes are inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth to mouth. If breathing is difficult, give oxygen and call a physician.
Eye and skin contact	Flush eyes with water. Wash skin with soap and water.
Ingestion	Induce vomiting immediately by giving two glasses of water and sticking finger down throat.
Injury from detonation	Seek prompt medical attention.

SPILL OR LEAK PROCEDURES	
Spill/leak response	Review fire and explosion hazards before proceeding with clean up. Remove all ignition sources. Wear protective equipment during clean up. Mop up with water.
Waste disposal	Dispose of in compliance with federal regulations under the authority of the *Resource Conservation and Recovery Act* (40 CFR Parts 260-271).

SPECIAL PROTECTION INFORMATION	
Ventilation	General ventilation with local exhaust in operation area.
Respiratory	Wear fitted NIOSH approved respirator, avoid dusting by keeping wet when possible .
Eye	Chemical goggles.
Gloves	Cotton or leather gloves
Other	Flame proof coveralls and conductive boots.

SPECIAL PRECAUTIONS
Refer to manufacturer's instructions and warnings supplied with product.

STORAGE CONDITIONS
Store in accordance with the requirements of *Subpart K, ATF: Explosives Law and Regulations* (27 CFR 55.201-55.219).

SHIPPING INFORMATION		
Proper shipping name	TNT	
Hazard class	1.1D	
UN Number	UN0209 (1.1D)	
DOT Label & Placard	DOT Label	EXPLOSIVE 1.1D
	DOT Placard	EXPLOSIVES 1.1

The information contained in this Material Safety Data Sheet is based upon available data and believed to be correct; however, as such has been obtained from various sources, including the manufacturer and independent laboratories, it is given without warranty or representation that it is complete, accurate, and can be relied upon. *OWEN COMPLIANCE SERVICES, INC.* has not attempted to conceal in any manner the deleterious aspects of the product listed herein, but makes no warranty as to such. Further, *OWEN COMPLIANCE SERVICES, INC.* cannot anticipate nor control the many situations in which the product or this information may be used; there is no guarantee that the health and safety precautions suggested will be proper under all conditions. It is the sole responsibility of each user of the product to determine and comply with the requirements of all applicable laws and regulations regarding its use. This information is given solely for the purposes of safety to persons and property. Any other use of this information is expressly prohibited.

For further information contact:

David W. Boston, President
OWEN COMPLIANCE SERVICES, INC.
12001 County Road 1000
P.O. Box 765
Godley, TX 76044
Telephone number: 817-551-0660
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MSDS prepared by:

Johnny R. Rodriguez, Compliance Specialist

Original publication date: 04/30/97
Review date: 2/22/06
12/03/03

The MSDS format adheres to the standards and regulatory requirements of the United States and may not meet regulatory requirements in other countries.

DUPONT SPECIALTY ELECTRIC "SQUIBS" - "S" PRODUCTS

6103CR Revised 6-OCT-2006

CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Material Identification

"SQUIBS" is a registered trademark of DuPont.

Corporate MSDS Number : DU008073

Tradenames and Synonyms

SQUIBS
S - ***
*** = Number and/or Letter Designation of Product

Tradenames and Synonyms (Remarks)

****

PREVENTION OF ACCIDENTS IN THE USE OF EXPLOSIVES

The prevention of accidents in the use of explosives is a result of careful planning and observance of the best known practices. The explosives user must remember they are dealing with a powerful force and various devices and methods have been developed to assist them in directing this force. The user should realize this force, if misdirected, may either kill or injure.

WARNING

All explosives are dangerous and must be carefully handled and used following approved safety procedures either by or under the direction of competent, experienced persons in accordance with all applicable Federal, State and local laws regulations and ordinances. If, after carefully reading the "Instructions and Warnings" leaflet inserted in each case of these products, you have any questions or doubts as to how to use any explosive product, do not use it before consulting your supervisor. If your supervisor has any questions or doubts, he should consult the manufacturer before use. See "Additional Information and References" below.

****

Company Identification

MANUFACTURER/DISTRIBUTOR
DuPont
1007 Market Street
Wilmington, DE 19898

PHONE NUMBERS
Product Information : 1-800-962-9919
Transport Emergency : CHEMTREC: 1-800-424-9300

(CHEMICAL PRODUCT/COMPANY IDENTIFICATION - Continued)

Medical Emergency : 1-800-441-3637

COMPOSITION/INFORMATION ON INGREDIENTS

Components

Material	CAS Number	%
Boron	7440-42-8	0-10
Ferric Oxide	1309-37-1	0-20
Magnesium	7439-95-4	0-35
Smokeless Powder		0-100
Barium Peroxide	1304-29-6	0-35
Black Powder		0-100
Polyvinyl Acetate	9003-20-7	0-10
*Selenium	7782-49-2	0-35
Potassium Chlorate	3811-04-9	0-35
*Lead Oxide Red	1314-41-6	0-35
*Lead Dinitroorthocresylate	79357-62-3	0-35

* Disclosure as a toxic chemical is required under Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR part 372.

HAZARDS IDENTIFICATION

Potential Health Effects

As supplied, DuPont "S" Product "SQUIBS" do not present health hazards in normal handling and use. Under reasonably foreseeable conditions of use, there is no exposure to these materials. Attempting to dismantle the shell may cause physical injury due to detonation. Upon detonation, decomposition products produced and that may be released include nitrogen oxides, lead oxides, and oxides of various metals present in the product such as magnesium, selenium, boron, copper, barium or iron.

Overexposure to nitrogen oxides may cause coughing, shortness of breath or difficult breathing.

Effects of overexposure to nitrogen oxides and other metal oxides that may be present as decomposition products include skin irritation with discomfort or rash; or eye irritation with discomfort, tearing, blurring of vision. Inhalation overexposure to the products of decomposition may cause irritation of the respiratory passages with cough, difficult breathing or shortness of breath.

Carcinogenicity Information

The following components are listed by IARC, NTP, OSHA or ACGIH as carcinogens.

(HAZARDS IDENTIFICATION - Continued)

Material	IARC	NTP	OSHA	ACGIH
Lead Oxide Red	2A	X		A3

FIRST AID MEASURES

First Aid

Contact with the product under reasonably foreseeable conditions of use do not pose a skin, eye or inhalation hazard. Get medical attention immediately if explosion causes physical injury.

INHALATION

If decomposition fumes are inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

FIRE FIGHTING MEASURES

Flammable Properties

Detonates when exposed to heat or flame.

Fire and Explosion Hazards:

Hazardous gases/vapors produced in fire are nitrogen oxides and fumes of boron, selenium, lead, magnesium and iron. Product will detonate and produces shrapnel.

Extinguishing Media

None.

Fire Fighting Instructions

Evacuate personnel to a safe area. Do not fight fire. Isolate area. Guard against intruders.

ACCIDENTAL RELEASE MEASURES

Safeguards (Personnel)

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

(ACCIDENTAL RELEASE MEASURES - Continued)

Accidental Release Measures

Control access to area and remove sources of friction, impact, heat, low level electrical current, electrostatic or RF energy. Refer to manufacturer's "Instructions and Warnings" supplied with each product shipment.

HANDLING AND STORAGE

Handling (Personnel)

Avoid breathing dust. Avoid contact with eyes, skin, or clothing. Wash thoroughly after handling. Wash clothing after use.

Storage

Store in a well ventilated place. Store in a cool place.

Storage and distribution of explosives is regulated by the U.S. Department of the Treasury, Bureau of Alcohol, Tobacco, and Firearms (BAFT). Procedural requirements are described in 25 CFR 55, "Commerce in Explosives"

EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use only with adequate ventilation. Keep away from friction impact, heat, low level electrical current, electrostatic or RF energy. Refer to the manufacturer's "Instructions and Warnings" leaflet supplied with each product shipment.

See also OSHA Lead Standard 29 CFR 1910.1025.

Personal Protective Equipment

Eye/Face : Safety Glasses.
Additional : Cotton socks and conductive soled shoes, floors and surfaces.

Exposure Guidelines

Exposure Limits
DUPONT SPECIALTY ELECTRIC "SQUIBS" - "S" PRODUCTS
PEL (OSHA) : Particulates (Not Otherwise Regulated)
15 mg/m3, 8 Hr. TWA, total dust
5 mg/m3, 8 Hr. TWA, respirable dust

Other Applicable Exposure Limits

Ferric Oxide

PEL (OSHA)	: 10 mg/m3, as Total Particulate- 8 Hr TWA
TLV (ACGIH)	: 5 mg/m3, respirable dust, 8 Hr. TWA, A4
AEL * (DuPont)	: None Established

Selenium

PEL (OSHA)	: 0.2 mg/m3, as Se, 8 Hr. TWA
TLV (ACGIH)	: 0.2 mg/m3, as Se, 8 Hr. TWA
AEL * (DuPont)	: None Established

Lead Oxide Red

PEL (OSHA)	: 0.05 mg/m3, 8 Hr. TWA, as Pb for > 8 Hrs. exposure, limit in mg/m3 = 0.4 divided by hours worked.
TLV (ACGIH)	: 0.05 mg/m3 8-hour TWA, lead, elemental and inorganic compounds as Pb, A3
AEL * (DuPont)	: 0.05 mg/m3, 8 Hr. TWA, Skin 0.05 mg of lead/dL of blood "See Human Health Effects Section"

* AEL is DuPont’s Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

PHYSICAL AND CHEMICAL PROPERTIES

Physical Data

Form: Aluminum, bronze or cardboard shells with attached insulated copper leg wires.

STABILITY AND REACTIVITY

Chemical Stability

Unstable with heat. Unstable with shock. Unstable with static charges.

Detonates with friction, low level electrical current, electrostatic or RF energy.

Incompatibility with Other Materials

Incompatible with acids and alkalies.

Decomposition

Decomposes with heat. Decomposes with shock.

Hazardous gases/vapors produced are carbon monoxide, nitrogen oxides and fumes of lead, boron, iron, magnesium and selenium. Detonation produces shrapnel.

(STABILITY AND REACTIVITY - Continued)

Polymerization

Polymerization will not occur.

DISPOSAL CONSIDERATIONS

Waste Disposal

Consult explosive manufacturer for recommended methods of destroying explosive materials. Comply with applicable Federal, State/Provincial and Local Regulations.

TRANSPORTATION INFORMATION

Shipping Information

DOT/IMO

Proper Shipping Name	: IGNITERS
Hazard Class	: 1.4S
UN No.	: 0454
DOT/IMO Label	: EXPLOSIVE 1.4S
Packing Group	: II

REGULATORY INFORMATION

U.S. Federal Regulations

TSCA Inventory Status : Reported/Included.

State Regulations (U.S.)

Warning!

This product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

OTHER INFORMATION

Additional Information

It is obviously impossible to include warnings or approved methods for every conceivable situation. A list of suggestions to aid in avoiding the more common causes of accidents is set forth in the "Instructions and Warnings" included as case inserts with the product. Additional

(Continued)

information is available in the Blasters' Handbook, published by Explosives Technology International, Inc., Ordnance Safety Manual, published by the U.S. Army Ordnance Department, and the Institute of Makers of Explosives Safety Library Publications. Copies of these IME publications may be obtained by writing the Institute of Makers of Explosives, 1120 19th Street, N.W., Suite 510, Washington, D.C. 20036-3605, or from your explosives supplier:

IME publication subjects:

- o Storage Magazines
- o Table of Distances
- o Use and Handling of Explosives
- o RF Hazards
- o Destruction of Commercial Explosives
- o Transportation

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsible for MSDS : MSDS Coordinator
> : DuPont Chemical Solutions Enterprise
Address : Wilmington, DE 19898
Telephone : (800) 441-7515

# Indicates updated section.

This information is based upon technical information believed to be reliable. It is subject to revision as additional knowledge and experience is gained.

End of MSDS

1. PRODUCT AND COMPANY IDENTIFICATION

Name: **Single-base smokeless powder, propellant**.

Trade Names and Synonyms: **Accurate:: Solo 1000, Solo 1250, 2015, 2495, 4064, 4350, 3100**

Distributed By:

WESTERN POWDERS, INC.
P.O. Box 158
Miles City, Montana 59301
Telephone: (406)234-0422
Toll Free: (800)497-1007

Transportation Emergencies – Chemtrec – 1-800-424-9300

2. HAZARD IDENTIFICATION

Emergency Overview – Danger! Extremely Flammable – Explosive.
Accidental Fire or Explosion is Likely to Cause Severe Injury or Death.
Avoid Exposure to all Sources of Heat or Flame, Electrical Sparks, Static Electricity, and Shock.

OSHA Regulatory Status - This product may be considered to be a hazardous chemical under OSHA Hazard Communication Standard 29 CFR 1910.1200.
Applicable OSHA Classifications: Explosive, Toxic, ,Skin and Eye Irritant

Potential Health Effects – Eye contact may cause irritation. Acute contact may cause skin irritation. Acute exposure may cause irritation to nose, mouth, throat and lungs. Ingestion may cause irritation to gastrointestinal tract. Nausea, vomiting and abdominal pain may also occur. Some components of this granular mixture may be absorbed directly through the skin.
Neither this product nor any of its ingredients (except Dinitrotoluene) are listed as carcinogens by OSHA, NIOSH-NTP and IARC. Per IARC 28 Dinitrotoluene is listed as possibly carcinogenic to humans.

Potential Environmental Effects: Ecological studies on this product unknown. Some components are known to be harmful to aquatic organisms

3. COMPOSITION / INFORMATION ON INGREDIENTS

COMPONENT	CAS #	wt. %
Nitrocellulose	9004-70-0	<98
Dinitrotoluene	121-14-2	0 - 16
Diphenylamine	122-39-4	0.5 – 3.0
Potassium nitrate	7757-79-1	0 – 1.5
Potassium sulfate	7778-80-5	0 – 1
Graphite	7782-42-5	1.5 max.
Ethyl Centralite	85-98-3	0 - 6
Methyl Centralite	611-92-7	0 – 2

4. FIRST AID MEASURES

EYES: Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If eye irritation develops, call a physician.

Section 4 - Continued

SKIN : Immediately wash with soap water for at least 15 minutes. Call a physician if needed. If clothing comes in contact with the product, the clothing should be removed immediately and should be laundered before re-use.

INGESTION: Immediately drink large quantities of water. Induce vomiting. Call a physician at once. When vomiting occurs, keep head lower than hips to help prevent aspiration. DO NOT give anything by mouth if the person is unconscious or if having convulsions.

INHALATION:

- If person experiences nausea, headache or dizziness, person should stop work immediately and move to fresh air until these symptoms disappear. If breathing is difficult, administer oxygen, keep person warm and at rest. Call physician.
- In event that an individual inhales enough vapor to lose consciousness, person should be moved to fresh air at once and a physician should be called immediately. If breathing has stopped, artificial respiration should be given immediately.
- In all cases, ensure adequate ventilation and provide respiratory protection before the person returns to work.

5. FIRE FIGHTING MEASURES

DANGER!! **Extremely Flammable – Explosives**
Accidental Explosion May Cause Severe Injury or Death
Evacuate the area immediately in case of emergency.

FLASH POINT: Not Determined
FLAMMABLE LIMITS: Not Determined
AUTOIGNITION TEMPERATURE: 160°C – 180°C (320° F - 360°F)
No explosion – 5 hours at 120°C (248°F)

EXTINGUISHING MEDIA:
Apply large volumes of water as quickly as possible from automatic sprinklers or with fire hose from a distant, protected location. FIGHT EXPLOSIVE FIRES ONLY FROM WELL PROTECTED, DISTANT (FROM POINT OF FIRE) LOCATION. Since product is self-oxidizing, smothering agents such as dry chemical, carbon dioxide, or foam are ineffective.

PERSONAL PROTECTION FOR FIREFIGHTING
Self contained breathing apparatus (SCBA) and protective clothing, to include impervious boots, gloves, hard hat, and chemically impermeable suit. Eye and face protection. Wash all clothing prior to reuse.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
Product is self oxidizing. Products are propellant explosives and are extremely flammable and readily ignited. Protect from fire, sparks, impact and high temperatures.
DO NOT move or approach containers which have been damaged due to exposure to heat. Keep unnecessary people away, isolate hazard area. Use only trained and qualified clean up personnel wearing appropriate protective clothing to clean up heat damaged product.

HAZARDOUS DECOMPOSITION PRODUCTS: None expected, if stored and handled as in Section 7.

HAZARDOUS PRODUCTS OF COMBUSTION. Combustion products vary depending on fire conditions and other combustibles present in the fire. The predominant products will be carbon dioxide, and nitrogen oxides. Under some conditions, methane, carbon monoxide, irritating aldehydes and carboxylic acids, and hydrogen cyanide may be formed.

6. ACCIDENTAL RELEASE MEASURES

SPILL PROCEDURES:
Clean up spills immediately using soft bristle brush and conductive rubber or plastic shovel. Use caution, material is sensitive to initiation from sources such as heat, flame, impact, friction or sparks.

AIR RELEASE: Not applicable

Section 6 - Continued

WATER RELEASE:

- This material is heavier than water. Create an overflow dam with filtration capabilities to retain material.
- Divert water flow or stop if possible. Gather wet material using non-sparking or plastic utensils.
- Keep material damp until ready for disposal.

LAND SPILL:

- Clean up of spill materials may be accomplished using non-sparking or plastic utensils. Wear non-flammable or flame retardant clothing at all times. Wet all spill materials prior to initiating clean up procedure.
- Material may best be destroyed by controlled open burning in small quantities (maximum about 1 pound) in piles not over 1 inch deep. Use an ignition train of slow-burning, combustible materials to permit retreat to a safe distance before powder is ignited. Stay upwind, do not breathe products of combustion. Burn only with permission of all appropriate regulatory agencies.

WASTE DISPOSAL:

- If this product becomes a waste, it meets the criteria of a hazardous waste as defined under 40 CFR 261 and would have the following EPA hazardous waste number: D003
- If this product becomes a waste, it will be a hazardous waste which is subject to the Land Disposal Restrictions under 40 CFR 268 and must be managed accordingly.
- If this material becomes a waste, it can be disposed by controlled open burning in small quantities, as described above, with proper local agency authorization.

CARE MUST BE TAKEN TO PREVENT ENVIRONMENTAL CONTAMINATION FROM THE USE OF THIS MATERIAL. THE USER HAS THE RESPONSIBILITY TO DISPOSE OF UNUSED MATERIAL, RESIDUES AND CONTAINERS IN COMPLIANCE WITH ALL RELEVANT LOCAL, STATE AND FEDERAL LAWS AND REGULATIONS REGARDING TREATMENT, STORAGE AND DISPOSAL FOR HAZARDOUS AND NONHAZARDOUS WASTES.

7. HANDLING AND STORAGE

HANDLING AND STORAGE PRECAUTIONS:

- For handling and storage requirements see 29 CFR 1920.109. Also see <<Properties and Storage of Smokeless Powder>> published by the SPORTING ARMS AND AMMUNITION MANUFACTURES' INSTITUTE; INC. (SAAMI), PO Box 838, Brandford, CT 06405.
- This product may react with acids, oxidizing agents, alkalizes or amines (organic and inorganic) and should not be stored near such materials.
- Avoid exposure to sunlight or artificial ultraviolet light.
- Recommended storage conditions -: 21°C (70°F) 50% relative humidity.
- Keep away from heat, sparks and open flame.
- Store in a cool, dry place.
- Do not store smokeless powder in the same area with solvents, flammable gases or highly combustible materials.
- Must be stored in original DOT approved containers or shipping container.
- Do not smoke in areas where powder is stored or used. (50 ft. minimum distance required).
- Do not keep old or salvaged powders. Check old powders for deterioration regularly. Destroy deteriorated powders immediately.

Section 7 – continued.

- Empty containers may contain residues of powder, and should be treated as hazardous waste.

ENGINEERING CONTROLS:
Adequate ventilation should be provided to keep dust concentrations below acceptable exposure limits. Discharge from the ventilation system should comply with applicable air pollution control regulations.

PROTECTIVE MEASURES DURING REPAIR AND MAINTENACE:
Eliminate ignition sources and prevent build-up of static electric charges. Thoroughly clean up all powder grains and dust residues in the maintenance and repair areas before starting work.

8. EXPOSURE CONTROL / PERSONAL PROTECTION

ESTABLISHED EXPOSURE LIMITS

COMPONENT	OSHA (PEL)	ACGIH (TLV)
Nitrocellulose	None established	None established
Diphenylamine	Not established	10 mg/m^3 TWA
Potassium nitrate	None established	
Ethyl Centralite	None established	
Methyl Centralite	None established	
Graphite	15 mg/m^3 total dust 5 mg/m^3 respirable dust	2 mg/m^3 Respirable dust
Potassium sulfate	None established	None established
Dinitrotoluene	1.5 mg/m^3, skin	1.5 mg/m^3, skin

PERSONAL PROTECTIVE EQUIPMENT

- Safety glasses or goggles with side shields.
- Impervious gloves.
- Appropriate respiratory protection required when exposure to airborne containment is likely to exceed acceptable limits. Respirators should be selected and used in accordance with OSHA Subpart I (29 CFR 1910.134) and manufacturer's recommendations.
- Flame-retardant cotton coveralls and conductive safety shoes.

ENGINEERING CONTROLS
Adequate ventilation should be provided to keep dust concentrations below acceptable exposure limits. Discharge from the ventilation system should comply with applicable air pollution control regulations. Use a local mechanical ventilation system if needed, preferably with explosion proof construction, and with a suitable dust filter installed at inlet to suction piping to the system to prevent accumulation of explosive dust in ventilation piping and blower.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Granular Solid Mixture, silvery gray to black
Freezing Point	Not Applicable
Boiling Point	Not Applicable
Decomposition Temperature	Decomposition becomes measurable above 50° C (122°F)
Autoignition Temperature	160°C – 180°C (320° F - 360°F)
Specific Gravity	1.2 – 1.6
Bulk Density	0.5 – 1.1 (g/cc)
pH 25 Deg. C	Not Applicable
Solubility in Water	Negligible
Volatiles, Percent By Volume	<2
Vapor Pressure 25 Deg. C	<1mm Hg
Evaporation Rate	Negligible
Vapor Density	Not Applicable
Molecular Weight	Not Applicable - mixture
Odor	None
Coefficient of Oil/Water Distribution	No Data

10. STABILITY AND REACTIVITY

INSTABILITY: Unstable with heat, unstable with static charges, and unstable with impact. Not usual hazards when stored and used properly.
INCOMPATIBILITY: Incompatible with acids, bases, oxidants, amines.
DECOMPOSITION: Hazardous gases produced are carbon monoxide, carbon dioxide, oxides of nitrogen.
HAZARDOUS POLYMERIZATION: Will not occur.
FIRE AND EXPLOSION DATA: Ignition temperature: 160° - 180° C (320° - 360° F)
Decomposition begins at approximately 50°C (122°F)
OTHER CONDITIONS TO AVOID Direct sunlight.

11. TOXICOLOGICAL INFORMATION

ROUTES OF ABSORPTION: Inhalation Skin Ingestion Eye Contact

TOXICITY DATA:
Nitrocellulose: Rat, Oral LD_{50} : >5000 mg/kg
Dinitrotoluene Rat, Inhalation, LC_{50} : 2.87 mg/l, I hour
Rat, Oral LD_{50} :177mg/kg

12. ECOLOGICAL INFORMATION

AQUATIC TOXICITY - Components of this product known to be toxic to aquatic organisms:
diphenylamine, dinitrotoluene

Section 12 - Continued

Nitrocellulose: Acute aquatic 96- hour static LC50 value falls within the relatively harmless range of >1,000 mg/L, according to U.S. Wildlife criteria. Four species were tested. EC50 in four species of bacteria ranged from 731 mg/L to > 1,000 mg/L.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL:

- If this product becomes a waste, it meets the criteria of a hazardous waste as defined under 40 CFR 261 and would have the following EPA hazardous waste number: D003
- If this product becomes a waste, it will be a hazardous waste which is subject to the Land Disposal Restrictions under 40 CFR 268 and must be managed accordingly.
- Material may best be safely destroyed by controlled open burning in small quantities (maximum about 1 pound) in piles not over 1 inch deep. Use an ignition train of slow-burning, combustible materials to permit retreat to a safe distance before powder is ignited. Stay upwind, do not breathe products of combustion. Burn only with permission of all local regulatory authorities.

14. TRANSPORT INFORMATION

This material is regulated as a DOT Hazardous Material

US DOT Classification: Land – Powder, Smokeless, 1.3C, UN 0161, - for all powders listed in this MSDS shipped in excess of 100 pounds.
Land - Smokeless Powder for Small Arms (100 pounds or less), NA 3178, 4.1 – for all products listed in this MSDS, in DOT approved containers and packaging.

15. REGULATORY INFORMATION

Toxic Substance Control Act (TSCA) : all components of this product are listed in the TSCA Inventory.

SARA Title III, Sections 311/312 : Hazard Categories per 40 CFR 370.21 :
Acute (health) - Yes
Chronic (health) – No
Reactive (physical) - Yes
Sudden Release (physical) – Yes

CERCLA Sections 102a/103 – Hazardous Substances – RQ: dinitrotoluene, (4.54 kg)

SARA Title III, Section 313 covered components: diphenylamine, dinitrotoluene

16. OTHER INFORMATION

Revised: 11/15/2007 by Western Powders, Inc.

CAUTION: Propellants are extremely dangerous. Only highly trained and qualified personnel should utilize this material. Propellants should be tested for compatibility with any materials which they contact. Clean up any spills of material immediately. Proper housekeeping techniques must be maintained to minimize the accumulation of propellant dust. Follow all safety regulations and precautions when handling, storing, or processing propellant material.

The information contained herein is believed to be accurate and represents the best information currently available to Western Powders, Inc. . No warranty or guarantee, express or implied, with regard to the safety or suitability of these products, or the results obtained from their use, is offered by Western Powders, Inc.. Buyer and user assume any and all risk, responsibility and liability for any injury (including death), loss or damage arising from usage of these products.

OWEN COMPLIANCE SERVICES, INC.

Material Safety Data Sheet
(MSDS-RDX)

PRODUCT IDENTIFICATION	
Product Name	RDX
Trade Names and Synonyms	Cyclotrimethylenetrinitramine, Cyclonite, Hexogen, Composition A-6
Manufacturer/Distributor	Various
Transportation Emergency	**800-255-3924 (24 hrs -- *CHEM • TEL*)**

PREVENTION OF ACCIDENTS IN THE USE OF EXPLOSIVES

The prevention of accidents in the use of explosives is a result of careful planning and observance of the best known practices. The explosives user must remember that he is dealing with a powerful force and that various devices and methods have been developed to assist him in directing this force. He should realize that this force, if misdirected, may either kill or injure both him and his fellow workers.

WARNING

All explosives are dangerous and must be carefully handled and used following approved safety procedures either by or under the direction of competent, experienced persons in accordance with all applicable federal, state, and local laws, regulations, or ordinances. If you have any questions or doubts as to how to use any explosive product, **DO NOT USE IT** before consulting with your supervisor, or the manufacturer, if you do not have a supervisor. If your supervisor has any questions or doubts, he should consult the manufacturer before use.

HAZARDOUS COMPONENTS			
Material or Component	**CAS No.**	**TLV**	**PEL**
RDX (Cyclotrimethylenetrinitramine)	00121-82-4	1.5 mg/m^3	1.5 mg/m^3
Desensitizing Wax	N/A	NE	NE
Graphite	07782-42-5	15 mppct (TWA)	2.5 mg/m^3
Water	N/A	NE	NE
Methanol	00067-56-1	325 mg/m^3 (STEL)	260 mg/m^3
N/A = Not assigned NE = Not established			

PHYSICAL DATA	
Boiling Point	N/A
Vapor Pressure	4.08 x 10-5 @ 100°C
Vapor Density	N/A
Solubility in Water	0.15 % @ 100°C
Specific Gravity	1.820
Melting Point	>203°C + 1°C
Evaporation Rate	N/A
Appearance and Odor	White or gray (if graphite present) powder. Powder may be wet (desensitized) with water (odorless) or a water-alcohol mixture (methanol odor). Powder may be dry and desensitized with wax (paraffin odor)

HAZARDOUS REACTIVITY	
Instability	Detonates with friction, impact, heat, electrostatic energy.
Incompatibility	Acids and alkalis, some organics such as amines and chlorides.
Hazardous decomposition	Detonation produces hazardous overpressures and fragments (if confined). Gases produced may contain carbon monoxide and nitrogen oxide.
Polymerization	Polymerization will not occur.

FIRE AND EXPLOSION DATA	
Flashpoint	Not applicable
Extinguishing media	None
Special fire fighting procedures	**ALL EXPLOSIVES: DO NOT FIGHT EXPLOSIVES FIRES.** Try to keep fire from reaching explosives. Isolate area. Guard against intruders. Division 1.1 Explosives: Evacuate the area for 5000 feet (1 mile). Consult *the 2000 Emergency Response Guidebook, Guide 112* for further details..
Unusual fire and explosion hazards	May detonate with impact or on heating.

HEALTH HAZARDS	
General	RDX is a Division 1.1 explosive, and detonation may cause severe physical injury, including death. All explosives are dangerous and must be handled carefully and used following approved safety procedures under the direction of competent, experienced persons in accordance with all applicable federal, state, and local laws, regulations, and ordinances. RDX is toxic by ingestion. In chronic animal studies by ingestion, RDX caused lung and GI tract congestion, anxiety psychoses, central nervous system diseases, abnormal reflexes, and death. It was not mutagenic in bacterial cell cultures. Reported human health effects include convulsions, insomnia, restlessness, and irritability. Seizures were followed by temporary amnesia, nausea, and weakness. Immediately after convulsions, there was evidence of rapid pulse rate and hypertension. Recovery was eventually complete. RDX was not a human skin irritant and an epidemiology study did not identify any abnormalities attributed to RDX exposure. Inhalation of explosive powders may cause nervous system irregularities including headaches and dizziness. Nitrogen oxides generated during use are skin, eye, and respiratory tract irritants.
Toxicity	Oral LD50: 100 g/kg in rats.
Carcinogenicity	None of the components of RDX are listed as a carcinogen by NTP, IARC, or OSHA.

FIRST AID	
Inhalation	Not a likely route of exposure. If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably by mouth-to-mouth. If breathing is difficult, give oxygen. Seek prompt medical attention.
Eye and skin contact	Not a likely route of exposure. Flush eyes with water. Wash skin with soap and water
Ingestion	Not a likely route of exposure. Induce vomiting immediately by giving two glasses of water and sticking finger down throat.
Injury from detonation	Seek prompt medical attention.

SPILL OR LEAK PROCEDURES	
Spill/leak response	Use appropriate personal protective equipment. Isolate area and remove sources of friction, impact, heat, low level electrical current, electrostatic or RF energy. Only competent, experienced persons should be involved in cleanup procedures. Sweep up with non-sparking tools and remove.
Waste disposal	Dispose of in compliance with federal regulations under the authority of the *Resource Conservation and Recovery Act* (40 CFR Parts 260-271).

SPECIAL PROTECTION INFORMATION	
Ventilation	Use only with adequate ventilation.
Respiratory	NIOSH approved particle masks for dust and mist.
Eye	Safety glasses or goggles.
Gloves	Impervious rubber gloves.
Other	Cotton overalls, undergarments and socks. Conductive soled shoes

SPECIAL PRECAUTIONS
Keep away from friction, impact, and heat. Do not consume food, drink, or tobacco in areas where they may become contaminated with these materials.

STORAGE CONDITIONS
Store in accordance with the requirements of *Subpart K, ATF: Explosives Law and Regulations* (27 CFR 55.201-55.219).

SHIPPING INFORMATION		
Proper shipping name	RDX, Wetted	
Hazard class	1.1D	
UN Number	UN0072	
DOT Label & Placard	DOT Label	EXPLOSIVE 1.1D
	DOT Placard	EXPLOSIVES 1.1

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For further information contact:

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OWEN COMPLIANCE SERVICES, INC.
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MSDS prepared by:

David W. Boston

Original publication date: 03/15/93
Review date: 2/22/06
12/03/03

Material Safety Data Sheet

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2650 Decker Lake Boulevard, Suite 300
Salt Lake City, Utah 84119
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FOR 24 HOUR EMERGENCY, CALL   CHEMTREC (USA)   800-424-9300
CANUTEC (CANADA)   613-996-6666

MSDS # 1126
Date 08/13/08

Supercedes
MSDS # 1126 01/24/05

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): PRIMALINE®
PRIMACORD®
PRIMASHEAR™
OPTICORD®
GEOSEIS®
LOW FLEX™
FIRELINE CORD

Product Class: Detonating Cord

Product Appearance & Odor: Flexible cord of woven textile with a protected explosive core of PETN (white crystalline powder) and covered by a white or colored plastic or textile jacket. May have a waxed finish. No odor.

DOT Hazard Shipping Description: UN0065 Cord, Detonating 1.1D II

NFPA Hazard Classification: Not Applicable (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

Ingredients	CAS#	%	Occupational Exposure Limits: OSHA PEL-TWA	Occupational Exposure Limits: ACGIH TLV-TWA
Pentaerythritol tetranitrate (PETN)	78-11-5	-----*	None[1]	None[2]

[1] Use limit for particulates not otherwise regulated (PNOR): Total dust, 15 mg/m^3 ; respirable fraction, 5 mg/m^3.
[2] Use limit for particulates not otherwise classified (PNOC): Inhalable particulate, 10 mg/m^3 ; respirable part., 3 mg/m^3.
Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).
* Core powder is 100% PETN. The approximate amount of PETN in a given grade of cord is expressed as that number of grams of PETN per linear meter of cord. Range is from 1 to 280 gram/meter. Example: PRIMALINE® 5 contains approximately 5 grams PETN per meter of cord. (1 gram/meter = 4.7 grains/foot)

SECTION III - PHYSICAL DATA

Boiling Point: Not Applicable (PETN decomposes at melting point, about 141°C)
Vapor Pressure: Not Applicable
Percent Volatile by Volume: Not Applicable
Vapor Density: (Air = 1) Not Applicable
Solubility in Water: Insoluble.

DYNO
Dyno Nobel
Groundbreaking Performance

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Extinguishing Media: (See Special Fire Fighting Procedures section.)
Special Fire Fighting Procedures: Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe, distant location. Allow fire to burn unless it can be fought remotely or with fixed extinguishing systems (sprinklers). For transportation fires involving large quantities of detonating cord, such as a trailer load, evacuate no less than 2,500 feet in all directions.
Unusual Fire and Explosion Hazards: Can explode or detonate under fire conditions. Burning or detonating material may produce toxic vapors.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure
This is a packaged product that will not result in exposure to the explosive core material under normal conditions of use.

Eyes: May cause irritation, redness and tearing.
Skin: PETN is not known as a skin irritant or sensitizer.
Ingestion: PETN is moderately toxic if ingested. See systemic effects below.
Inhalation: See systemic effects below.
Systemic or Other Effects: PETN is a known coronary vasodilator, and ingestion or inhalation may result in a lowering of blood pressure, headache or faintness, and a decreased tolerance for grain alcohol. Repeated over-exposure may result in chest pains in the absence of exposure. Systemic effects by ingestion include dermatitis.
Carcinogenicity: No constituents are listed by NTP, IARC or OSHA.

Emergency and First Aid Procedures

Eye: Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.
Skin: Wash with soap and water.
Ingestion: Seek medical attention.
Inhalation: Remove to fresh air. If symptoms persist, seek medical attention.
Special Considerations: None**.**

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions, may explode when subjected to fire, supersonic shock or high-energy projectile impact, especially when confined or in large quantities.
Conditions to Avoid: Keep away from heat, flame, ignition sources, impact, friction, electrostatic discharge and strong shock.
Materials to Avoid (Incompatibility): Corrosives (strong acids and strong bases or alkalis).
Hazardous Decomposition Products: Nitrogen Oxides (NO_X), Carbon Monoxide (CO)
Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Protect from all ignition sources. In case of fire evacuate all personnel to a safe distant area and allow to burn or fight fire remotely. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If explosive powder is spilled from damaged detonating cord, remove all other explosives from the spill area. Wet down and clean spilled powder using a damp sponge or rag, avoid applying friction or pressure to the explosive, and place in a (Velostat) electrically conductive bag. Contamination of this material with sand, grit or dirt will render the material more sensitive to detonation. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other

clean DOT approved container. Ensure that a complete account of product has been made and is verified. Follow applicable Federal, State, and local spill reporting requirements.
Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Not required for normal handling.
Respiratory Protection: None normally required.
Protective Clothing: Work gloves and work clothing that reduce the possibility of skin abrasion and that would prevent contact with spilled explosive powder is suggested.
Eye Protection: Safety glasses or goggles are recommended.
Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry, well-ventilated location. Store in compliance with Federal, State and local regulations. Only properly qualified and authorized personnel should handle and use explosives. Keep away from heat, flame, ignition sources, impact, friction, electrostatic discharge and strong shock.
Precautions to be taken during use: Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death. Avoid breathing the fumes or gases from detonation of explosives. Detonation in confined or unventilated areas may result in exposure to hazardous fumes or oxygen deficiency.
Other Precautions: It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

SECTION X - SPECIAL INFORMATION

This product contains the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Chemical Name	CAS Number	% By Weight
None		

Disclaimer

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OWEN COMPLIANCE SERVICES, INC.

Material Safety Data Sheet
(MSDS-DET)

PRODUCT IDENTIFICATION	
Product Name	Detonators, Class 1.4 Explosive
Trade Names and Synonyms[1]	Non-electric detonators, electric detonators, detonating fuzes, EFI detonators, EBW detonators
Manufacturer/Distributor	Various
Transportation Emergency	**800-255-3924 (24 hrs -- *CHEM • TEL*)**

PREVENTION OF ACCIDENTS IN THE USE OF EXPLOSIVES

The prevention of accidents in the use of explosives is a result of careful planning and observance of the best known practices. The explosives user must remember that he is dealing with a powerful force and that various devices and methods have been developed to assist him in directing this force. He should realize that this force, if misdirected, may either kill or injure both him and his fellow workers.

WARNING

All explosives are dangerous and must be carefully handled and used following approved safety procedures either by or under the direction of competent, experienced persons in accordance with all applicable federal, state, and local laws, regulations, or ordinances. If you have any questions or doubts as to how to use any explosive product, **DO NOT USE IT** before consulting with your supervisor, or the manufacturer, if you do not have a supervisor. If your supervisor has any questions or doubts, he should consult the manufacturer before use.

[1] If needed, an MSDS Supplement Page is available to describe specific item references

HAZARDOUS COMPONENTS			
Material or Component	**CAS No.**	**TLV**	**PEL**
Black Powder	N/A	NE	NE
PETN (Pentaerythritol Tetranitrate)	00078-11-5	NE	NE
RDX (Cyclotrimethylenetrinitramine)	00121-82-4	1.5 mg/m^3	1.5 mg/m^3
HMX (Cyclotetramethylenetetranitramine)	026914-41-0	NE	NE
HNS **(**Hexanitrostilbene)	20062-22-0	NE	NE
PYX (Picrylaminodinitropyridine)	38082-89-2	NE	NE
TACOT (Tetranitrodibento-tetra-azapentalene)	25243-36-1	NE	NE
Lead azide (TLV & PEL given for lead)	13424-46-9	0.15 mg/m^3	50 $\mu g/m^3$
Lead Styphnate (TLV & PEL given for lead)	15245-44-0	0.15 mg/m^3	50 $\mu g/m^3$
Aluminum	07429-90-5	5 mg/m^3	10 mg/m^3
Corrosion resistant steel	N/A	NE	NE
Iron	07439-89-6	5 mg/m^3	10 mg/m^3
Copper	07440-50-8	1 mg/m^3	1 mg/m^3
Detonators may contain and/or be constructed of one or more of the items listed above N/A = Not assigned NE = Not established			

PHYSICAL DATA
Metal shells containing explosives, with or without insulated metal leg wires.

HAZARDOUS REACTIVITY	
Instability	Detonates with friction, impact, heat, low level electrical current, electrostatic or RF energy
Incompatibility	Acids and alkalis
Hazardous decomposition	Detonation produces hazardous fragments. Gases produced may contain iron, lead, carbon and nitrogen oxides
Polymerization	Polymerization will not occur

FIRE AND EXPLOSION DATA	
Flashpoint	Not applicable
Extinguishing media	None
Special fire fighting procedures	**ALL EXPLOSIVES: DO NOT FIGHT EXPLOSIVES FIRES.** Try to keep fire from reaching explosives. Isolate area. Guard against intruders. Division 1.4 Explosives: Evacuate the area for 1500 feet (1/3 mile). Consult *the 2000 Emergency Response Guidebook, Guide 114* for further details.
Unusual fire and explosion hazards	May detonate with impact or on heating

HEALTH HAZARDS	
General	Detonators do not present health hazards in normal handling and use; however, the products are Division 1.4 explosives, and detonation may cause severe physical injury, including death. All explosives are dangerous and must be handled carefully and used following approved safety procedures under the direction of competent, experienced persons in accordance with all applicable federal, state, and local laws, regulations, and ordinances. Inhalation of explosives powders may cause nervous system irregularities including headaches and dizziness. Overexposure to lead may cause adverse effects to the blood forming, nervous, urinary, reproductive systems, including weakness, weight loss, insomnia, constipation, anemia, motor weakness, and encephalopathy. Lead may penetrate the placental barrier and has caused congenital abnormalities in animals. Several animal studies have indicated that high doses of lead may be carcinogenic. Nitrogen oxides generated during use are skin, eye, and respiratory tract irritants.
Carcinogenicity	None of the components of detonators are listed as a carcinogen by NTP, IARC, or OSHA.

FIRST AID	
Inhalation	Not a likely route of exposure. If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably by mouth-to-mouth. If breathing is difficult, give oxygen. Seek prompt medical attention.
Eye and skin contact	Not a likely route of exposure.
Ingestion	Not a likely route of exposure.
Injury from detonation	Seek prompt medical attention.

SPILL OR LEAK PROCEDURES	
Spill/leak response	Use appropriate personal protective equipment. Isolate area and remove sources of friction, impact, heat, low level electrical current, electrostatic or RF energy. Only competent, experienced persons should be involved in cleanup procedures. Sweep up with non-sparking tools and remove.
Waste disposal	Dispose of in compliance with federal regulations under the authority of the *Resource Conservation and Recovery Act* (40 CFR Parts 260-271).

SPECIAL PROTECTION INFORMATION	
Ventilation	Use only with adequate ventilation.
Respiratory	NIOSH approved particle masks for dust and mist.
Eye	Safety glasses or goggles.
Gloves	Impervious rubber gloves.
Other	Cotton overalls, undergarments, and socks. Conductive soled shoes.

SPECIAL PRECAUTIONS
Keep away from friction, impact, and heat. Do not consume food, drink, or tobacco in areas where they may become contaminated with these materials.

STORAGE CONDITIONS
Store in accordance with the requirements of *Subpart K, ATF: Explosives Law and Regulations* (27 CFR 555.201-555.219).

<table>
<tr><th colspan="3">SHIPPING INFORMATION</th></tr>
<tr><td>Basic Description</td><td colspan="2">This MSDS applies to any of the following DOT Basic descriptions. If supplying this MSDS in fulfillment of the requirements of 49 CFR 172.602, place a check mark in the box next to the basic description being transported.

☐ UN0456, Detonators, electric, 1.4S
☐ UN0455, Detonators, non-electric, 1.4S
☐ UN0367, Fuzes, detonating, 1.4S
☐ UN0410, Fuzes, detonating, 1.4D</td></tr>
<tr><td rowspan="2">DOT Label & Placard</td><td>DOT Label</td><td>Products described in this MSDS may bear one of the following labels on each outer packaging. The actual label present will depend upon the hazard classification approved by the U.S. Department of Transportation.

UN0367, UN0455, UN0456 (1.4S products)
UN0410 (1.4D products)</td></tr>
<tr><td>DOT Placard</td><td>Transport vehicles transporting products described in this MSDS may may be placarded in accordance with DOT requirements utilizing one or more of the following placards. The actual placard(s) present will depend upon the hazard classification approved by the U.S. Department of Transportation.

UN0367, UN0455, UN0456 (1.4S products)
UN0410 (1.4D products)
< OR > (1.4D & 1.4S products)</td></tr>
</table>

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MSDS prepared by:	David W. Boston	
	Original publication date:	03/15/93
	Revision date:	1/22/10
		2/22/06
		12/03/03

== MSDS Safety Information == TOP

FSC:	NIIN:	MSDS Date:	MSDS Num:
1375	00−691−1671	09/01/1991	BPRJP

Submitter:	Tech Review:	Status CD:
A AM	05/15/1992	C

Product ID:	MFN:
M 60,IGNITER,FUSE	01

Article:	Kit Part:
N	N

	Cage:
Responsible Party	13759

Name:

SECURITY SIGNALS,INC

Address:

9509 MACON RD

City:	State:	Zip:
CORDOVA	TN	38018

Country:

US

Info Phone Number:

901−754−7228

Emergency Phone Number:

901−754−7228

Preparer's Name:

N/P

Proprietary Ind:

N

Review Ind: Y

Published: Y

Special Project CD: N

== Contractor Summary == TOP

Cage:	Name:
13759	SECURITY SIGNALS INC

Address:

9509 MACON RD

City:	State:	Zip:
CORDOVA	TN	38018−9746

Country:	Phone:
US	901−754−7228

== Item Description Information == TOP

Item Manager:

B14

Item Name: IGNITER,TIME BLASTING FUSE

Specification Number: NK

Type/Grade/Class: NK

Unit of Issue: EA

Quantitative Expression:

UI Container Qty: Z

Type of Container: WOOD BOX

==
Ingredients
==

TOP

Cas: X

Code: RTECS #: X

Code:

Name: **PRIMER PERCUSSION M39.HAZ ING IN OLIN CENTER FIRE PRIMER−SEE OLIN MSDS UNDER NSN 1375−00−691−1671,CAGE 99530,PART NUM A.**

% Text: N/K

Environmental Wt:

Other REC Limits: NOT KNOWN

OSHA PEL:

NOT KNOWN

Code: M OSHA STEL:

Code:

ACGIH TLV: NOT KNOWN

Code: M ACGIH STEL: N/P

Code:

EPA Rpt Qty:

DOT Rpt Qty:

Ozone Depleting Chemical:

== **Health Hazards Data**
==

TOP

LD50 LC50 Mixture

NOT KNOWN

Route Of Entry Inds − Inhalation:YES

Skin:NO

Ingestion:NO

Carcinogenicity Inds − NTP:NO

IARC:NO

OSHA:NO

Health Hazards Acute And Chronic

SEE SIGNS AND SYMPTOMS OF OVEREXPOSURE.

Explanation Of Carcinogenicity

NONE

Signs And Symptions Of Overexposure

EFFECTS OF OVEREXPOSURE TO SMOKE FROM BURNING IGNITERS:EYES:SEVERE IRRITATION,BLURRED VISION. SKIN:MODERATE IRRITATION. INHALATION:IRRITATION,HEADACHE,NAUSEA,DIZZINESS.

Medical Cond Aggravated By Exposure

NOT KNOWN

First Aid

EYES:FLUSH WITH LARGE AMOUNTS OF WATER FOR AT LEAST 15 MINUTES (FP A).CONSULT PHYSICIAN IMMEDIATELY. SKIN:WASH WITH SOAP & WATER.GET MEDICAL ATTENTION. INGESTION:GET MEDICAL ATTENTION. INHALATION:REMO VE TO FRESH AIR,BEGIN RESUSCITATION.GETMEDICAL ATTENTION.

Spill Release Procedures

ELIMINATE ALL SOURCES OF IGNITION.RECOVER ALL SPILLED UNITS AND EXAMINE FOR PHYSICAL CHANGE.

Neutralizing Agent

NOT KNOWN

Waste Disposal Methods

DISP MUST BE IAW FED,STATE,& LOC REGS.COORDINATE W/ SUPPORTING INSTALLATION/MACOM ENVIRON OFFICE PRIOR TO DISP (FP A).DETERMINE IF WASTE MEETS FED/STATE HAZ WASTE CRITERIA BECAUSE USE,MIXTURES,PROCESS ES,ETC MAY RENDER MATERIAL HAZARDOUS.

Handling And Storage Precautions

DESIGNED FOR MILITARY USE OR COMMERCIAL BLASTING OPERATIONS ONLY BY PERSONNEL THOROUGHLY TRAINED IN HANDLING/USE.NOT DESIGNED FOR RECREATIONAL USE.

Other Precautions

LABEL AS EXPLOSIVE.

=== Fire and Explosion Hazard Information ===

TOP

Flash Point Method:

N/P

Flash Point:

Flash Point Text: NOT KNOWN

Autoignition Temp:

Autoignition Temp Text: N/A

Lower Limits: NOT KNOWN

Upper Limits: NOT KNOWN

Extinguishing Media

WATER SPRAY,DRY SAND,TALC,DRY GRAPHITE.

Fire Fighting Procedures

WEAR SELF−CONTAINED BREATHING APPARATUS,PROTECTIVE BODY AND HEAD GEAR.MAINTAIN SAFE DISTANCE FROM BURNING MATERIALS.

Unusual Fire/Explosion Hazard

FLAMMABLE WHEN EXPOSED TO OPEN FLAME,EXCESSIVE HEAT OR IMPACT.

== Control Measures ==

TOP

Respiratory Protection

CONTACT LOCAL SAFETY/INDUSTRIAL HYGIENE OFFICE TO DETERMINE IF RESPIRATORY PROTECTION IS REQUIRED (FP A).

Ventilation

CONTACT LOCAL SAFETY/INDUSTRIAL HYGIENE OFFICE TO DETERMINE IF LOCAL EXHAUST VENTILATION IS NEEDED (FP A).

Protective Gloves

NOT KNOWN

Eye Protection

CHEMICAL SAFETY GOGGLES (FP A).

Other Protective Equipment

NOT KNOWN

Work Hygienic Practices

LAUNDER CONTAMINATED CLOTHING BEFORE REUSE.

Supplemental Safety and Health

CONTRACT #:DAAA09−91−R−0873.HAZARDOUS INGREDIENTS ARE IN OLIN CENTER FIRE PRIMER−SEE OLIN MSDS UNDER NSN 1375−00−691−1671,CAGE 99530,PART NUM A.

==
Physical/Chemical Properties
==

TOP

HCC:

NRC/State LIC No: N/R

Net Prop WT For Ammo:

Boiling Point: B.P. Text: N/A

Melt/Freeze Pt: M.P/F.P Text: NOT KNOWN

Decomp Temp: Decomp Text: NOT KNOWN

Vapor Pres: N/A Vapor Density: N/A

Volatile Org Content %: Spec Gravity: N/A

VOC Pounds/Gallon:

PH: N/A

VOC Grams/Liter: Viscosity: N/P

Evaporation Rate & Reference: N/A

Solubility in Water: INSOLUBLE

Appearance and Odor: ODORLESS,GREEN PLASTIC,POLYAMIDE,NYLON TUBE (ASSEMBLY).

Percent Volatiles by Volume: N/K Corrosion Rate: N/K

=== Reactivity Data === TOP

Stability Indicator:

YES

Stability Condition To Avoid: HEAT AND FLAME.

Materials To Avoid: N/A

Hazardous Decomposition Products: SMOKE FROM BURNING IGNITERS.

Hazardous Polymerization Indicator: NO

Conditions To Avoid Polymerization: WILL NOT OCCUR.

=== Toxicological Information === TOP

Toxicological Information:

N/P

== Ecological Information == TOP

Ecological:

N/P

== MSDS Transport Information == TOP

Transport Information:

N/P

== Regulatory Information == TOP

Sara Title III Information:

N/P

Federal Regulatory Information: N/P

State Regulatory Information: N/P

== Other Information == TOP

Other Information:

N/P

==

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Material Safety Data Sheet

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910. 1200. Standard must be consulted for specific requirements

MODEL 6210HC Canister
HC Smoke Grenade

QUICK IDENTIFIER
Common Name: (used on label and list)

SECTION 1

Manufacturer's Name	Combined Systems, Inc.		
Address	388 Kinsman Road	**Emergency Telephone No.**	800-424-9300
City, State and ZIP	Jamestown, PA 16134	**Other Information Calls**	724-932-2177
Signature of Person Responsible for Preparation (Optional)		**Date Prepared**	08/17/07

SECTION 2 - HAZARDOUS INGREDIENTS / IDENTITY

Hazardous Component(s) (chemical & common name(s))	OSHA PEL	ACGIH TLV	Other Exposure Limits	% (Optional)	CAS No.
Zinc Oxide		5 mg/m^3			1314-132
Hexachloroethane			MLD 325 mg/kg		67-72-1
Aluminum Powder		10 mg/m^3			

SECTION 3 - PHYSICAL & CHEMICAL CHARACTERISTICS

Boiling Point	N/A	**Specific Gravity H_2O=1**	N/A	**Vapor Pressure (mm Hg)**	N/A
Vapor Density (Air=1)	N/A	**Solubility in Water**	Slight	**Reactivity in Water**	Yes (Aluminum Powder
Appearance & Odor	Grey Smoke, Slight odor			**Melting Point**	N/A

SECTION 4 - FIRE & EXPLOSION DATA

Flash Point	N/A	**Method Used**	**N/A**	**Flammable Limits in Air % by Volume**	**LEL Lower** N/A	**UEL Upper**	N/A
Auto-Ignition Temperature	N/A	**Extinguisher Media**	CO^2, Dry Chemical				

Special Fire Fighting Procedures Do not fight fire. If ignition occurs evacuate downwind area until unit burns out.

Unusual Fire & Explosion Hazards

SECTION 5 - PHYSICAL HAZARDS (REACTIVITY DATA)

Stability	**Unstable**	☐	**Conditions to Avoid**	High heat sources, open flames and fire
	Stable	☒		
Incompatibility (Materials to Avoid)	Water			
Hazardous Decomposition Products	None known			
Hazardous Polymerization	**May Occur**	☐	**Conditions to Avoid**	N/A
	Will Not Occur	☒		

SECTION 6 - HEALTH HAZARDS

1. Acute	See Signs & Symptoms	**2. Chronic**	None under normal handling
Signs and Symptoms of Exposure		May be irritating to skin & mucus membrane. In high concentrations, it has a narcotic effect	
Medical Conditions Generally Aggravated by Exposure		May damage kidney & liver	

Listed as Carcinogen or Potential Carcinogen	**National Toxicology Program**	**Yes** ☐	**No** ☒	**I.A.R.C. Monographs**	**Yes** ☐	**No** ☒	**OSHA**	**Yes** ☐	**No** ☒
Emergency and First Aid Procedures	If any medical problem arises from the use of this product seek medical attention from qualified medical persons.								

ROUTES OF ENTRY	**1. Inhalation**	Remove to fresh air, & give oxygen as necessary.
	2. Eyes	Wash with water.
	3. Skin	Wash with soap & water.
	4. Ingestion	Contact physician.

SECTION 7 - SPECIAL PRECAUTIONS & SPILL / LEAK PROCEDURES

Precautions in Handling and Storage	Keep away from heat, flames and strong oxidizers
Other precautions	
Steps to be Taken in Case Material is released or Spilled	Wear suitable protective clothing, Undamaged units may be returned to shipping container
Waste Disposal Method (Consult Federal, State and local Regulations)	

SECTION 8 - SPECIAL PROTECTION INFORMATION / CONTROL MEASURES

Respiratory Protection (Specify Type)	N/A								
Ventilation	Yes	**Local Exhaust**	Yes	**Mechanical (General)**	Yes	**Special**	Explosio n Proof	**Other**	N/A
Protective Gloves	Yes	**Eye Protection**	Yes	**Other Protective Clothing or Equipment**	Goggles				
Work / Hygienic Practices	Normal Hygiene Practices								

IMPORTANT - Do not leave any blank spaces. If required information is unavailable, unknown or does not apply, so indicate.

ATLAS POWDER COMPANY -- ELECTRIC DETONATORS-ALL TYPES -- 1375-00N015162
==================== Product Identification ====================

Product ID:ELECTRIC DETONATORS-ALL TYPES
MSDS Date:02/08/1988
FSC:1375
NIIN:00N015162
MSDS Number: BKNNY
=== Responsible Party ===
Company Name:ATLAS POWDER COMPANY
Address:15301 DALLAS PARKWAY SUITE 1200
City:DALLAS
State:TX
ZIP:75248
Country:US
Info Phone Num:717-386-4121;417-624-0212
Emergency Phone Num:717-386-4121;417-624-0212
Preparer's Name:T A HARTER
CAGE:HO819
=== Contractor Identification ===
Company Name:ATLAS POWDER CO
Address:15301 DALLAS PARKWAY SUITE 1200
Box:City:DALLAS
State:TX
ZIP:75248
Country:US
Phone:717-386-4121; 417-624-0212
CAGE:5P744
Company Name:ATLAS POWDER COMPANY
Address:15301 DALLAS PARKWAY SUITE 1200
Box:City:DALLAS
State:TX
ZIP:75248
Country:US
Phone:717-386-4121;417-624-0212
CAGE:HO819

============ Composition/Information on Ingredients ============

Ingred Name:PENTAERYTHRITOL TETRANITRATE. VP: .001 @ 97C. MP: D @ 300C.
SPEC GRAV: 1.47(SOLID).
CAS:78-11-5
RTECS #:PZ2620000

Ingred Name:MANNITOL, HEXANITRATE. MP: 112C. BP: D @ 155C. SPEC GRAV:
1.604.
CAS:15825-70-4
RTECS #:OP3000000

Ingred Name:DIAZODINITROPHENOL. BP: D @ 180C. SPEC GRAV: 1.63.
CAS:4682-03-5

Ingred Name:BLACK POWDER: MIXTURE OF THE 3 FOLLOWING INGREDIENTS.

Ingred Name:POTASSIUM NITRATE
CAS:7757-79-1
RTECS #:TT3700000

Ingred Name:SULFUR
CAS:7704-34-9
RTECS #:WS4250000

Ingred Name:CHARCOAL
CAS:7704-34-9
RTECS #:WS4250000

Ingred Name:ANTIMONY (SARA III)
CAS:7440-36-0
RTECS #:CC4025000
OSHA PEL:0.5 MG/M3
ACGIH TLV:0.5 MG SB/M3; 9192
EPA Rpt Qty:5000 LBS
DOT Rpt Qty:5000 LBS

Ingred Name:POTASSIUM PERMANGANATE (SARA III)
CAS:7722-64-7
RTECS #:SD6475000
OSHA PEL:5 MG MN/M3;CEILING
ACGIH TLV:5 MG MN/M3; 9192
EPA Rpt Qty:100 LBS
DOT Rpt Qty:100 LBS

===================== Hazards Identification =====================

LD50 LC50 Mixture:NONE SPECIFIED BY MANUFACTURER.
Routes of Entry: Inhalation:YES Skin:YES Ingestion:NO
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO
Health Hazards Acute and Chronic:SULFUR: EYE IRRITANT. ANTIMONY: HIGHLY TOXIC & TOXIC.
Explanation of Carcinogenicity:NOT RELEVANT
Effects of Overexposure:NONE SPECIFIED BY MANUFACTURER.
Medical Cond Aggravated by Exposure:NONE SPECIFIED BY MANUFACTURER.

======================= First Aid Measures =======================

First Aid:INGEST: CALL MD IMMEDIATELY . INHAL: REMOVE TO FRESH AIR. SUPPORT BREATHING (GIVE O*2/ARTF RESP) .

===================== Fire Fighting Measures =====================

Extinguishing Media:NONE SPECIFIED BY MANUFACTURER.
Fire Fighting Procedures:DO NOT ATTEMPT TO FIGHT FIRES INVOLVING

EXPLOSIVES. IMMEDIATELY EVACUATE THE AREA.
Unusual Fire/Explosion Hazard:AVOID TOXIC FUMES FROM THE FIRE.

================== Accidental Release Measures ==================

Spill Release Procedures:NONE SPECIFIED BY MANUFACTURER.
Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER.

====================== Handling and Storage ======================

Handling and Storage Precautions:NONE SPECIFIED BY MANUFACTURER.
Other Precautions:AVOID TOXIC FUMES FROM BLASTING.

============= Exposure Controls/Personal Protection =============

Respiratory Protection:NONE SPECIFIED BY MANUFACTURER.
Ventilation:NONE SPECIFIED BY MANUFACTURER.
Protective Gloves:NONE SPECIFIED BY MANUFACTURER.
Eye Protection:CHEMICAL WORKERS GOGGLES .
Other Protective Equipment:HARD HATS.
Work Hygienic Practices:NONE SPECIFIED BY MANUFACTURER.
Supplemental Safety and Health
APPEAR/ODOR: (ING 1) COLORLESS CRYSTAL. (ING 2) COLORLESS NEEDLES. (ING 3) RED/YELLOW POWDER. (ING 4) BLACK GRAINS. (ING 8) SILVER METAL. (ING 9) PURPLE CRYSTALS.

================== Physical/Chemical Properties ==================

HCC:E2
Boiling Pt:B.P. Text:SEE INGRED
Melt/Freeze Pt:M.P/F.P Text:SEE INGRED
Vapor Pres:SEE INGRED
Spec Gravity:SEE INGRED
Appearance and Odor:SEE SUPP DATA

================= Stability and Reactivity Data =================

NONE SPECIFIED BY MANUFACTURER.
Stability Condition to Avoid:NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products:NONE SPECIFIED BY MANUFACTURER.

==================== Disposal Considerations ====================

Waste Disposal Methods:THE DISPOSAL OF DAMAGED OR DETERIORATED ELECTRIC DETONATORS MUST BE CARRIED OUT IN ACCORDANCE WITH ALL FEDERAL AND STATE REGULATIONS.

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AUSTIN POWDER CO -- GELATIN & SEMI-GELATIN DYNAMITES, 60% SEISMOGRAPH -- 1377-00N054762

==================== Product Identification ====================

Product ID:GELATIN & SEMI-GELATIN DYNAMITES, 60% SEISMOGRAPH
MSDS Date:01/01/1991
FSC:1377
NIIN:00N054762
MSDS Number: BVXXW
=== Responsible Party ===
Company Name:AUSTIN POWDER CO
Address:25800 SCIENCE PARK DR
City:CLEVELAND
State:OH
ZIP:44122
Country:US
Info Phone Num:216-464-2400
Emergency Phone Num:216-464-2407
CAGE:79985
=== Contractor Identification ===
Company Name:AUSTIN POWDER CO
Address:25800 SCIENCE PARK DR
Box:City:CLEVELAND
State:OH
ZIP:44122
Country:US
Phone:216-464-2400
CAGE:79985

============ Composition/Information on Ingredients ============

Ingred Name:NITROGLYCERIN; (NG) (SARA III)
CAS:55-63-0
RTECS #:QX2100000
Fraction by Wt: 3-15%
OSHA PEL:0.1 MG/M3, S
ACGIH TLV:0.05 PPM, S
EPA Rpt Qty:10 LBS
DOT Rpt Qty:10 LBS

Ingred Name:ETHYLENE GLYCOL DINITRATE; (EGDN)
CAS:628-96-6
RTECS #:KW5600000
Fraction by Wt: 11-50%
OSHA PEL:0.2 MG/M3, S, C
ACGIH TLV:0.05 PPM, S

Ingred Name:AMMONIUM (I) NITRATE (1:1); (AMMONIUM NITRATE)
CAS:6484-52-2
RTECS #:BR9050000
Fraction by Wt: 0-40%

OSHA PEL:N/K
ACGIH TLV:N/K

===================== Hazards Identification =====================

LD50 LC50 Mixture:NONE SPECIFIED BY MANUFACTURER.
Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO
Health Hazards Acute and Chronic:INGESTION, INHALATION OR ABSORPTION THROUGH SKIN CONTACT MAY CAUSE HEADACHE, NAUSEA, BLOOD VESSEL DILATION, VOMITING & CONVULSIONS. IN EXTREME CASES, DEATH MAY RESULT. EYES:SLIGHT IRRITANT. SKIN:SLIGH T IRRITANT - ABSORBS THROUGH SKIN. NITRIC ESTERS ARE CORONARY VASODILATORS.
Explanation of Carcinogenicity:NOT RELEVANT
Effects of Overexposure:SEE HEALTH HAZARDS.
Medical Cond Aggravated by Exposure:NONE SPECIFIED BY MANUFACTURER.

====================== First Aid Measures ======================

First Aid:INHAL:REMOVE TO FRESH AIR. SUPPORT BREATHING (GIVE O*2/ARTF RESP) . EYES:HOLD EYE LID OPEN & FLUSH W/LARGE AMOUNTS OF WATER FOR AT LEAST 15 MINUTES. SKIN:WASH W/MILD SOAP & WATER. INGEST:CONSULT MD IF PERSISTENT HEADACHES OR CHEST PAINS DEVELOP.

===================== Fire Fighting Measures =====================

Extinguishing Media:DO NOT FIGHT FIRE.
Fire Fighting Procedures:WITHDRAW PERSONNEL IMMEDIATELY. ALLOW FIRE TO BURN ITSELF OUT. DO NOT FIGHT FIRES.
Unusual Fire/Explosion Hazard:MAY EXPLODE WHEN SUBJECTED TO FIRE OR SHOCK. AVOID TOXIC FUMES FROM FIRE. EXPLOSION POINT:337F.

================== Accidental Release Measures ==================

Spill Release Procedures:SWEEP UP & DISPOSE OF ALL SPILLED MATERIAL IMMEDIATELY USING NON-SPARKING TOOLS. DO NOT PERMIT SMOKING OR OPEN FLAMES NEAR SPILL SITE. TRANSPORTATION EMERGENCIES INVOLVING SPILLS, LEAKS, FIRES/EXPOSUR ES CALL CHEMTREC: 1-800-424-9300.
Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER.

===================== Handling and Storage =====================

Handling and Storage Precautions:MINIMIZE INHALATION & SKIN CONTACT. PREVENT CONTACT W/FOOD & CHEWING OR SMOKING MATERIALS.
Other Precautions:COMPLY W/"ALWAYS & NEVER" AS ADOPTED BY THE INSTITUTE OF MAKERS OF EXPLOS. TRANSPORTATION, STOR & USE MUST COMPLY W/OSHA SFTY & HLTH STDS, 29CFR1910.109, APPLIC MSHA REGS, DOT & HAZ MATLS REGS, BATF R EQUIREMENTS & STATE & LOC (SUPP DATA)

============= Exposure Controls/Personal Protection =============

Respiratory Protection:NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN . NOT REQUIRED UNDER NORMAL CONDITIONS.
Ventilation:VENTILATE MAGAZINES BEFORE ENTERING.
Protective Gloves:ABSORBANT COTTON GLOVES.
Eye Protection:ANSI APPROVED CHEM WORKERS GOGGS .
Other Protective Equipment:NONE SPECIFIED BY MANUFACTURER.
Work Hygienic Practices:NONE SPECIFIED BY MANUFACTURER.
Supplemental Safety and Health
VP:0.038-0.05. SOL IN H*2O:SOL IN WATER, BUT NITRIC ESTERS (NG & EGDN) ARE ONLY SLIGHTLY SOL. APPEAR/ODOR:SLIGHTLY SWEET ODOR. OTHER PREC:TRANSPORTATION, STORAGE & USE REGULATIONS & ORDINANCES.

================= Physical/Chemical Properties ==================

Boiling Pt:B.P. Text:NONE
Vapor Pres:SUPP DATA
Spec Gravity:1-1.7 (H*2O=1)
Solubility in Water:SALTS ARE (SUPDAT)
Appearance and Odor:MIXT OF ABSORBANTS, WHITE OXIDIZING SALTS. TAN COLOR W/WHITE GRANULES; (SUPDAT)

================ Stability and Reactivity Data ================

Stability Indicator/Materials to Avoid:YES
AVOID ALL CONTAMINATION ESPECIALLY ACIDS, ALKALIES, PEROXIDES & CHLORATES.
Stability Condition to Avoid:MAY EXPLODE WHEN SUBJECTED TO FIRE OR SHOCK.
Hazardous Decomposition Products:GASEOUS NITROGEN OXIDES & CARBON OXIDES.

=================== Disposal Considerations ===================

Waste Disposal Methods:DISP OF UNDER DIRECT SUPERVISION OF QUALIFIED PERS ACCORDING TO LOC, STATE & FED REGS. CALL MFR FOR RECS & ASSISTANCE. THIS MATL MAY BECOME HAZ WASTE UNDER CERTAIN CNDTNS & MUST BE COLLECTED, LABELED & DISPOSED OF PER STATE & FED HAZ WASTEREGS.

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DU PONT

MATERIAL SAFETY DATA SHEET

PRODUCT IDENTIFICATION

NAME : DETAFLEX* PRODUCTS
TRADE NAMES AND SYNONYMS :
DETAPRIME* BOOSTERS: UF-4, UF, UAL, UA-4, UA-6, EB-6, EB-18 WG, GA, S
DETAFLEX*
DETASHEET*

*Du Pont Trademarks

MANUFACTURER/DISTRIBUTOR : E.I. du Pont de Nemours & Co., Inc.
1007 Market Street
Wilmington, DE 19898
PRODUCT INFORMATION PHONE : 1-800-441-7515
MEDICAL EMERGENCY PHONE : 1-800-441-3637
TRANSPORTATION EMERGENCY PHONE : CHEMTREC 1-800-424-9300

PREVENTION OF ACCIDENTS IN THE USE OF EXPLOSIVES

THE PREVENTION OF ACCIDENTS IN THE USE OF EXPLOSIVES IS A RESULT OF CAREFULL PLANNING AND OBSERVANCE OF THE BEST KNOWN PRACTICES. THE EXPLOSIVES USER MUST REMEMBER THAT HE IS DEALING WITH A POWERFUL FORCE AND THAT VARIOUS DEVICES AND METHODS HAVE BEEN DEVELOPED TO ASSIST HIM IN DIRECTING THIS FORCE. HE SHOULD REALIZE THAT THIS FORCE, IF MISDIRECTED, MAY EITHER KILL OR INJURE BOTH HIM AND HIS FELLOW WORKERS.

WARNING

ALL EXPLOSIVES ARE DANGEROUS AND MUST BE CAREFULLY HANDLED AND USED FOLLOWING APPROVED SAFETY PROCEDURES EITHER BY OR UNDER THE DIRECTION OF COMPETENT, EXPERIENCED PERSONS IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL LAWS, REGULATIONS AND ORDINANCES. IF, AFTER CAREFULLY READING THE ENTIRE LEAFLET(S) "DO'S AND DON'TS" INSTRUCTIONS AND WARNINGS INSERTED IN EACH CASE OF THESE PRODUCTS, YOU HAVE ANY QUESTIONS OR DOUBTS AS TO HOW TO USE ANY EXPLOSIVE PRODUCT, DO NOT USE IT BEFORE CONSULTING YOUR SUPERVISOR, OR THE MANUFACTURER IF YOU DO NOT HAVE A SUPERVISOR. IF YOUR SUPERVISOR HAS ANY QUESTIONS OR DOUBTS, HE SHOULD CONSULT THE MANUFACTURER BEFORE USE. SEE "ADDITIONAL INFORMATION AND REFERENCES" BELOW.

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HAZARDOUS COMPONENTS

CHEMICAL	CAS NUMBER
Pentaerythritol Tetranitrate	78-11-5
Acetyl Tributyl Citrate	77-90-7
Nitrocellulose	9004-70-0

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The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

FIRE AND EXPLOSION DATA

Flammable Limits of Styrene Monomer: LEL 1.1%; UEL 6.1%

FIRE AND EXPLOSION HAZARDS

Hazardous gases produced in fire are carbon monoxide. Will burn like wood if contacted with open flame.

EXTINGUISHING MEDIA

Water. CO2.

SPECIAL FIRE FIGHTING INSTRUCTIONS

Flood with water. Keep personnel removed & upwind of fire.

****

HEALTH HAZARD INFORMATION

PRINCIPAL HEALTH HAZARDS

The catalyst and resin mix components of these products are mixtures of varying ratios of components. In animal tests of representative compositions, both catalyst and resin mix compositions were skin and eye irritants. The resin caused corneal injury. The ALD for the catalyst mixture was >17,000 mg/kg in rats. There have been reports of eye irritation and dermatitis in humans from contact with the products during manufacture and use.

STYRENE which is present in the product has caused nonspecific effects such as irritation, weight loss and moderate blood changes in laboratory animals. In humans, overexposure may cause eye, nose and throat iritation. Repeated or prolonged contact may cause skin irritation with discomfort and dermatitis. It can be absorbed through the skin in harmful amounts. Overexposure may cause central nervous system effects such as dizziness, headache, nausea, and loss of consciousness. Reports have associated repeated and prolonged overexposure to solvents with permanent brain and nervous system damage.

CARCINOGENICITY

NONE OF THE COMPONENT(S) OF THIS MATERIAL IS LISTED AS A CARCINOGEN BY NTP, IARC, OR OSHA.

EXPOSURE LIMITS

TLV * (ACGIH) : None established.
PEL (OSHA) : None established.
* TLV is a registered trademark.

Styrene:	TLV (ACGIH)	50ppm
	PEL (OSHA)	100ppm

EXPOSURE LIMITS - CONTINUED

Vinyl Toluene: TLV (ACGIH) 50ppm
PEL (OSHA) 100ppm

Butyl Benzyl Phthalate: AEL (Du Pont) 5mg/M3, 8 hr TWA

SAFETY PRECAUTIONS
Avoid contact with eyes. Avoid contact with skin. Avoid contact with clothing. Wash thoroughly after handling. Do not open or puncture cartridges. Avoid breathing vapors.

FIRST AID

INHALATION :
If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT :
Flush skin with water.

EYE CONTACT :
In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION :
If swallowed, induce vomiting immediately by giving two glasses of water and sticking finger down throat. Never give anything by mouth to an unconscious person. Call a physician.

****
PROTECTION INFORMATION

GENERALLY APPLICABLE CONTROL MEASURES and PRECAUTIONS
Use only with adequate ventilation. Keep container in a cool place. Do not mix with acids, alkalies, oxidants.Do not consume food, drink or tobacco in areas where they may become contaminated with this material.

PERSONAL PROTECTIVE EQUIPMENT
Face shield. Chemical Cartridge Respirator : for organic vapors if exposure to excessive styrene fumes is likely. Impervious gloves such as NEOPRENE if contact is likely.

****
SPILL, LEAK, OR RELEASE
Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.

Remove source of heat, sparks, flame, impact, friction or electricity. Recover undamaged and minimally contaminated material for reuse or

DISPOSAL INFORMATION - CONTINUED

applicable Federal Regulations under the authority of the Resource Conservation and Recovery Act (40 CFR, parts 260-271).

****

SHIPPING INFORMATION

DOMESTIC OTHER THAN AIR (DOT)
Shipping Name : High Explosive
Hazard Class : Class A Explosive
UN/NA no. : UN: 0084
DOT Label(s) : EXPLOSIVE A
DOT Placard : EXPLOSIVES A

INTERNATIONAL WATER OR AIR (IMO/ICAO)
Shipping Name : IMO: Explosives, Blasting Type D
Hazard Class : 1.10
UN no. : 0084
IMO/ICAO Label : EXPLOSIVE
Special Information : IATA/ICAO: EXPLOSIVES, BLASTING, TYPE D; FORBIDD EN

****

STORAGE CONDITIONS

Store in well ventilated area. Store in cool place. Do not store with other explosives. Store in accordance with National Fire Protection Assn regulations. Store in accordance with Federal Regulations. Do not store or consume food, drink, or tobacco in areas where they may become contaminated with this material. Store in approved type magazine.

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IT IS OBVIOUSLY IMPOSSIBLE TO INCLUDE WARNINGS OR APPROVED METHODS FOR EVERY CONCEIVABLE SITUATION. A LIST OF SUGGESTIONS TO AID IN AVOIDING THE MORE COMMON CAUSES OF ACCIDENTS IS SET FORTH IN THE "DO'S AND DON'TS" INSTRUCTIONS AND WARNINGS INCLUDED AS CASE INSERTS WITH THE PRODUCT. ADDITIONAL INFORMATION IS AVAILABLE IN THE BLASTERS' HANDBOOK, PUBLISHED BY E. I. DU PONT DE NEMOURS AND COMPANY, ORDNANCE SAFETY MANUAL, PUBLISHED BY THE U. S. ARMY ORDNANCE DEPARTMENT, AND IN THE INSTITUTE OF MAKERS OF EXPLOSIVES SAFETY LIBRARY PUBLICATIONS LISTED BELOW. COPIES OF THESE IME PUBLICATIONS MAY BE OBTAINED BY WRITING THE INSTITUTE OF MAKERS OF EXPLOSIVES, 1575 EYE STREET, N. W., SUITE 550, WASHINGTON, D. C. 20005, OR FROM YOUR EXPLOSIVES SUPPLIER: CONSTRUCTION GUIDE FOR STORAGE MAGAZINES (NO. 1); AMERICAN TABLE OF DISTANCES (NO. 2); SUGGESTED CODE OF REGULATIONS FOR THE MANUFACTURE, TRANSPORTATION, STORAGE, SALE, POSSESSION, AND USE OF EXPLOSIVES AND BLASTING MATERIALS (NO. 3); SAFETY GUIDE FOR THE STORAGE, HANDLING AND USE OF EXPLOSIVES MATERIALS (NO. 17); SAFETY GUIDE FOR THE PREVENTION OF RADIO FREQUENCY RADIATION HAZARDS (NO. 20); IME DESTRUCTION OF COMMERCIAL EXPLOSIVES (NO. 21); IME STANDARD FOR THE SAFE TRANSPORTATION OF CLASS C COMMERCIAL DETONATORS (BLASTING CAPS) IN A VEHICLE WITH OTHER CERTAIN EXPLOSIVES (NO. 22).

Date of latest Revision : 02-Nov-85
Person Responsible for MSDS : Product Manager, EP. F & FP
Address : E. I. Du Pont de Nemours & Co.,Inc.
Wilmington, DE 19898
Telephone : 302-774-3120

DU PONT
REG U.S. PAT & TM OFF

1. PRODUCT AND COMPANY IDENTIFICATION

Name: **Double-base smokeless powder, propellant**.

Trade Names and Synonyms: **Accurate::No. 2, No. 5, No. 7, No. 9, 4100, 1680, 2200, 2230, 2460, 2520, 2700, MAGPRO, 8700, Nitro 100, 5744**

Distributed By: **WESTERN POWDERS, INC.**
P.O. Box 158
Miles City, Montana 59301
Telephone: (406)234-0422
Toll Free: (800)497-1007

Transportation Emergencies – Chemtrec – 1-800-424-9300

2. HAZARD IDENTIFICATION

Emergency Overview – Danger! Extremely Flammable – Explosive.
Accidental Fire or Explosion is Likely to Cause Severe Injury or Death.
Avoid Exposure to all Sources of Heat or Flame, Electrical Sparks, Static Electricity, and Impact Shock.

OSHA Regulatory Status - This product may be considered to be a hazardous chemical under OSHA Hazard Communication Standard 29 CFR 1910.1200.
Applicable OSHA Classifications: Explosive, Toxic, Blood Toxin, Skin and Eye Irritant

Potential Health Effects – Eye contact may cause irritation. Acute contact may cause skin irritation. Acute exposure may cause irritation to nose, mouth, throat and lungs. Ingestion may cause irritation to gastrointestinal tract. Nitroglycerin content may cause dilation of blood vessels with a drop in blood pressure and headache, cyanosis and mental confusion. Nausea, vomiting and abdominal pain may also occur. Some components of this granular mixture may be absorbed directly through the skin. Neither this product nor any of its ingredients (except Dinitrotoluene) are listed as carcinogens by OSHA, NIOSH-NTP and IARC. Per IARC 28 Dinitrotoluene is listed as possibly carcinogenic to humans.

Potential Environmental Effects: Ecological studies on this product unknown. Some components are known to be harmful to aquatic organisms

3. COMPOSITION / INFORMATION ON INGREDIENTS

COMPONENT	CAS #	wt. %
Nitrocellulose	9004-70-0	<90
Nitroglycerin	55-63-0	7 - 23
Dinitrotoluene	121-14-2	0 - 2
Dibutyl phthalate	84-74-2	0 - 7
Diphenylamine	122-39-4	0.5 – 3.0
Potassium nitrate	7757-79-1	0 – 1.5
Sodium sulfate	7757-82-6	0 – 1
Graphite	7782-42-5	1 max.
Polyester adipate	Not disclosed	0 - 10
Ethyl Centralite	85-98-3	0 - 6
Potassium sulfate	7778-80-5	0 - 1
Calcium carbonate	471-34-1	0 - 1
Deterrent	Not given	0 - 7
Rosin	8050-09-7	0 - 5

4. FIRST AID MEASURES

EYES: Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If eye irritation develops, call a physician.

SKIN : Immediately wash with soap water for at least 15 minutes. Call a physician if needed. If clothing comes in contact with the product, the clothing should be removed immediately and should be laundered before re-use.

INGESTION: Immediately drink large quantities of water. Induce vomiting. Call a physician at once. When vomiting occurs, keep head lower than hips to help prevent aspiration. DO NOT give anything by mouth if the person is unconscious or if having convulsions.

INHALATION:

- If person experiences nausea, headache or dizziness, person should stop work immediately and move to fresh air until these symptoms disappear. If breathing is difficult, administer oxygen, keep person warm and at rest. Call physician.
- In event that an individual inhales enough vapor to lose consciousness, person should be moved to fresh air at once and a physician should be called immediately. If breathing has stopped, artificial respiration should be given immediately.
- In all cases, ensure adequate ventilation and provide respiratory protection before the person returns to work.

5. FIRE FIGHTING MEASURES

DANGER!! Extremely Flammable – Explosives
Accidental Explosion May Cause Severe Injury or Death
Evacuate the area immediately in case of emergency.

FLASH POINT: Not Determined
FLAMMABLE LIMITS: Not Determined
AUTOIGNITION TEMPERATURE: 160°C – 180°C (320° F - 360°F)
No explosion – 5 hours at 120°C (248°F)

EXTINGUISHING MEDIA:
Apply large volumes of water as quickly as possible from automatic sprinklers or with fire hose from a distant, protected location. FIGHT EXPLOSIVE FIRES ONLY FROM WELL PROTECTED, DISTANT (FROM POINT OF FIRE) LOCATION. Since product is self-oxidizing, smothering agents such as dry chemical, carbon dioxide, or foam are ineffective.

PERSONAL PROTECTION FOR FIREFIGHTING
Self contained breathing apparatus (SCBA) and protective clothing, to include impervious boots, gloves, hard hat, and chemically impermeable suit. Eye and face protection. Wash all clothing prior to reuse.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
Product is self oxidizing. Products are propellant explosives and are extremely flammable and readily ignited. Protect from fire, sparks, impact and high temperatures.
DO NOT move or approach containers which have been damaged due to exposure to heat. Keep unnecessary people away, isolate hazard area. Use only trained and qualified clean up personnel wearing appropriate protective clothing to clean up heat damaged product.

HAZARDOUS DECOMPOSITION PRODUCTS: None expected, if stored and handled as in Section 7.

HAZARDOUS PRODUCTS OF COMBUSTION. Combustion products vary depending on fire conditions and other combustibles present in the fire. The predominant products will be carbon dioxide, and nitrogen oxides. Under some conditions, methane, carbon monoxide, irritating aldehydes and carboxylic acids, and hydrogen cyanide may be formed.

6. ACCIDENTAL RELEASE MEASURES

SPILL PROCEDURES:

Clean up spills immediately using soft bristle brush and conductive rubber or plastic shovel. Use caution, material is sensitive to initiation from sources such as heat, flame, impact, friction or sparks.

AIR RELEASE: Not applicable

WATER RELEASE:

- This material is heavier than water. Create an overflow dam with filtration capabilities to retain material.
- Divert water flow or stop if possible. Gather wet material using non-sparking or plastic utensils.
- Keep material damp until ready for disposal.

LAND SPILL:

- Clean up of spill materials may be accomplished using non-sparking or plastic utensils. Wear non-flammable or flame retardant clothing at all times. Wet all spill materials prior to initiating clean up procedure.
- Material may best be destroyed by controlled open burning in small quantities (maximum about 1 pound) in piles not over 1 inch deep. Use an ignition train of slow-burning, combustible materials to permit retreat to a safe distance before powder is ignited. Stay upwind, do not breathe products of combustion. Burn only with permission of all appropriate regulatory agencies.

WASTE DISPOSAL:

- If this product becomes a waste, it meets the criteria of a hazardous waste as defined under 40 CFR 261 and would have the following EPA hazardous waste number: D003
- If this product becomes a waste, it will be a hazardous waste which is subject to the Land Disposal Restrictions under 40 CFR 268 and must be managed accordingly.
- If this material becomes a waste, it can be disposed by controlled open burning in small quantities, as described above, with proper local agency authorization.

CARE MUST BE TAKEN TO PREVENT ENVIRONMENTAL CONTAMINATION FROM THE USE OF THIS MATERIAL. THE USER HAS THE RESPONSIBILITY TO DISPOSE OF UNUSED MATERIAL, RESIDUES AND CONTAINERS IN COMPLIANCE WITH ALL RELEVANT LOCAL, STATE AND FEDERAL LAWS AND REGULATIONS REGARDING TREATMENT, STORAGE AND DISPOSAL FOR HAZARDOUS AND NONHAZARDOUS WASTES.

7. HANDLING AND STORAGE

HANDLING AND STORAGE PRECAUTIONS:

- For handling and storage requirements see 29 CFR 1920.109. Also see <<Properties and Storage of Smokeless Powder>> published by the SPORTING ARMS AND AMMUNITION MANUFACTURES' INSTITUTE; INC. (SAAMI), PO Box 838, Brandford, CT 06405.
- This product may react with acids, oxidizing agents, alkalizes or amines (organic and inorganic) and should not be stored near such materials.
- Avoid exposure to sunlight or artificial ultraviolet light.
- Recommended storage conditions -: 21°C (70°F) 50% relative humidity.
- Keep away from heat, sparks and open flame.
- Store in a cool, dry place.
- Do not store smokeless powder in the same area with solvents, flammable gases or highly combustible materials.
- Must be stored in original DOT approved containers or shipping container.
- Do not smoke in areas where powder is stored or used. (50 ft. minimum distance required).

Section 7 - Continued

- Do not keep old or salvaged powders. Check old powders for deterioration regularly. Destroy deteriorated powders immediately.
- Empty containers may contain residues of powder, and should be treated as hazardous waste.

ENGINEERING CONTROLS:
Adequate ventilation should be provided to keep dust concentrations below acceptable exposure limits. Discharge from the ventilation system should comply with applicable air pollution control regulations.

PROTECTIVE MEASURES DURING REPAIR AND MAINTENACE:
Eliminate ignition sources and prevent build-up of static electric charges. Thoroughly clean up all powder grains and dust residues in the maintenance and repair aieas before starting work.

8. EXPOSURE CONTROL / PERSONAL PROTECTION

ESTABLISHED EXPOSUR LIMITS

COMPONENT	OSHA (PEL)	ACGIH (TLV)
Nitrocellulose	None established	None established
Nitroglycerin	2mg/m^3 ceiling (skin)	0.05ppm TWA (skin)
Dinitrotoluene	1.5 mg/m^3, skin	1.5 mg/m^3, skin
Dibutyl phthalate	5 mg/m^3 TWA	5 mg/m^3 TWA
Diphenylamine	Not established	10 mg/m^3 TWA
Potassium nitrate	None established	
Sodium sulfate	None established	
Graphite	15 mg/m^3 total dust 5 mg/m^3 respirable dust	2 mg/m^3 Respirable dust
Polyester adipate	None established	
Ethyl Centralite	None established	
Potassium sulfate	None established	None established
Calcium carbonate	15 mg/m^3 total dust 5 mg/m^3 respirable dust	10 mg/m^3
Deterrent	Not disclosed	
Rosin	None established	

PERSONAL PROTECTIVE EQUIPMENT

- Safety glasses or goggles with side shields.
- Impervious gloves.
- Appropriate respiratory protection required when exposure to airborne containment is likely to exceed acceptable limits. Respirators should be selected and used in accordance with OSHA Subpart I (29 CFR 1910.134) and manufacturer's recommendations.
- Flame-retardant cotton coveralls and conductive safety shoes.

ENGINEERING CONTROLS
Adequate ventilation should be provided to keep dust concentrations below acceptable exposure limits. Discharge from the ventilation system should comply with applicable air pollution control regulations. Use a local mechanical ventilation system if needed, preferably with explosion proof construction, and with a suitable dust filter installed at inlet to suction piping to the system to prevent accumulation of explosive dust in ventilation piping and blower.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Granular Solid Mixture, silvery gray to black
Freezing Point	Not Applicable
Boiling Point	Not Applicable
Decomposition Temperature	Decomposition becomes measurable above 50° C (122°F)
Autoignition Temperature	160°C – 180°C (320° F - 360°F)
Specific Gravity	1.2 – 1.6
Bulk Density	0.5 – 1.1 (g/cc)
pH 25 Deg. C	Not Applicable
Solubility in Water	Negligible
Volatiles, Percent By Volume	<2
Vapor Pressure 25 Deg. C	<1mm Hg
Evaporation Rate	Negligible
Vapor Density	Not Applicable
Molecular Weight	Not Applicable - mixture
Odor	None
Coefficient of Oil/Water Distribution	No Data

10. STABILITY AND REACTIVITY

INSTABILITY: Unstable with heat, unstable with static charges, and unstable with impact. Not usual hazards when stored and used properly.
INCOMPATIBILITY: Incompatible with acids, bases, oxidants, amines.
DECOMPOSITION: Hazardous gases produced are carbon monoxide, carbon dioxide, oxides of nitrogen.
HAZARDOUS POLYMERIZATION: Will not occur.
FIRE AND EXPLOSION DATA: Ignition temperature: 160° - 180° C (320° - 360° F)
Decomposition begins at approximately 50°C (122°F)
OTHER CONDITIONS TO AVOID Direct sunlight.

11. TOXICOLOGICAL INFORMATION

ROUTES OF ABSORPTION: Inhalation Skin Ingestion Eye Contact

TOXICITY DATA:
Nitrocellulose: Rat, Oral LD_{50} : >5000 mg/kg
Dinitrotoluene Rat, Inhalation, LC_{50} : 2.87 mg/l, I hour
Rat, Oral LD_{50} :177mg/kg
Dibutyl Phthalate: Human, Oral TD_{LO} : 140 mg/kg
Rat, Oral LD_{50} : 7499 mg/kg
Nitroglycerin: Woman, Oral TD_{LO} : 8 µg/kg
Rat, Acute Oral LD_{50} : 105 mg/kg

12. ECOLOGICAL INFORMATION

AQUATIC TOXICITY - Components of this product known to be toxic to aquatic organisms: diphenylamine, dibutyl phthalate, dinitrotoluene, nitroglycerine

Nitrocellulose: Acute aquatic 96**-** hour static LC50 value falls within the relatively harmless range of >1,000 mg/L, according to U.S. Wildlife criteria. Four species were tested. EC50 in four species of bacteria ranged from 731 mg/L to > 1,000 mg/L.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL:

- If this product becomes a waste, it meets the criteria of a hazardous waste as defined under 40 CFR 261 and would have the following EPA hazardous waste number: D003
- If this product becomes a waste, it will be a hazardous waste which is subject to the Land Disposal Restrictions under 40 CFR 268 and must be managed accordingly.
- Material may best be safely destroyed by controlled open burning in small quantities (maximum about 1 pound) in piles not over 1 inch deep. Use an ignition train of slow-burning, combustible materials to permit retreat to a safe distance before powder is ignited. Stay upwind, do not breathe products of combustion. Burn only with permission of all local regulatory authorities.

14. TRANSPORT INFORMATION

This material is regulated as a DOT Hazardous Material

US DOT Classification: Land – Powder, Smokeless, 1.3C, UN 0161, - for all non-bulk powders listed in this MSDS shipped in excess of 100 pounds

Land - Smokeless Powder for Small Arms (100 pounds or less), NA 3178, 4.1 – for all products listed in this MSDS, in DOT approved containers and packaging.

15. REGULATORY INFORMATION

Toxic Substance Control Act (TSCA) : all components of this product are listed in the TSCA Inventory.

SARA Title III, Sections 311/312 : Hazard Categories per 40 CFR 370.21 :
Acute (health) - Yes
Chronic (health) – No
Reactive (physical) - Yes
Sudden Release (physical) – Yes

CERCLA Sections 102a/103 – Hazardous Substances – RQ: dinitrotoluene, (4.54 kg), Nitroglycerin (4.54 kg), **Dibutyl phthalate (4.54 kg**),

SARA Title III, Section 313 covered components: diphenylamine, dinitrotoluene, dibutyl phthalate, Nitroglycerin

16. OTHER INFORMATION

Revised: 11/15/2007 by Western Powders, Inc.

CAUTION: Propellants are extremely dangerous. Only highly trained and qualified personnel should utilize this material. Propellants should be tested for compatibility with any materials which they contact. Clean up any spills of material immediately. Proper housekeeping techniques must be maintained to minimize the accumulation of propellant dust. Follow all safety regulations and precautions when handling, storing, or processing propellant material.

The information contained herein is believed to be accurate and represents the best information currently available to Western Powders, Inc. . No warranty or guarantee, express or implied, with regard to the safety or suitability of these products, or the results obtained from their use, is offered by Western Powders, Inc.. Buyer and user assume any and all risk, responsibility and liability for any injury (including death), loss or damage arising from usage of these products.

Material Safety Data Sheet
(MSDS-PLT)

PRODUCT IDENTIFICATION	
Product Name	Explosive Cartridges or Explosive Pellets
Trade Names and Synonyms	
Manufacturer/Distributor	Various
Transportation Emergency	**800-255-3924 (24 hrs -- *CHEM • TEL*)**

PREVENTION OF ACCIDENTS IN THE USE OF EXPLOSIVES

The prevention of accidents in the use of explosives is a result of careful planning and observance of the best known practices. The explosives user must remember that he is dealing with a powerful force and that various devices and methods have been developed to assist him in directing this force. He should realize that this force, if misdirected, may either kill or injure both him and his fellow workers.

WARNING

All explosives are dangerous and must be carefully handled and used following approved safety procedures either by or under the direction of competent, experienced persons in accordance with all applicable federal, state, and local laws, regulations, or ordinances. If you have any questions or doubts as to how to use any explosive product, **DO NOT USE IT** before consulting with your supervisor, or the manufacturer, if you do not have a supervisor. If your supervisor has any questions or doubts, he should consult the manufacturer before use.

HAZARDOUS COMPONENTS			
Material or Component	**CAS No.**	**TLV**	**PEL**
Black Powder	N/A	NE	NE
C-4	See RDX	See RDX	See RDX
HMX Cyclotetramethylenetetranitramine)	02691-41-0	NE	NE
HNS (Hexanitrostilbene)	20062-22-0	NE	NE
PYX (Picrylaminodinitropyridine)	38082-89-2	NE	NE
RDX (Cyclotrimethylenetrinitramine)	00121-82-4	1.5 mg/m^3	1.5 mg/m^3
Smokeless	000055-63-0	0.46 mg/m^3	0.1 mg/m^3
Depending upon model, cartridges/pellets contain one of the items listed above N/A = Not assigned NE = Not established			

PHYSICAL DATA
Cartridges or Pellets of compressed high explosive. May be contained in plastic case. May be any of a number of different shapes.

HAZARDOUS REACTIVITY	
Instability	Detonates with friction, impact, heat, low level electrical current, electrostatic or RF energy
Incompatibility	Acids and alkalis
Hazardous decomposition	Detonation produces hazardous fragments. Gases produced may contain lead, carbon, and nitrogen oxide.
Polymerization	Polymerization will not occur.

FIRE AND EXPLOSION DATA	
Flashpoint	Not applicable
Extinguishing media	None
Special fire fighting procedures	**ALL EXPLOSIVES: DO NOT FIGHT EXPLOSIVES FIRES.** Try to keep fire from reaching explosives. Isolate area. Guard against intruders. Division 1.4 Explosives: Evacuate the area for 1500 feet (1/3 mile). Consult *the 2000 Emergency Response Guidebook, Guide 114* for further details.
Unusual fire and explosion hazards	May detonate with impact or on heating.

HEALTH HAZARDS	
General	Pellets do not present health hazards in normal handling and use; however, the products are Division 1.4 explosives, and detonation may cause severe physical injury, including death. All explosives are dangerous and must be handled carefully and used following approved safety procedures under the direction of competent, experienced persons in accordance with all applicable federal, state, and local laws, regulations, and ordinances. Inhalation of explosive powders may cause nervous system irregularities including headaches and dizziness. Nitrogen oxides generated during use are skin, eye, and respiratory tract irritants.
Carcinogenicity	None of the components of Pellets are listed as a carcinogen by NTP, IARC, or OSHA.

FIRST AID	
Inhalation	Not a likely route of exposure. If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably by mouth-to-mouth. If breathing is difficult, give oxygen. Seek prompt medical attention.
Eye and skin contact	Not a likely route of exposure.
Ingestion	Not a likely route of exposure.
Injury from detonation	Seek prompt medical attention.

SPILL OR LEAK PROCEDURES	
Spill/leak response	Use appropriate personal protective equipment. Isolate area and remove sources of friction, impact, heat, low level electrical current, electrostatic or RF energy. Only competent, experienced persons should be involved in cleanup procedures. Sweep up with non-sparking tools and remove.
Waste disposal	Dispose of in compliance with federal regulations under the authority of the *Resource Conservation and Recovery Act* (40 CFR Parts 260-271).

SPECIAL PROTECTION INFORMATION	
Ventilation	Use only with adequate ventilation.
Respiratory	NIOSH approved particle masks for dust and mist.
Eye	Safety glasses or goggles.
Gloves	Impervious rubber gloves.
Other	Cotton overalls, undergarments and socks. Conductive soled shoes

SPECIAL PRECAUTIONS
Keep away from friction, impact, and heat. Do not consume food, drink, or tobacco in areas where they may become contaminated with these materials.

STORAGE CONDITIONS
Store in accordance with the requirements of *Subpart K, ATF: Explosives Law and Regulations* (27 CFR 555.201-555.219).

SHIPPING INFORMATION (May be one of the following)		
Proper shipping name	Charges, shaped	
Hazard class	1.4S	
UN Number	UN0441	
DOT Label & Placard	DOT Label	EXPLOSIVE 1.4S
	DOT Placard	EXPLOSIVE 1.4
Proper shipping name	Articles, explosive, n.o.s. (*** pellets or ***cartridges) (*** = RDX, HMX, HNS, PYX, C-4, etc.)	
Hazard class	1.4D	
UN Number	UN0352	
DOT Label & Placard	DOT Label	EXPLOSIVE 1.4D
	DOT Placard	EXPLOSIVE 1.4
Proper shipping name	Articles, explosive, n.o.s. (*** pellets or *** cartridges) (*** = RDX, HMX, HNS, PYX, C-4, etc.)	
Hazard class	1.4S	
UN Number	UN0349	
DOT Label & Placard	DOT Label	EXPLOSIVE 1.4S
	DOT Placard	EXPLOSIVES 1.4

The information contained in this Material Safety Data Sheet is based upon available data and believed to be correct; however, as such has been obtained from various sources, including the manufacturer and independent laboratories, it is given without warranty or representation that it is complete, accurate, and can be relied upon. OWEN COMPLIANCE SERVICES, INC. has not attempted to conceal in any manner the deleterious aspects of the product listed herein, but makes no warranty as to such. Further, OWEN COMPLIANCE SERVICES, INC. cannot anticipate nor control the many situations in which the product or this information may be used; there is no guarantee that the health and safety precautions suggested will be proper under all conditions. It is the sole responsibility of each user of the product to determine and comply with the requirements of all applicable laws and regulations regarding its use. This information is given solely for the purposes of safety to persons and property. Any other use of this information is expressly prohibited.

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MSDS prepared by: David W. Boston

Original publication date: 03/15/93

Revision dates: 03/07/08
11/28/05
12/03/03

ATLAS POWDER CO -- BOOSTERS -- 1376-00N015161
===================== Product Identification =====================

Product ID:BOOSTERS
MSDS Date:06/27/1988
FSC:1376
NIIN:00N015161
MSDS Number: BKNNX
=== Responsible Party ===
Company Name:ATLAS POWDER CO
Address:15301 DALLAS PARKWAY SUITE 1200
City:DALLAS
State:TX
ZIP:75248
Country:US
Info Phone Num:717-386-4121; 417-624-0212
Emergency Phone Num:717-386-4121; 417-624-0212
Preparer's Name:P.E. THERRIAULT
CAGE:5P744
=== Contractor Identification ===
Company Name:ATLAS POWDER CO
Address:15301 DALLAS PARKWAY SUITE 1200
Box:City:DALLAS
State:TX
ZIP:75248
Country:US
Phone:717-386-4121; 417-624-0212
CAGE:5P744

============= Composition/Information on Ingredients =============

Ingred Name:2,4,6-TRINITROTOLUENE (TNT)
CAS:118-96-7
RTECS #:XU0175000
Other REC Limits:TRANS PEL:1.5MG/M3,S
OSHA PEL:S, 1.5 MG/M3
ACGIH TLV:S, 0.5 MG/M3; 9293

Ingred Name:2,4,6-TRINITROTOLUENE (TNT)
CAS:118-96-7
RTECS #:XU0175000
OSHA PEL:S, 1.5 MG/M3
ACGIH TLV:S, 0.5 MG/M3; 9293

Ingred Name:PENTAERYTHRITOL, TETRANITRATE (PETN). VP:0.001 @ 97C.
MP:141.3C. BP:>202C. SPEC GRAV:1.76. APPEAR:COLORLESS CRYSTAL.
CAS:78-11-5
RTECS #:RZ2620000

Ingred Name:CYCLONITE
CAS:121-82-4

RTECS #:XY9450000
OSHA PEL:S, 1.5 MG/M3
ACGIH TLV:S, 1.5MG/M3; 9192

Ingred Name:CYCLONITE
CAS:121-82-4
RTECS #:XY9450000
OSHA PEL:S, 1.5 MG/M3
ACGIH TLV:S, 1.5MG/M3; 9192

===================== Hazards Identification =====================

LD50 LC50 Mixture:NONE SPECIFIED BY MANUFACTURER.
Routes of Entry: Inhalation:NO Skin:YES Ingestion:NO
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO
Health Hazards Acute and Chronic:TRINITROTOLUNE:IRRITANT.
CYCLOTRIMETHYLENE TRINITRAMINE:TOXIC.
Explanation of Carcinogenicity:NOT RELEVANT
Effects of Overexposure:NONE SPECIFIED BY MANUFACTURER.
Medical Cond Aggravated by Exposure:NONE SPECIFIED BY MANUFACTURER.

======================= First Aid Measures =======================

First Aid:INHAL:REMOVE TO FRESH AIR. SUPPORT BREATHING (GIVE OXYGEN/ARTIFICIAL RESPIRATION), CALL MD . INGEST:CALL MD IMMEDIATELY .

===================== Fire Fighting Measures =====================

Extinguishing Media:USE MEDIA SUITABLE FOR SURROUNDING FIRE .
Fire Fighting Procedures:DO NOT ATTEMPT TO FIGHT FIRES INVOLVING EXPLOSIVES. IMMEDIATELY EVACUATE AREA.
Unusual Fire/Explosion Hazard:AVOID TOXIC FUMES FROM FIRE.

================== Accidental Release Measures ==================

Spill Release Procedures:NONE SPECIFIED BY MANUFACTURER.
Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER.

====================== Handling and Storage ======================

Handling and Storage Precautions:FOLLOW OSHA STANDARDS FOR STORE/USE (29 CFR 1910.109). SEE "DO'S/DON'TS-INSTRUCTIONS & WARNINGS" FOUND IN EVERY SHIPPING CASE.
Other Precautions:AVOID TOXIC FUMES FROM BLASTING. WEAR NORMAL PROTECTIVE EQUIPMENT. SEE INSTITUTE OF MAKERS OF EXPLOSIVES PUBLICATIONS.

============= Exposure Controls/Personal Protection =============

Respiratory Protection:USE NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE

FOR EXPOSURE OF CONCERN .
Ventilation:NONE SPECIFIED BY MANUFACTURER.
Protective Gloves:NONE SPECIFIED BY MANUFACTURER.
Eye Protection:CHEMICAL WORKERS GOGGLES .
Other Protective Equipment:NONE SPECIFIED BY MANUFACTURER.
Work Hygienic Practices:NONE SPECIFIED BY MANUFACTURER.
Supplemental Safety and Health
NONE SPECIFIED BY MANUFACTURER.

================== Physical/Chemical Properties ==================

HCC:E2
Boiling Pt:B.P. Text:SEE INGREDS
Melt/Freeze Pt:M.P/F.P Text:SEE INGREDS
Vapor Pres:SEE INGRED
Spec Gravity:SEE INGREDIENTS
Appearance and Odor:SEE INGREDIENTS.

================= Stability and Reactivity Data =================

NONE SPECIFIED BY MANUFACTURER.
Stability Condition to Avoid:NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products:NONE SPECIFIED BY MANUFACTURER.

==================== Disposal Considerations ====================

Waste Disposal Methods:DISPOSAL OF DAMAGED OR DETERIORATED EXPLOSIVES MUST BE CARRIED OUT I/A/W ALL FEDERAL, AND STATE REGULATIONS.

Disclaimer (provided with this information by the compiling agencies): This information is formulated for use by elements of the Department of Defense. The United States of America in no manner whatsoever, expressly or implied, warrants this information to be accurate and disclaims all liability for its use. Any person utilizing this document should seek competent professional advice to verify and assume responsibility for the suitability of this information to their particular situation.

OWEN COMPLIANCE SERVICES, INC.

Material Safety Data Sheet
(MSDS-BP)

PRODUCT IDENTIFICATION	
Product Name	BLACK POWDER
Trade Names and Synonyms	N/A
Manufacturer/Distributor	GOEX, Inc. (Doyline, LA) & various international sources
Transportation Emergency	**800-255-3924 (24 hrs — *CHEM • TEL*)**

PREVENTION OF ACCIDENTS IN THE USE OF EXPLOSIVES

The prevention of accidents in the use of explosives is a result of careful planning and observance of the best known practices. The explosives user must remember that he is dealing with a powerful force and that various devices and methods have been developed to assist him in directing this force. He should realize that this force, if misdirected, may either kill or injure both him and his fellow workers.

WARNING

All explosives are dangerous and must be carefully handled and used following approved safety procedures either by or under the direction of competent, experienced persons in accordance with all applicable federal, state, and local laws, regulations, or ordinances. If you have any questions or doubts as to how to use any explosive product, **DO NOT USE IT** before consulting with your supervisor, or the manufacturer, if you do not have a supervisor. If your supervisor has any questions or doubts, he should consult the manufacturer before use.

HAZARDOUS COMPONENTS				
Material or Component	**%**	**CAS No.**	**TLV**	**PEL**
Potassium nitrate[1]	70-76	007757-79-1	NE	NE
Sodium nitrate[1]	70-74	007631-99-4	NE	NE
Charcoal	8-18	N/A	NE	NE
Sulfur	9-20	007704-34-9	NE	NE
Graphite[2]	Trace	007782-42-5	15 mppct (TWA)	2.5 mg/m^3
N/A = Not assigned NE = Not established				

[1] Black Powder contains either potassium nitrate ***or*** sodium nitrate in the percentages indicated. Black powder ***does not contain both***.

[2] Not contained in all grades of black powder.

PHYSICAL DATA	
Boiling Point	N/A
Vapor Pressure	N/A
Vapor Density	N/A
Solubility in Water	Good
Specific Gravity	1.70 - 1.82 (mercury method) ◆ 1.92 - 2.08 (pycnometer)
PH	6.0 - 8.0
Evaporation Rate	N/A
Appearance and Odor	Black granular powder. No odor detectable.

HAZARDOUS REACTIVITY	
Instability	Keep away from heat, sparks, and open flame. Avoid impact, friction, and static electricity.
Incompatibility	When dry, black powder is compatible with most metals; however, it is hygroscopic, and when wet, attracts all common metals except stainless steel. Black powder must be tested for compatibility with any material not specified in the production/procurement package with which they may come in contact. Materials include other explosives, solvents, adhesives, metals, plastics, paints, cleaning compounds, floor and table coverings, packing materials, and other similar materials, situations, and equipment.
Hazardous decomposition	Detonation produces hazardous overpressures and fragments (if confined). Gases produced may be toxic if exposed in areas with inadequate ventilation.
Polymerization	Polymerization will not occur.

FIRE AND EXPLOSION DATA	
Flashpoint	Not applicable
Auto ignition temperature	Approx. 464°C (867°F)
Explosive temperature (5 sec)	Ignites @ approx. 427°C (801°F)
Extinguishing media	Water
Special fire fighting procedures	**ALL EXPLOSIVES: DO NOT FIGHT EXPLOSIVES FIRES.** Try to keep fire from reaching explosives. Isolate area. Guard against intruders. Division 1.1 Explosives (heavily encased): Evacuate the area for 5000 feet (1 mile) if explosives are heavily encased. Division 1.1 Explosives (not heavily encased): Evacuate the area for 2500 feet (½ mile) if explosives are not heavily encased. Division 1.1 Explosives (all): Consult the *2000 Emergency Response Guidebook, Guide 112* for further details.
Unusual fire and explosion hazards	Black powder is a deflagrating explosive. It is very sensitive to flame and spark and can also be ignited by friction and impact. When ignited unconfined, it burns with explosive violence and will explode if ignited under even slight confinement.

HEALTH HAZARDS	
General	Black powder is a Division 1.1 Explosive, and detonation may cause severe physical injury, including death. All explosives are dangerous and must be handled carefully and used following approved safety procedures under the direction of competent, experienced persons in accordance with all applicable federal, state, and local laws, regulations, and ordinances.
Carcinogenicity	None of the components of Black powder are listed as a carcinogen by NTP, IARC, or OSHA.

FIRST AID	
Inhalation	*Not a likely route of exposure*. If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably by mouth-to-mouth. If breathing is difficult, give oxygen. Seek prompt medical attention.
Eye and skin contact	*Not a likely route of exposure*. Flush eyes with water. Wash skin with soap and water.
Ingestion	*Not a likely route of exposure*.. If ingested, induce vomiting immediately by giving two glasses of water and sticking finger down throat.
Injury from detonation	Seek prompt medical attention.

SPILL OR LEAK PROCEDURES	
Spill/leak response	Use appropriate personal protective equipment. Isolate area and remove sources of friction, impact, heat, low level electrical current, electrostatic or RF energy. Only competent, experienced persons should be involved in cleanup procedures. Carefully pick up spills with non-sparking and non-static producing tools.
Waste disposal	Desensitize by diluting in water. Open train burning, by qualified personnel, may be used for disposal of small unconfined quantities. Dispose of in compliance with federal regulations under the authority of the *Resource Conservation and Recovery Act* (40 CFR Parts 260-271).

SPECIAL PROTECTION INFORMATION	
Ventilation	Use only with adequate ventilation.
Respiratory	None
Eye	None
Gloves	Impervious rubber gloves.
Other	Metal-free *and* non-static producing clothes

SPECIAL PRECAUTIONS

- Keep away from friction, impact, and heat. Do not consume food, drink, or tobacco in areas where they may become contaminated with these materials.
- Contaminated equipment must be thoroughly water cleaned before attempting repairs.
- Use only non-spark producing tools.
- No smoking.

STORAGE CONDITIONS
Store in a cool, dry place in accordance with the requirements of *Subpart K, ATF: Explosives Law and Regulations* (27 CFR 55.201-55.219).

SHIPPING INFORMATION		
Proper shipping name	Black powder	
Hazard class	1.1D	
UN Number	UN0027	
DOT Label & Placard	DOT Label	EXPLOSIVE 1.1D
	DOT Placard	EXPLOSIVES 1.1
Alternate shipping information	Limited quantities of black powder may be transported as "Black powder for small arms", NA0027, class 4.1 pursuant to U.S. Department of Transportation authorization EX-8712212.	

The information contained in this Material Safety Data Sheet is based upon available data and believed to be correct; however, as such has been obtained from various sources, including the manufacturer and independent laboratories, it is given without warranty or representation that it is complete, accurate, and can be relied upon. OWEN COMPLIANCE SERVICES, INC. has not attempted to conceal in any manner the deleterious aspects of the product listed herein, but makes no warranty as to such. Further, OWEN COMPLIANCE SERVICES, INC. cannot anticipate nor control the many situations in which the product or this information may be used; there is no guarantee that the health and safety precautions suggested will be proper under all conditions. It is the sole responsibility of each user of the product to determine and comply with the requirements of all applicable laws and regulations regarding its use. This information is given solely for the purposes of safety to persons and property. Any other use of this information is expressly prohibited.

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MSDS prepared by:

David W. Boston
Original publication date: 12/08/93
Revision date: 12/12/05
12/03/03

SECURITY SIGNALS,INC -- M 60,IGNITER,FUSE -- 1375-00-691-1671
===================== Product Identification =====================

Product ID:M 60,IGNITER,FUSE
MSDS Date:09/01/1991
FSC:1375
NIIN:00-691-1671
MSDS Number: BPRJP
=== Responsible Party ===
Company Name:SECURITY SIGNALS,INC
Address:9509 MACON RD
City:CORDOVA
State:TN
ZIP:38018
Country:US
Info Phone Num:901-754-7228
Emergency Phone Num:901-754-7228
CAGE:13759
=== Contractor Identification ===
Company Name:SECURITY SIGNALS INC
Address:9509 MACON RD
Box:City:CORDOVA
State:TN
ZIP:38018-9746
Country:US
Phone:901-754-7228
CAGE:13759

============= Composition/Information on Ingredients =============

Ingred Name:PRIMER PERCUSSION M39.HAZ ING IN OLIN CENTER FIRE PRIMER-SEE OLIN MSDS UNDER NSN 1375-00-691-1671,CAGE 99530,PART NUM A.
Other REC Limits:NOT KNOWN
OSHA PEL:NOT KNOWN
ACGIH TLV:NOT KNOWN

===================== Hazards Identification =====================

LD50 LC50 Mixture:NOT KNOWN
Routes of Entry: Inhalation:YES Skin:NO Ingestion:NO
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO
Health Hazards Acute and Chronic:SEE SIGNS AND SYMPTOMS OF OVEREXPOSURE.
Explanation of Carcinogenicity:NONE
Effects of Overexposure:EFFECTS OF OVEREXPOSURE TO SMOKE FROM BURNING IGNITERS:EYES:SEVERE IRRITATION,BLURRED VISION. SKIN:MODERATE IRRITATION. INHALATION:IRRITATION,HEADACHE,NAUSEA,DIZZINESS.
Medical Cond Aggravated by Exposure:NOT KNOWN

======================= First Aid Measures =======================

First Aid:EYES:FLUSH WITH LARGE AMOUNTS OF WATER FOR AT LEAST 15 MINUTES .CONSULT PHYSICIAN IMMEDIATELY. SKIN:WASH WITH SOAP & WATER.GET MEDICAL ATTENTION. INGESTION:GET MEDICAL ATTENTION. INHALATION:REMO VE TO FRESH AIR,BEGIN RESUSCITATION.GETMEDICAL ATTENTION.

===================== Fire Fighting Measures =====================

Flash Point:NOT KNOWN
Lower Limits:NOT KNOWN
Upper Limits:NOT KNOWN
Extinguishing Media:WATER SPRAY,DRY SAND,TALC,DRY GRAPHITE.
Fire Fighting Procedures:WEAR SELF-CONTAINED BREATHING APPARATUS,PROTECTIVE BODY AND HEAD GEAR.MAINTAIN SAFE DISTANCE FROM BURNING MATERIALS.
Unusual Fire/Explosion Hazard:FLAMMABLE WHEN EXPOSED TO OPEN FLAME,EXCESSIVE HEAT OR IMPACT.

================== Accidental Release Measures ==================

Spill Release Procedures:ELIMINATE ALL SOURCES OF IGNITION.RECOVER ALL SPILLED UNITS AND EXAMINE FOR PHYSICAL CHANGE.
Neutralizing Agent:NOT KNOWN

====================== Handling and Storage ======================

Handling and Storage Precautions:DESIGNED FOR MILITARY USE OR COMMERCIAL BLASTING OPERATIONS ONLY BY PERSONNEL THOROUGHLY TRAINED
IN HANDLING/USE.NOT DESIGNED FOR RECREATIONAL USE.
Other Precautions:LABEL AS EXPLOSIVE.

============= Exposure Controls/Personal Protection =============

Respiratory Protection:CONTACT LOCAL SAFETY/INDUSTRIAL HYGIENE OFFICE TO DETERMINE IF RESPIRATORY PROTECTION IS REQUIRED .
Ventilation:CONTACT LOCAL SAFETY/INDUSTRIAL HYGIENE OFFICE TO DETERMINE IF LOCAL EXHAUST VENTILATION IS NEEDED .
Protective Gloves:NOT KNOWN
Eye Protection:CHEMICAL SAFETY GOGGLES .
Other Protective Equipment:NOT KNOWN
Work Hygienic Practices:LAUNDER CONTAMINATED CLOTHING BEFORE REUSE.
Supplemental Safety and Health
CONTRACT #:DAAA09-91-R-0873.HAZARDOUS INGREDIENTS ARE IN OLIN CENTER FIRE PRIMER-SEE OLIN MSDS UNDER NSN 1375-00-691-1671,CAGE 99530,PART NUM A.

================== Physical/Chemical Properties ==================

Melt/Freeze Pt:M.P/F.P Text:NOT KNOWN

Decomp Temp:Decomp Text:NOT KNOWN
Solubility in Water:INSOLUBLE
Appearance and Odor:ODORLESS,GREEN PLASTIC,POLYAMIDE,NYLON TUBE (ASSEMBLY).

================= Stability and Reactivity Data =================

Stability Indicator/Materials to Avoid:YES
Stability Condition to Avoid:HEAT AND FLAME.
Hazardous Decomposition Products:SMOKE FROM BURNING IGNITERS.
Conditions to Avoid Polymerization:WILL NOT OCCUR.

=================== Disposal Considerations ===================

Waste Disposal Methods:DISP MUST BE IAW FED,STATE,& LOC REGS.COORDINATE W/ SUPPORTING INSTALLATION/MACOM ENVIRON OFFICE PRIOR TO DISP .DETERMINE IF WASTE MEETS FED/STATE HAZ WASTE CRITERIA BECAUSE USE,MIXTURES,PROCESS ES,ETC MAY RENDER MATERIAL HAZARDOUS.

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Olin WINCHESTER AMMUNITION

MATERIAL SAFETY DATA SHEET

Olin MSDS No.: **00050.001**	Revision Date: **1/1/06**
Revision No.: **11**	Supercedes: **8/10/05**

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: **CENTERFIRE LOADED ROUNDS**

Chemical Name: Mixture – Metal Alloy

Synonyms: Super-X Centerfire Rifle: 218 Bee, 22 Hornet, 22-250 Remington, 222 Remington, 223 Remington, 225 Winchester, 243 Winchester, 6mm Remington, 25-06 Remington 25-20 Winchester, 25-35 Winchester, 250 Savage, 257 Roberts + P, 264 Winchester Mag., 270 Winchester, 284 Winchester, 7mm Mauser (7 x 57), 7mm Remington Mag., 30 Carbine, 30-30 Winchester, 30-06 Spring- field, 30-40 Krag, 300 Winchester Mag., 300 H & H Magnum, 300 Savage, 303 Savage, 303 British, 307 Winchester, 308 Winches- ter, 32 Win. Special, 32-20 Winchester, 8mm Mauser (8 x57), 338 Winchester Mag., 35 Remington, 356 Winchester, 357 Magnum, 358 Winchester, 375 Winchester, 375 H & H Magnum, 38-40 Winchester, 38-55 Winchester, 44 Remington Magnum, 44-40 Winchester, 45-70 Government, 458 Winchester Mag, 280 Remington, Supreme 243 Winchester, Supreme 22-250 Remington, Supreme 270 Winchester, Supreme 280 Remington, Supreme 7mm Remington Magnum, Supreme 30-30 Winchester, Supreme 308 Winchester, Supreme 30-06 Springfield, Supreme 300 Winchester Magnum, 223 Remington 55 gr. Pointed Soft Point Varminator, 22-250 Remington, 55 gr. Pointed Soft Point Varminator, 22 Hornet, 46 gr. Hollowpoint, Varminator, 243 Winchester, 100 gr. Power Point, Varminator, 222 Remington, 50 gr. Pointed Soft Point, Varminator, 220 Swift, 55 gr. Pointed Soft Point Varminator, 25-06 Remington, 90 gr. Positive Expanding Point, Varminator, 454 Casull, 260 gr. Jacketed Flat Point, 454 Casull, 300 gr. Jacketed Flat Point, 30-06 Springfield, 150 gr. Fail Safe, 280 Remington, 140 gr. Fail Safe, 7MM Remington Magnum, 140 gr. Fail Safe, 220 Swift, 40 gr. Ballistic Silvertip, 22-250 Remington, 50 gr. Ballistic silver- tip, 222 Remington, 40 gr. Ballistic Silvertip, 223 Remington, 50 gr. Ballistic Silvertip, 243 Winchester, 55 gr. Ballistic Silvertip, 25-06 Remington, 115 gr. Ballistic Silvertip, 270 Winchester, 130 gr. Ballistic Silvertip, 280 Remington, 140 gr. Ballistic Silvertip, 7mm Remington Magnum, 150 gr. Ballistic Silvertip, 30-06 Springfield, 150 gr. Ballistic Silvertip, 30-06 Springfield, 168 gr. Ballistic Silvertip, 300 Winchester Magnum, 180 gr. Ballistic Silvertip, 308 Winchester, 150 gr. Ballistic Silvertip, 308 Winchester, 168 gr. Ballistic Silvertip, 338 Winchester Magnum, Cal .50 - Long Range Sniper.

Military Centerfire Rifle: 5.56mm Ball M193 55 gr. full metal jacket, 5.56mm Penetrator M855 62 gr. full metal jacket, 7.62mm NATO Ball M80 147 gr. full metal jacket, Caliber 50 Ball M33 650 gr. full metal jacket.

Super-X Centerfire Pistol/Revolver: 25 Automatic (6.35mm) Expanding Point and Full Metal Case; 30 Luger (7.65mm) Full Metal Case; 30 Carbine Hollow Soft Point and Full Metal Case; 32 Smith & Wesson Lead Round Nose and Long Lead Round Nose; 32 Short and Long Colt Lead Round Nose; 32 Automatic Silvertip Hollow Point and Full Metal Case; 38 Smith & Wesson Lead Round Nose, 380 Automatic Silvertip Hollow Point and Full Metal Case; 38 Special Silvertip Hollow Point, Lead Round Nose, Lead Semi-Wad Cutter, Metal Point, Silvertip Hollow Point + P, Jacketed Hollow Point + P, Lead Hollow Point + P, Lead Semi-Wad Cutter + P, Match Lead Mid-Range Match; 9mm Luger(Parabellum): Full Metal Jacket Encapsulated, Full Metal Case, Silvertip Hollow Point; 38 Super Automatic Silvertip Hollow point + P, Full Metal Case + P; 357 Magnum Jacketed Hollow Point, Silvertip Hollow Point, Lead Semi-Wad Cutter, Jacketed Soft Point; 10mm Automatic Silvertip Hollow Point; 41 Remington Magnum Silvertip Hollow Point, Lead Semi-Wad Cutter, Jacketed Soft Point, Jacketed Hollow Point; 44 Smith & Wesson Special Silvertip Hollow Point, Hollow Soft Point; 44 Remington Magnum Silvertip Hollow Point, Hollow Soft Point, Lead Semi-Wad Cutter(Med. Vel. & Gas Check); 45 Automatic Silvertip Hollow Point + P, Full Metal Case, Super-Match Full Metal Case Semi-Wad Cutter; 45 Colt Silvertip Hollow Point, Lead Round Nose; 45 Winchester Magnum: Jacketed Soft Point, Full Metal Case; Black Talon; 40 Smith and Wesson: Silvertip Hollow Point, Full Metal Jacket Truncated Cone, Full Metal Jacket Encapsulated, Jacket Hollow Point, Full Metal Jacket, Supreme 357 Magnum 180 gr. Partition Bullet, Supreme 44 Magnum 250 gr. Partition Bullet, 180 gr. SXT, 165 gr. SXT; Ranger Talon, 40 Cal. 180 gr. JHP; Ranger Talon, 40 Cal. 165 gr. JHP; Ranger Talon, 45 Auto, 230 gr. JHP; Ranger Talon, 9mm, 147 gr. JHP, Winclean (BEB), Ranger Bonded Handgun Ammunition

Chemical Family: Metal mixture

Formula: Not applicable - mixture

Product Use: Centerfire Rifle and Pistol Loaded Ammunition

COMPANY ADDRESS MSDS Control Group
Olin Brass and Winchester, Inc.
427 North Shamrock St.
East Alton, IL 62024-1197
www.winchester.com

TECHNICAL INFORMATION:
618-258-3507

EMERGENCY TELEPHONE NUMBER:
1-888-2891-911

2. COMPOSITION / INFORMATION ON INGREDIENTS

CAS Number	Components	% By Weight	EINECS/ ELINCS #	EU Classification	
				Symbol	R-Phrase
7439-92-1	Lead	5 - 10	231-100-4	T, N*	R1-33-50/53-62
7440-50-8	Copper	30 - 55	231-159-6	None	None
7440-66-6	Zinc	5 - 15	231-175-3	F (as dust or powder)	R 15-17
9004-70-0	Nitrocellulose	10 - 20	Not listed	E*	R 2
55-63-0	Nitroglycerin	1 - 2	200-240-8	E, T+, N	R 3-26/27/28-33-51-53

*This material is not listed in Annex 1 of Directive 88/379/EEC. Olin has classified the material according to the conventional method based upon information from similar materials.

OSHA REGULATORY STATUS: Explosive

3. HAZARDS IDENTIFICATION

CAUTION!
EXPLOSIVE. KEEP AWAY FROM HEAT. DO NOT SUBJECT TO MECHANICAL SHOCK. PARTICLES FROM FIRING MAY BE HARMFUL IF INHALED. DO NOT TAKE INTERNALLY.

HAZARD RATINGS (for dust or fume) Degree of hazard (0 = low, 4 = extreme)
Hazardous Materials Identification System (HMIS) Health: 0 Flammability: 0 Physical Hazard: Explosive: 2

National Fire Protection Association (NFPA) Mixture. Not rated.

HUMAN THRESHOLD RESPONSE DATA
Odor Threshold: Unknown
Irritation Threshold: Unknown
Immediately Dangerous to Life or Health (IDLH) Value(s): The IDLH for this product is not known. The IDLH for copper and lead is 100 mg/m^3. The IDLH for nitroglycerin is 75 mg/m^3.

POTENTIAL HEALTH EFFECTS

This product is composed of a finished metal alloy cartridge which contains the various components completely sealed within. Therefore, under normal handling of this product, no exposure to any harmful materials will occur.

When the ammunition is fired, a small amount of particles may be generated which may be slightly irritating to the eyes and the respiratory tract. The particles may contain trace amounts of these harmful substances:

Lead: Ingestion of large amounts of lead can cause abdominal pain, constipation, cramps, nausea and/or vomiting. Chronic exposure to lead can cause kidney damage, anemia, reproductive effects, developmental effects and permanent nervous system damage in humans including changes in cognitive function.
Nitroglycerin: Will produce dilation of blood vessels and drop in blood pressure which may affect the heart. It has also been shown to cause methemoglobinemia (cyanosis).
Copper: Inhalation of high concentrations of metallic copper dusts or fumes may cause nasal irritation and/or nausea, vomiting and stomach pain.

It is unlikely that the amount of particles that someone would be exposed to from firing a loaded round would be sufficient to cause any of these effects.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: There are no medical conditions known to be aggravated by exposure to this product in its solid form. Exposure to lead can aggravate anemia, cardiovascular and respiratory disease.

POTENTIAL ENVIRONMENTAL EFFECTS: Product has not been tested for environmental properties. Lead shot has been shown to be toxic to aquatic species.

4. FIRST AID MEASURES

EYE CONTACT:	Immediately flush out fume or particles with large amounts of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If eye irritation develops, call a physician at once.
SKIN CONTACT:	Wash skin with plenty of soap and water.
INHALATION:	If symptoms of lung irritation occur (coughing, wheezing or breathing difficulty), remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial respiration. Keep affected person warm and at rest. Get medical attention.
INGESTION:	If ingested, immediately call a physician.

5. FIRE FIGHTING MEASURES

PROPERTY	*VALUE*	*PROPERTY*	*VALUE*
Explosive	Yes	Flammable	Not applicable
Combustible	Not applicable	Pyrophoric	No
Flash Point (°C):	Not applicable	Burning Rate of Material:	Not applicable
Lower Explosive Limit:	Not applicable	Autoignition Temp.:	No data
Upper Explosive Limit:	Not applicable	Flammability Classification: (defined by 29 CFR 1910.1200)	Explosive

UNUSUAL FIRE AND EXPLOSION HAZARDS:	If fire reaches cargo, do not fight. Evacuate all person, including emergency responders from the area for 1500 feet (1/3 mile) in all directions.
EXTINGUISHING MEDIA:	Flood area with water. If no water is available, carbon dioxide, dry chemical or earth may be used. If the fire reaches the cargo, withdraw and let fire burn.
SPECIAL FIREFIGHTING PROCEDURES:	In case of fire, use normal fire fighting equipment. Protection concerns must also address the potential of the physical characteristic of this product as explosive.

6. ACCIDENTAL RELEASE MEASURES

FOR ALL TRANSPORTATION ACCIDENTS, CALL CHEMTREC AT 800-424-9300.

Spills of this material should be handled carefully. Do not subject materials to mechanical shock. A spill of this material will normally not require emergency response team capabilities. If, however, a large spill occurs, call 1-888-289-1911 for technical assistance.

7. HANDLING AND STORAGE

HANDLING:	No special requirements
STORAGE:	No special requirements
Shelf Life Limitations:	Not known
Incompatible Materials for Packaging:	None known
Incompatible Materials for Storage or Transport:	Acids, Class A & B explosives, strong oxidizers, and caustics
CONDITIONS TO AVOID:	Mechanical impact or shock and electrical discharge.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

CAS #	*CHEMICAL NAME*	*ACGIH TLV*	*OSHA PEL*	*INTERNATIONAL OELS*
7440-50-8	Copper	0.2 mg/m^3 (fume), 1 mg/m^3 (dusts and mists)	0.1 mg/m^3 (fume) 1 mg/m^3 (dusts and mists)	Austria, Belgium, Canada: 0.2 mg/m^3 (fumes), 1 mg/m^3 (dusts) Denmark: 1.0 mg/m^3 (dust and powder) Germany (MAK): 0.1 mg/m^3 (fume), 1 mg/m^3 (dusts and mists)
7439-92-1	Lead	0.05 mg/m^3	0.05 mg/m^3	Austria, Denmark, Germany, Sweden, Switzerland: 0.1 mg/m^3 Norway, Poland: 0.05 mg/m^3
7440-66-6	Zinc	None established	None established	None established
9004-70-0	Nitrocellulose	None established	None established	None established
55-63-0	Nitroglycerin	0.05 ppm (0.46 mg/m^3) Skin	Ceiling – 0.2 ppm (2 mg/m^3) Skin	Denmark: 0.02 ppm (0.2 mg/m^3) Norway, Sweden: 0.03 ppm (0.3 mg/m^3) Austria, Belgium, Germany, The Netherlands, Poland, Switzerland: 0.05 ppm (0.47 mg/m^3), skin Finland, France: 0.1 ppm (0.9 mg/m^3), skin U.K.: 0.2 ppm (2 mg/m^3), skin

ENGINEERING CONTROLS:	Local exhaust ventilation is recommended if significant dusting occurs or fumes are generated. Otherwise, use general exhaust ventilation. Use hearing protection.
EYE / FACE PROTECTION:	Use safety glasses.
SKIN PROTECTION:	Not normally needed
RESPIRATORY PROTECTION:	Respiratory protection not normally needed.
GENERAL HYGIENE:	Do not eat, drink, or smoke while using this product. Wash hands thoroughly after use.

9. PHYSICAL AND CHEMICAL PROPERTIES

PROPERTY	VALUE	PROPERTY	VALUE
Appearance:	Cylindrical brass cartridge	Vapor Density (air = 1):	Not applicable
Odor:	None	Boiling Point (°F):	Not applicable
Molecular Weight:	Not applicable - Mixture	Melting point:	Not applicable
Physical State:	Solid	Specific gravity (g/cc):	Not applicable
pH:	Not applicable	Bulk Density	Not applicable
Vapor Pressure (mm Hg):	Not applicable	Viscosity (cps):	Not applicable
Vapor Density	Not applicable	Decomposition Temperature:	Not applicable
Solubility in Water (20 °C):	Insoluble	Evaporation Rate:	Not applicable
Volatiles, Percent by volume:	Not applicable	Octanol/water partition coefficient:	Not applicable

10. STABILITY AND REACTIVITY

STABILITY: Stable under normal temperatures and pressure.
MATERIALS TO AVOID: Acids, Class A & B explosives, strong oxidizers, and caustics
HAZARDOUS DECOMPOSITION PRODUCTS: Nitrogen oxides, carbon monoxide, lead oxides, carbon dioxide, lead dust/fume
HAZARDOUS POLYMERIZATION: Will not occur.
OTHER: **Cartridge may detonate if case is punctured or severely damaged.**

11. TOXICOLOGICAL INFORMATION

POTENTIAL EXPOSURE ROUTES: The physical nature of this product makes absorption from any route unlikely. A small amount of inhalable particles may be created when projectile is fired.

ACUTE ANIMAL TOXICITY DATA:

For Product:		For Components				
		Copper	Lead	Nitrocellulose	Zinc	Nitroglycerin
Oral LD_{50}	Not applicable for product	3.5 mg/kg (mouse, intraperitoneal)	No data	> 5 g/kg (rat)	No data	105 mg/kg (rat)
Dermal LD_{50}	Not applicable for product	375 mg/kg (rabbit, subcutaneous)	No data	No data	No data	> 280 mg/kg (rabbit)
Inhalation LC_{50}	Not applicable for product. Particles generated from firing may be slightly toxic.	No data	No data	No data	No data	No data
Irritation	Not a skin or eye irritant as a loaded round.	Respiratory irritant	Not irritating	No data	Eye irritant	Mild eye and skin irritant

SUBCHRONIC/ CHRONIC TOXICITY: Lead has caused blood, kidney and nervous system damage in laboratory animals.

CARCINOGENICITY: The International Agency for Research on Cancer (IARC) lists lead as possibly carcinogenic to humans, group 2B.

MUTAGENICITY: This product is not known or reported to be mutagenic. Lead has been shown to be mutagenic in several *in vitro* assays.

REPRODUCTIVE, TERATOGENICITY, OR DEVELOPMENTAL EFFECTS: This product is not known or reported to cause reproductive or developmental effects. Lead has been shown to affect fetal development including birth defects and reduce male reproductive function in laboratory animals.

NEUROLOGICAL EFFECTS: This product is not known or reported to cause neurological effects. Lead has caused peripheral and central nervous system damage and behavioral effects in laboratory animals.

INTERACTIONS WITH OTHER CHEMICALS WHICH ENHANCE TOXICITY: None known or reported.

12. ECOLOGICAL INFORMATION

ECOTOXICITY: No data is available on this product. Individual constituents are as follows:

Copper: The toxicity of copper to aquatic organisms varies significantly not only with the species, but also with the physical and chemical characteristics of the water, such as its temperature, hardness, turbidity and carbon dioxide content. Copper concentration varying from 0.1 to 1.0 mg/l have been found by various investigators to be not toxic for most fish. However, concentrations of 0.015 to 3.0 mg/l have been reported as toxic, particularly in soft water to many kinds of fish, crustacea, mollusks, insects, and plankton.

Lead: LC 50 (48 hrs.) to bluegill (Lepomis macrochirus) is reported to be 2-5 mg/l. Lead is toxic to waterfowl.

Nitrocellulose: LC_{50} > 1000 mg/l (fish, invertebrates, algae)
Nitroglycerin: Bluegill, 96 hour LC_{50} = 1.228 mg/l (static)
Zinc: The following concentrations of zinc have been reported as lethal to fish:
Rainbow trout fingerlings: 0.13 mg/l, 12 – 24 hours
Bluegill sunfish: 6 hr TLM = 1.9 – 3.6 mg/l (soft water, 30°C)
Rainbow trout: 4 mg/l (hard water) 3 days
Sticklebacks: 1 mg/l (soft water) 24 hrs
The presence of copper appears to have a synergistic effect on the toxicity of zinc towards fish.

MOBILITY: Dissolved lead from degraded bullets may migrate through soil.
PERSISTANCE/DEGRADABILITY: Not biodegradable. Bullets may fragment and decompose in soil leading to accumulation of lead.
BIOACCUMULATION: No data

13. DISPOSAL CONSIDERATIONS

Care must be taken to prevent environmental contamination from the use of this material. The user of this material has the responsibility to dispose of unused material, residues and containers in compliance with all relevant local, state and federal laws and regulations regarding treatment, storage and disposal for hazardous and nonhazardous wastes.

14. TRANSPORT INFORMATION

	U.S. DOT	RID/ADR	IMDG	IATA	IMO	Canada TDG
PROPER SHIPPING NAME:	Cartridges, small arms (other than blanks)					
HAZARD CLASS:	Explosive, 1.4S					
UN NO.:	UN 0012					
PACKING GROUP:	1.4 S					
HAZARD LABEL/PLACARD:	None required					
REPORTABLE QUANTITY:	Not applicable					
SPECIAL COMMENTS:	May be reclassified domestically as an ORM-D if packaged as a consumer commodity per 49 CFR 173.					

15. REGULATORY INFORMATION

US FEDERAL

TSCA	The components of this product are listed on the Toxic Substance Control Act inventory.						
CERCLA:	Copper, R.Q.= 5000 lbs.; Lead, R.Q. = 10 lbs.; Zinc, R.Q. = 1000 lbs.; Nitroglycerin, R.Q. = 10 lbs (No reporting is required if diameter of the pieces of metal is equal to or exceeds 100 micrometers (0.004 inches).						
SARA 313:	Copper, Lead and Lead compounds, Zinc (fume or dust), Nitroglycerin						
SARA 313 Hazard Class:	Health:	Acute – No Chronic - No	Fire: No	Reactivity: None	Release of Pressure: Yes		
SARA 302 EHS List:	None of the components of this product are listed.						

*RQ = Reportable Quantity

STATE RIGHT-TO-KNOW STATUS

Component	*CA Prop. 65	New Jersey	Pennsylvania	Massachusetts	Michigan
Copper	Not listed	X	X	X	X
Lead	X	X	X	X	X
Zinc	Not listed	X	Not listed	X	X
Nitrocellulose	Not listed	X	X	X	Not listed
Nitroglycerin	Not listed	X	X	X	Not listed

* "WARNING: This product contains detectable amounts of a chemical(s) known to the State of California to cause cancer and/or birth defects or other reproductive harm."

EUROPEAN REGULATIONS

Hazard Classification

Danger Symbol:	E	Explosive
Risk Phrases:	R2	Risk of explosion by shock, friction, fire or other sources of ignition
Safety Phrases:	S2	Keep out of reach of children.

German WGK Classification: Not known.

CANADIAN REGULATIONS

DSL LIST: The components of this product are on the DSL or are exempt from reporting under the New Substances Notification Regulations.
IDL: Lead, Copper
WHMIS: This product is not subject to WHMIS. It is regulated as a Class 6 Explosive in Canada.

16. OTHER INFORMATION

REVISIONS: Change to international format, revision of synonyms & composition, 1/1/03
PREPARED BY: Olin Corporation
OTHER: Additional information available from: www.winchester.com
NOTICE: THE INFORMATION IN THIS MSDS SHOULD BE PROVIDED TO ALL WHO WILL USE, HANDLE, STORE, TRANSPORT, OR OTHERWISE BE EXPOSED TO THIS PRODUCT. THIS INFORMATION HAS BEEN PREPARED FOR THE GUIDANCE OF PLANT ENGINEERING, OPERATIONS AND MANAGEMENT AND FOR PERSONS WORKING WITH OR HANDLING THIS PRODUCT. OLIN BELIEVES THIS INFORMATION TO BE RELIABLE AND CURRENT AS OF THE DATE OF PUBLICATION, BUT MAKES NO WARRANTY THAT IT IS.

MATERIAL SAFETY DATA SHEET (MSDS)

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Revision Date: 11/1/06
For the following products:
#10-030, #10-060, #10-180, and
#10-182 White Smoke Candles
#10-200 Standard Smoke Grenade
#10-210 Professional Smoke Grenade

SECTION I: MATERIAL IDENTIFICATION

Material Name: *Safe-Vue*™ Smoke Candles & Grenades
Chemical Family: Screening Smoke
Trade Name: *Safe-Vue*™ Smoke for air flow studies.
UN Number: none
CAS Registry Number: none

SECTION II: INGREDIENTS AND HAZARDS (SMOKE)

Component	Amount		Hazard Data
	TLV	PEL	8-hour, time weighted averages
Hydrated Zinc Chloride	1 mg/m^3	1 mg m^3	
Water Condensate	-	-	Neither TLV nor PEL is applicable because product is intended for use in short term tests.
Carbon Monoxide	55 mg/m^3	55 mg/m^3	
All other ingredients are present in negligible amounts and/or are non-hazardous.			

SECTION III: PHYSICAL DATA (SMOKE)

Boiling Point: n/a
Vapor Pressure: n/a
Vapor Density: n/a
Water Solubility at 20°C: Soluble
pH: No Data

Appearance and Odor: Gray to white with an odor of burning paper.

SECTION IV: FIRE AND EXPLOSION DATA

Flash Point and Method (Smoke): None
Autoignition Temp. (Smoke): n/a
Flammability Limits in Air (Smoke): n/a
Extinguishing Media (Solid Product): Use media suitable for surrounding fire.
Special Fire Fighting Procedures (Smoke and Solid Product): Self-contained breathing apparatus and full protective clothing.
Unusual Fire and Explosion Hazards: None known.

SECTION V: REACTIVITY DATA

Stable: Yes, under normal conditions.
Hazardous Decomposition Products: See section II.
Polymerization: None known.

SECTION VI: HEALTH HAZARD INFORMATION

Safe-Vue™ white smoke can be used without hazard if applied as directed. The main effects of the smoke are some minimal irritation of the throat, an awareness of an odd odor, and the appearance of smoke. These effects act as a warning and are desirable to prevent voluntary overexposure. Individuals should be urged not to accept exposures that cause minor irritation, but to leave the area and ventilate well to dissipate the smoke. Persons with respiratory ailments must never be exposed to any smoke. **Warning**: the #10-200 and #10-210 Smoke Grenades generate huge volumes of white smoke that would quickly accumulate to concentrations hazardous in confined spaces. Never use these items in an interior or enclosed space.

Ingestion: Not a significant route of exposure.
Eye Contact: Acute exposure is not likely to induce eye irritation.
Skin Absorption: Not a significant route of exposure.

Inhalation: Acute exposure can cause irritation of the respiratory tract and mucous membranes. Irritation is a warning property of smoke materials. In itself irritation is not usually regarded as a toxic effect unless it is sufficient to cause inflammation and then inflammation, not irritation, is the toxic effect.

Effects of Overexposure: Irritation of the respiratory passages; cough; nausea. Gross overexposure to dense smoke concentrations could result in throat irritation and mucous membrane congestion requiring medical treatment. Coughs, chills, fever and pulmonary edema can result from overwhelming exposure. Increasingly severe overexposure is likely to result in increasingly severe irritation and inflammation to all mucous membranes contacted by the smoke with most severe effects usually appearing in the respiratory tract.

FIRST AID: Remove to fresh air. If breathing is difficult, get medical attention.

SECTION VII: SPILL, LEAK AND DISPOSAL PROCEDURES

(Smoke): Ventilate area. Use local exhaust to keep exposure to a minimum. The duration of smoke would be short and the length of exposure could be reduced further by opening doors and windows for a few minutes, if and when smoke appears.
(Solid Product): Dispose in chemical disposal area in a manner that complies with local, state and federal regulations.

SECTION VIII: SPECIAL PROTECTION INFORMATION

Respiratory Protection: See section IV.
Ventilation: Use product in a well-ventilated area.
Protective Gloves:
Other Protective Equipment: Use self-contained breathing apparatus and full protective clothing when treating spills or fighting fires.

SECTION IX: SPECIAL PRECAUTIONS AND COMMENTS

Store in a cool, dry place. Keep product out of the reach of children.
Use only in a well-ventilated place.
Do not use or store around food or food products. Before eating, drinking or smoking, hands and face must be thoroughly washed.
Product should be used only by those familiar with all safety documentation.

This MSDS is provided as a guideline for the use of our products only. E. Vernon Hill, Inc. disclaims responsibility for damage or injury resulting from the improper use of these products. Contact E. Vernon Hill, Inc. for a "Product Information Sheet."

We believe all information given is accurate. It is offered in good faith, but without guarantee. Since conditions of product use are beyond our control, all risks of use are assumed by the user. Nothing herein shall be construed as a recommendation for uses which infringe valid patents or as extending a license under valid patents.

Ref. S.S. "SD/1A & SD/2A 2/1/93"

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 HWSU and other properties. Land administered by the BLM 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 EODU Access

Access to the EODU requires the approval of the NSTec Facility Manager. The EODU Supervisor must escort all visitors/workers and will remain onsite with these persons, unless there are no explosives onsite. In cases where work is performed in the absence of explosives (road grading, soil sampling), the Supervisor will accompany personnel to their work location and provide instructions for locking the gates when exiting. All personnel entering the EODU must also notify the Operations Control Center upon entry and exit.

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

This section describes the EODU inspection program. EODU personnel are responsible for tracking inspection due dates and ensuring that the inspections and remedial actions are completed. Table 6 provides the EODU inspection schedule, including the type of inspection, description, and frequency. The inspection schedule is maintained at the unit. An example checklist is provided in Exhibit 2.

Table 6 Area 11 EODU Inspection Schedule

Inspection	Description	Frequency
Signs, Gates, and Locks	Verify that items are intact. Also, verify that signs are legible.	Each site visit (minimum of monthly)
Fire Extinguishers[a]	Verify that hoses are in good condition and pressure gauges are in the appropriate range.	Monthly
Magazine Inventory[b]	Verify the availability and condition of materials stored in the magazines.	Monthly
Magazine Structural Integrity	Verify integrity of magazine structure.	Each site visit (minimum of monthly)
Magazine Cleanliness	Materials are organized and stored in an efficient manner.	Each site visit (minimum of monthly)
Satellite Accumulation Area	Verify that amount of waste in the SAA magazine matches the SAA magazine log.	Weekly (when waste is present); otherwise, monthly

[a]. Fire extinguishers are inspected monthly by Area 11 EODU personnel and certified annually by trained personnel according to National Fire Protection Association requirements.
[b]. Quantities of each stored material are logged.

B.5.a Remedial Action

If an inspection reveals the deterioration of the explosives magazine, satellite accumulation container, or gates, the problem will be documented on the inspection checklist. Corrective actions are scheduled to ensure compliant operation of the EODU before continuing operations. When corrective actions are completed or delayed, action or non-action will be noted on the next scheduled inspection checklist.

EXHIBIT 2 EXAMPLE OF AREA 11 EODU INSPECTION CHECKLIST

EODU Monthly Inspection		
Item	**Status**	**Comments**
Lower Gate		
Signs		
Locks		
Warning Flag		
Chain Gate		
Signs		
Lock		
Emergency Equipment		
Radio		
Fire Extinguishers		
Tools		
Storage/SAA Magazine		
Complete FRM-2238		
Structural		
Security/Locks Secured		
Signage		
Cleanliness		
Lightning Protection System		
EODU Range Flag		
EODU Pit		
Roads		
Vehicle		
I certify this inspection was done on the date listed below and the site conditions were as represented in this document at that time.		
By:		Date:
Time:		

EXAMPLE OF SATELLITE ACCUMULATION STORAGE AREA CHECKLIST, FRM-2238

NSTec Form FRM 2238	SATELLITE ACCUMULATION STORAGE AREA CHECKLIST	09/30/09 Rev. 0 Page 1 of 1

Inspector Name / Signature ____________________

Date ____________

Time ____________

Is there a sign posted identifying area as 'Satellite Accumulation Area'?	☐ Yes / ☐ No
Is container marked "Hazardous Waste"?	☐ Yes / ☐ No
Is the container in good condition?	☐ Yes / ☐ No
Is the container labeled with identification number, description of the contents, and organization name?	☐ Yes / ☐ No
Is the labeling legible?	☐ Yes / ☐ No
Are there any signs of spills or leaks?	☐ Yes / ☐ No
Are the container lids closed?	☐ Yes / ☐ No
Is the SAA secure?	☐ Yes / ☐ No
Are all SAA contents appropriate?	☐ Yes / ☐ No
Is there less than .55 gallons (or 1qt if acute waste)?	☐ Yes / ☐ No
Is training current and is record available?	☐ Yes / ☐ No

Comments / Corrective Actions ____________________

(Reference: CD-P270.014)

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

EODU 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 and NNSA/NSO representative.

DOE maintains memorandums of understanding (MOU) for emergency activities with Nye County, the BLM, 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 3 provides a copy of the emergency response procedure (ERP) for the EODU. 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 3 is a copy of the Area 11 Explosives Ordnance Disposal Unit Emergency Response Procedure.

EXHIBIT 3 AREA 11 EXPLOSIVES ORDNANCE DISPOSAL UNIT EMERGENCY RESPONSE PROCEDURE

Not available for public viewing

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

This section describes the procedures that will be used at the EODU to ensure safety and prevent hazards to human health and the environment. A description of the procedures, structures, and equipment to be used at the EODU are summarized below. In addition, inspections of the EODU are conducted as described in Section B.5.

B.8.a Operational Hazards

Transportation

- Transport vehicles that meet the DOT definition of a commercial motor vehicle are operated by trained and qualified drivers.
- Transport vehicles are inspected, maintained, and repaired to ensure parts and accessories necessary for safe operation are in proper operating condition.
- Vehicles loading or unloading explosives will have the motor turned off, unless the motor is required to provide power to vehicle accessories used in loading and unloading and the motor is equipped with an exhaust spark arrestor.
- Vehicles transporting explosives will be placarded according to DOT regulations.
- Matches, lighters, or other fire-, flame-, or spark-producing devices shall not be in the vehicle or carried by personnel in the vehicle.
- Except for emergency situations, fueling or maintenance of vehicles containing explosives is prohibited.
- Explosives cargo shall be blocked, braced, chocked, tied down, or otherwise secured to prevent shifting during transit.
- Transport of explosive material will be suspended during adverse weather conditions (e.g. lightning, snowy, icy or flooded roads, poor visibility).
- No smoking is allowed within 25 ft of any vehicle transporting explosive material.

Storage

- Only qualified explosive handlers, UXO technicians, blasters shall load or unload explosives.
- Explosives shipments shall be inspected for damage before storage.
- Spilled materials shall be cleaned up before continuing with loading or unloading.
- Magazines used to store explosives will meet the current DOE Explosive Safety Manual requirements. Magazine doors are kept locked except when inspecting, loading, or unloading the magazine.

Access Control

- Gates are locked unless personnel are at the EODU.
- Operating personnel are limited to the number required to work in a safe and efficient manner, but never less than two during explosive operations.
- Entry into the EODU shall only be accomplished with escort of an EODU Operations Supervisor.
- Before entry, all personnel entering the EODU are given a documented safety briefing.
- All work at the EODU must be coordinated with the Operations Control Center.
- For operations which do not require activity level work, only the EODU Operations Supervisor needs to be present.

Detonation

- No more than 100 pounds of net waste explosive weight may be detonated per shot.
- The firing system will be tested and checked before each use.
- The EODU Operations Supervisor will physically ensure that all personnel present at the EODU are accounted for at the firing point before detonation.
- The Operations Control Center will be notified before each detonation event.

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

(1) Run-on

Run-on is prevented at the detonation area because of its location on a topographic saddle (on top of a hill).

(2) Runoff

Surface runoff from the detonation area is not expected since detonations do not take place during inclement weather. The detonation area is not expected to contain undetonated waste, therefore runoff of waste explosives is not likely.

B.8.c Contamination of Water Supplies

Contamination of water supplies from EODU activities is unlikely since annual rainfall is low, evaporation rates are high, and depth from the land surface to the water table. Groundwater at this site is present at a depth of 550 to 610 m (1,800 to 2,000 ft). There are no surface waters or intermittent streams in this area.

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

No power is needed or supplied to the unit. Potential for equipment failure is limited to the firing system, emergency communications, locks on gates, warning devices, and vehicles. The following procedures are used to safeguard personnel and property:

- Firing system is tested and checked before each use.
- Vehicle and hand-held radios are checked each day.
- If communications with the Operations Control Center cannot be made, detonations are suspended until communications are re-established.
- Locks are checked during each entry and relocked when personnel exit the EODU.
- Pre-trip inspections are conducted on vehicles.

B.8.e Undue Exposure of Personnel at the EODU

EODU personnel involved in managing waste explosives are thoroughly trained in the proper procedures from handling explosive materials, performing site operations, and responding to emergency situations. Section B.12 describes training qualifications for EODU personnel. Emergency response is covered in Section B.7.

B.8.f Releases to the Atmosphere

Releases to the atmosphere from detonation events are documented in the treatment plans and using PM_{10} [particulate matter] air monitors. Explosive wastes are identified and emission factors are calculated using standard data from Environmental Protection Agency (EPA) publications. These factors are reported to the NDEP to obtain prior approval for detonation events. Particulate release is monitored using approved methods and the results are reported to the state.

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

Explosive materials handled at the EODU and stored in magazines must meet the following criteria:

- Explosive materials must be stored in approved containers.
- Explosive materials are placed in a magazine in a manner that allows adequate ventilation, ready inspection of containers, and the removal of oldest materials first.
- Only compatible materials are stored in an individual magazine.
- No liquid type explosives or unstable explosives that may be adversely affected by an earthquake are stored in magazines.

These criteria along with procedures indentified in Sections B.3.c and B.8 are designed to prevent the acceptance and/or storage of materials that may explode in an uncontrolled environment.

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

[Content of three paragraphs removed from public view.]

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

[Content of one paragraph removed from public view.]

B.11.a Seismic Standard

Seismic standards for RCRA are derived from location standards that are related to the natural stability of the site and to the occurrence of surface-cutting Holocene faults. 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. No known surface-cutting faults that have had displacement during Holocene time are present within 915 m (3,000 ft) of the EODU.

B.11.b Flood Hazard

The EODU is located outside the 100-year flood hazard area and is in compliance with **40 CFR 264.18(b)** and **270.14(b)(11)(iii)**. [Content of two paragraphs removed from public view.]

A flood assessment of the EODU consisted of a field investigation and analysis of large-scale (1:6,000) aerial photographs. [Content of one sentence removed from public view.] The EODU is not located within a 100-year flood hazard area as defined by the Federal Emergency Management Agency (100-year flow flooding depths greater than 0.3 m [1 ft]). Runoff is prevented by the structure of the EODU area which consists of a pit formed by previous detonations. Precipitation falling inside the pit is allowed to evaporate.

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

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

B.12.a EODU Training Program

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 EODU Operations Supervisor and subject matter experts, who are knowledgeable in the areas of explosives handling, disposal, safety, 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 EODU personnel that document completion of the assigned training program for their functional title. Annual reviews of training programs and qualification status for EODU personnel are performed to ensure personnel training qualifications are current. Personnel qualification records are maintained by the contractor's Training Department. Personnel training records are accessible at the Operations Supervisor's office via the contractor's training database. The EODU Operations Supervisor also maintains a List of Qualified Individuals at the EODU to ensure personnel training and qualifications are current.

B.12.b EODU Personnel

The information provided in Table 7, EODU Training Matrix, includes functional title, required training, and job descriptions for personnel assigned to perform work at the EODU. Current functional titles and job descriptions are maintained in the Operations Supervisor's office.

Table 7 EODU Training Matrix

FUNCTIONAL TITLE[1]	REQUIRED TRAINING	JOB DESCRIPTION
EODU Operations Supervisor (Qualification CONST01)	Hazardous Waste Site General Worker Course Hazardous Waste Site General Worker Refresher Hazardous Waste – Supervisor Training Blaster Qualification Program Required Activity	Responsible for all the operations of the EODU including, but not limited to, waste identification and characterization, handling, tracking, and storage; determining hazard potential of explosives and waste explosives; detonating explosives; conducting inspections; and writing appropriate reports and records. Responsible for all waste tracking and documentation associated with EODU operations. Administers Required Activity.
Explosives Handler (Qualification CONST02)	Hazardous Waste Site General Worker Course Hazardous Waste Site General Worker Refresher Explosives Handler Qualification Program Required Activity	Provides explosives handler support for the detonation of discarded explosive material from research or testing projects, construction projects, or unexploded ordnance.
UXO Technician (Qualification UXOT001)	DOE Explosives Safety Course Explosives Handler Qualification Program NTS UXO Briefing Hazardous Waste Site General Worker Course Hazardous Waste Site General Worker Refresher	Directs and conducts all aspects of the UXO remediation process to include, but not limited to, reconnoiter, locate, identify, classify UXO, transport ammunition and explosives, conduct disposal operations, and complete all required documentation.

[1] Specific Job Titles may change, although job descriptions and required training remains consistent. The updated list of job titles is contained in the Area 11 EODU Facility Operating Record.

B.12.c Visitors

Visitors are not permitted within the boundaries of the EODU without an escort. Training requirements for visitors are reviewed on a case-by-case basis by the EODU Operations Supervisor. The amount of training required for a visitor is dependent upon the task the visitor is performing, type of operations occurring at the EODU at the time of visitation, and whether exposure to waste or hazardous constituents could occur. Visitors include inspectors; auditors; consultants; and treatment, storage, and disposal contractors. In addition, visitors could include personnel not assigned to perform normal day-to-day operations at the EODU. Visitors will receive a site safety briefing which, at a minimum, includes the following:

- Elements of the emergency response procedure (alarms, evacuation routes, emergency equipment, etc.)
- Hazard communication (as needed)
- Hazard awareness and personal protective equipment requirements

Non-assigned personnel who are performing work within the boundaries of the EODU, including management duties and/or movement of materials or equipment, must receive approval from the EODU Operations Supervisor. At a minimum, these visitors must present credentials certifying that they have successfully completed Hazardous Waste General Site Worker Training/Refresher. They must also receive a site safety briefing specific to the task to be performed including additional hazard communication if required.

B.12.d Training Program Implementation

All new employees must meet the training requirements within six months of employment and before working at the EODU. When detonation events are not planned in the six month new employee training period, the requirement for three days of supervised field training may be delayed until detonation events are conducted.

The contractor's Training Department and the EODU Operations Supervisor will:

- Maintain, update, and revise the training program as necessary.
- Review regulations and operations to determine the 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 EODU personnel training records.
- Verify that former employee records are maintained in the EODU personnel training records.
- 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

- Hazardous Waste Site General Worker/Annual Refresher **[29 CFR 1910.120, 40 CFR 264.16]** – Workers at a hazardous waste Treatment, Storage, or 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. (Frequency – one time 40-hour and annual 8-hour refresher)

- 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 procedures and techniques; and the legal aspects of supervising when conducting hazardous waste operations. (Frequency – one time)

- Hands On Fire Extinguisher Training **[Blaster Qualification Program & Explosives Handler Qualification Program]** –This course provides general awareness of fire safety measures, reporting, evacuation procedures, theory and classes of fires, and the operation and use of a portable fire extinguisher. Performance of monthly inspection and types of extinguishers versus types of fires are covered. (Frequency – annual)

- Explosives Safety for Handlers **[Blaster Qualification Program & Explosives Handler Qualification Program]** – This course instructs proper explosives storage techniques in order to prevent damage, degradation, and inadvertent detonation. Types of above ground storage magazines and their use, compatibility of stored explosives, prohibited materials, configuration of explosives in the magazine, inspection criteria, packaging requirements, potential exposure to explosive materials, and inspection criteria for equipment used to transport explosives are covered. (Frequency – biennial)

- Blasting Training **[Blaster Qualification Program & Explosives Handler Qualification Program]** – Safe methods for detonating explosives are covered. Leading causes of explosives accidents, precautions for preparing explosives detonation, how to initiate and prevent inadvertent detonation, determining safe distances, and steps to deal with misfires are instructed. Additionally, signs and symptoms of exposure to potential toxic gases, fume classification and precautions for each and how to inspect explosive devices for defects are taught. (Frequency – biennial)

- Explosives Safety Awareness **[Blaster Qualification Program & Explosives Handler Qualification Program]** – Awareness level course describes characteristics of explosives, common hazards, and methods to control common hazards. Course objectives include characteristics of explosives, identification/meaning of warning labels and placards, explanation of the rule of minimization as it applies to explosive operations, prevention of inadvertent sparks, proper hygiene while working in areas containing explosives, how to deal with inclement weather, and discussion of the role and responsibility of supervisors as it applies to explosive operations. (Frequency – one time)

- Explosives Safety Awareness for Managers **[Blaster Qualification Program & Explosives Handler Qualification Program]** – This course explains the responsibilities of managers and/or supervisors of employees who work in the vicinity of explosive operations or facilities containing explosives. Course objectives include required documentation and verification requirements, implementation and maintenance of procedures, inspection and modification requirements for facilities, equipment and vehicles, and determining if employees can perform their job duties safely. (Frequency – one time)

- Required Activity **[40 CFR 264.16]** – Site-specific training that covers all aspects of operating the EODU and provides hands on live explosives training at the EODU. Training includes emergency response actions (notifications, equipment, and communications). (Frequency – annual)

B.13 Closure and Post-Closure Care Plan [40 CFR 270.14(b)(13)]

This information represents the Closure and Post-Closure Plan for the EODU. 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 section presents an interim closure and post-closure care plan for the EODU. 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 EODU operating record.

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

The closure of the EODU is proposed as a clean closure; therefore does not include a written post- closure care plan or monitoring.

B.13.a.1 EODU Detonation Area

Waste explosives detonated at the EODU are similar to those used in road and tunnel construction blasting, small arms ammunition, legacy explosives, and waste explosives from research and testing. Clean closure will require removal of hazardous wastes and constituents from the unit.

Explosive residue in the surface and sub-surface soils have been monitored on a five-year cycle in the detonation area and pit (see Exhibit 4).

B.13.a.2 EODU Magazine

[Content of one paragraph removed from public view.]

B.13.b Closure Performance Standard [40 CFR 264.111]

As defined in **40 CFR 264.111** and **Nevada Administrative Code (NAC) 444.8632**, the standard for closure for the EODU will:

- Use engineering and administrative controls during closure to minimize or eliminate, to the extent necessary, the release of hazardous substances from the unit.
- Minimize the need for maintenance.
- Protect human health and the environment during closure and after closure activities.

Hazardous wastes and residues will be removed from the site. Container systems and closure equipment will be decontaminated before removal from the unit.

B.13.c Closure Plan Implementation

B.13.c.1 Pre Closure Activities

- Existing inventory of waste explosives will be treated or removed for offsite disposal.
- No further waste explosives will be accepted at the unit.
- Estimated amount of waste treated while the unit was active will be calculated based on information in the operating record.

B.13.c.2 Removal of Debris

After detonation activities are complete, debris (shrapnel, wire, etc.) will be collected. The Operations Supervisor will determine by visual inspection and acceptable knowledge whether the debris is a hazardous waste. If the debris is hazardous for other than its reactive characteristic, the debris will be handled and disposed in compliance with the requirements in effect at the time of closure. If the remaining debris is reactive, it will be detonated so that no reactive debris remains. If the debris is determined to be non-hazardous, it will be disposed in an onsite solid waste disposal unit.

B.13.c.3 Site Investigation

After debris removal, soil will be sampled and tested for residual contamination (i.e., hazardous constituents normally associated with the materials routinely detonated at the unit). Unless the site characterization results indicate otherwise, or subsequent changes occur in the materials being treated at the unit, the soil samples will then be tested as described in the soil characterization plan (see Section B.20). The analytical results will be compared with background soil values using a statistical method **[40 CFR 264, Appendix IV]** to identify whether the EODU soils exhibit significantly increased levels of residual contaminants. The soil characterization plan will be repeated every five years over the active life of the unit. It is anticipated that adequate data will be generated to provide a comprehensive statistical evaluation.

During the operational phase of the unit, it may be necessary to remove residual contaminated soils before closure of the unit. If this occurs, soil removal will be addressed under the operation and maintenance procedures for the unit.

B.13.c.4 Soil Removal and Decontamination

Soils exhibiting statistically increased levels of residual explosives contaminants will be removed. Additional samples may have to be obtained to determine the extent and depth of the contamination.

Guided by the soil characterization results, residual contaminated soils will be excavated using appropriate equipment. Following soil removal, the excavation area will be sampled to provide data for the closure certification. If these sample results do not show residual contamination that is statistically significant, then no further soil removal activities will be required. Sample locations and the number of samples will be selected following procedures described in EPA publication "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846. Analytical methods will mirror those in the soil characterization plan.

Equipment used in soil removal will be decontaminated and decontamination residues will be tested to determine the appropriate disposal path.

B.13.d Closure Schedule

Table 8 depicts a closure activity schedule for the unit.

Table 8 Area 11 EODU Closure Activity Schedule

Closure Activity	Duration (days)
(1) Notify NDEP of closure	Within 45 days before commencement of closure activities and within 30 days of treatment of the last known volume of hazardous waste
(2) Closure of the unit	Initiated 45 days after notification of closure and completed within 180 days after treatment of last volume of hazardous waste
(3) Certification of closure submitted to NDEP	Within 60 days after completion of closure activities

B.13.d.1 Notification of Closure

The NDEP will be notified in writing 45 days before commencing closure activities and within 30 days of treatment of the last known volume of hazardous waste.

B.13.d.2 Time Allowed for Closure

The unit will be closed within 180 days after treatment of the last volume of hazardous waste.

B.13.d.3 Certification of Closure

Within 60 days after closure of the unit, NNSA/NSO will certify that closure was performed according to the approved Closure Plan. This certification will be submitted to NDEP.

B.13.e Amendment to Closure Plan

Any amendments to the closure plan will be submitted to the NDEP as permit modifications. An amended closure plan will be submitted to the 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 that occurs which has affected 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.

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 DOE 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 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 [corrective action unit/corrective action site] files, and in the U.S. Air Force Geographical Information System.

B.15 Closure Cost Estimate [40 CFR 279.14(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 279.14(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)]

[Content of two paragraphs removed from public view.]

Per **40 CFR 270.14(b)(19)**, the following elements do not currently exist on or within 305 m (1,000 ft) of the Area 11 EODU [Content of one sentence removed from public view.]

- Runoff system
- Storm, sanitary, or process sewer systems
- Buildings
- Injection and withdrawal wells
- Surface waters and intermittent streams
- Potable water well supplies.

B.19.a Land Use

Several Public Land Orders (PLOs) withdrew land from the public domain for the NTS to be established. PLO 805, issued in 1952, withdrew the land where the Area 11 EODU is located. Since then, the land has been used for national defense and energy-related purposes. The NTS is not open to public entry for any purpose (e.g., agriculture, mining, homesteading, or recreation). Due to the nature of the NTS land use over the past 50 years, it is doubtful that the area will be returned to public use in the future. Certain areas around Area 11 have been used for atmospheric and underground nuclear weapons testing.

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B.19.b Well Locations

[Content of one paragraph removed from public view.]

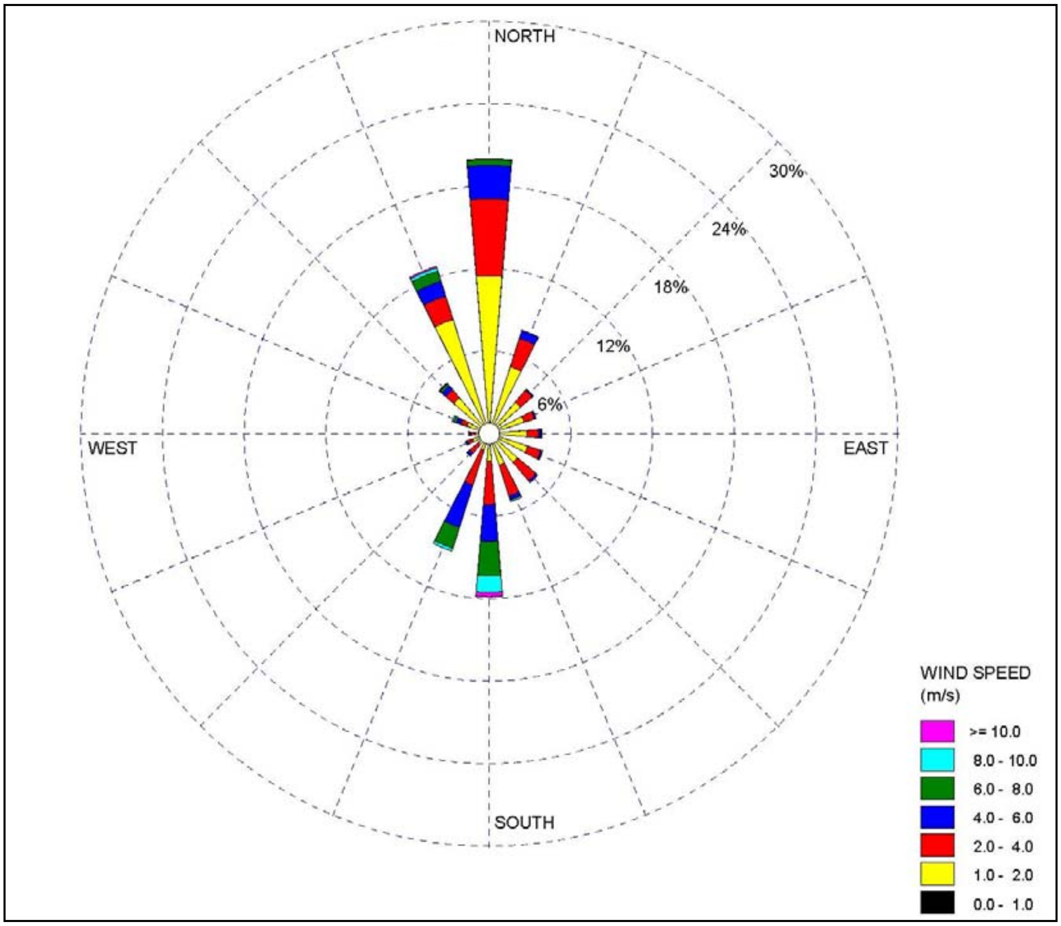
Figure 5 Topographic Features
Not available for public view

Figure 6 Topographic Features
Not available for public view

B.19.c Wind Rose

Wind speed and direction data are shown for the Frenchman Flat area in Figure 7. This diagram indicates that winds in this area are generally from the southwest, with wind velocities varying from 0 to 20 m/s. However, there is a diurnal reversal effect such that winds are predominantly southerly during the day and northerly at night. In a similar manner, there is a seasonal reversal effect such that winds are predominately southerly during the summer and northerly during the winter. At the EODU, explosive materials are stored in closed magazines and operations do not occur during inclement weather; therefore, wind dispersion effects are minimal.

Figure 7 Wind Rose Diagram for the Area 5 RWMS Meteorology Station



B.19.d Utility Characteristics

There are no electric, water, sewage utilities, or drainage structures at the EODU.

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 EODU is located in a remote area with no buildings, the operating record is maintained at Building 6-900 in Area 6. NDEP inspections of the current operating record for the EODU acknowledge this separation as functional and compliant with regulatory requirements. The operating record will include:

- A description and quantity of each hazardous waste received/treated and the date of treatment.
- Location and quantity of each hazardous waste within the EODU (satellite accumulation).
- Records and results of waste analysis, process knowledge documents, 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.

B.20.a.2 Unit Description [40 CFR 270.23(a)(1-2)]

The EODU was first operated on May 12, 1965. The location of this unit is shown on Figure 1. According to **40 CFR 264.601**, owners or operators choosing to detonate explosives in a miscellaneous unit must do so in a manner that does not threaten human health or the environment. The nearest, most populated area to the Area 11 EODU is Mercury, Nevada, which is approximately 26 km (16 mi) to the south and is occupied 24 hours per day, seven days per week.

[Content of one paragraph removed from public view.]

These figures [removed from public view] show the following features:

- A locked, chained barrier at the entrance of the Area 11 EODU area.
- Three graded areas.
- Dirt access roads leading up to each graded area.
- One small crater on the Detonation Unit Pad.
- Firing point.

The access road to the EODU is composed of native soil. The access road and graded areas are re-graded approximately every two years, typically after a period of high rainfall. [Content of four sentences removed from public view.]

The firing point is located approximately 1.4 km (.86 mi) west of the detonation pad adjacent to the access road.

Inspection of the EODU is discussed in Section B.5. The EODU will be clean closed (see Section B.13.d).

B.20.b Standard Detonation Procedures

The NNSA/NSO Operations Coordination Center (OCC) is responsible for overseeing each detonation and must be notified as required in current procedures before any detonation. The OCC is responsible for scheduling activities to allow for detonations and for controlling air traffic over the EODU during detonations. Detonations are not scheduled during inclement weather or during hours of darkness.

When a detonation is scheduled, waste explosives are removed from the magazine or delivered to the EODU before each event using a designated explosives transportation vehicle. Handling of explosives is conducted under the supervision of the EODU Operations Supervisor. Standard explosives industry procedures are followed. The basic components of detonation are loading, priming, and firing. Detonations must be conducted by at least two people meeting the training requirements of Section B.12, including the Operations Supervisor.

The following is an outline of the steps involved in a standard detonation procedure.

B.20.b.1 Pre-Shot

- OCC notified before entry at lower gate.
- Hazards briefing conducted by Operations Supervisor.
- Personnel leave matches, lighters, or other fire-, flame-, or spark-producing devices at the lower gate.
- Vehicle and two-way radios are turned off; only the Operations Supervisor maintains radio communication.
- The Operations Supervisor will ensure the EODU is clear of unauthorized personnel and that the detonation pit is clear.
- If waste and donor explosives are being transported, personnel will proceed directly to the detonation area; or if waste and donor explosives are stored in the magazine – remove from the magazine and transport to the detonation area.
- The magazine will be locked during all detonation activities.

B.20.b.2 Testing

- Two blasting caps are set up in the detonation pit.
- Personnel return to the firing point and initiate blasting caps to test firing system.
- Personnel clear detonation pit.

B.20.b.3 Detonation

- Configure waste explosives and donor charge in detonation pit.
- Personnel return to firing point.
- Warning signal (warbling) sounded.
- Initiate detonation.

B.20.b.4 Post-Shot

- Following a safe time after the detonation, return to examine the detonation pad and pit for fires or shrapnel by performing a walk-through inspection of the area.
- Sound all clear signal (steady) and lower flag at firing point.
- Secure equipment and chain gate, return to lower gate.
- Lock lower gate and notify OCC that operations are completed.

B.20.b.5 Misfires

In the unlikely event of a misfire, the procedure is as follows:

- Remain at the firing point for at least 30 minutes.
- Observe the detonation area with binoculars for smoke and fire.
- If no hazards are identified, drive to the detonation area.
- Check detonation system and configuration of materials in the detonation pit.
- Reconfigure explosive material in the detonation pit.
- Follow standard detonation procedures.

B.20.b.6 Remote Firing Device

The remote firing device operates using a two-way radio controlled remote blast initiation system. The radio system's signal is digitally encoded. The system has the capability to initiate non-electric shock tube, as well as electric blasting caps. Using redundant internal safety circuitry and a timed automatic disarming feature, the remote is disarmed if the encoded firing signal is not properly received within two minutes of being armed.

The device will be checked using two blasting caps before loading the material to be detonated. During this check, only the Operations Supervisor and an Explosives Handler will be allowed into the EODU. Other personnel, when applicable, will remain at the firing point.

B.20.c Live Explosives Training

Live explosives training (including detonation) at the EODU will be conducted quarterly. This training is required to maintain proficiency with operating/emergency procedures, meet annual review requirements of initial training, and provide a larger pool of qualified personnel to support the Operations Supervisor. Additionally, the treatment of experimental explosives from research projects will require that subject matter experts associated with these projects provide consultation and hands on support to the Operations Supervisor for the treatment of these explosives.

Title 40 CFR 264.16(a) requires classroom or on-the-job training to ensure facility compliance. The training will include:

- EODU explosives operations and emergency operations
- Procedures for using, inspecting, repairing, and replacing facility emergency and monitoring equipment
- Communications or alarm systems
- Response to fires or explosions
- Shutdown of operations

Live explosives training will involve a maximum of kg (5 lb) of conventional explosives per shot four times per calendar year. Treatment of waste explosives at any time during a calendar year will be counted against the four live explosives training events. For example, if the EODU conducts treatment of waste explosives twice in a calendar year, only two live explosives training events would be allowed for that calendar year. Documentation of live explosives training will be kept in the operating record for the facility and will include, date, quantity and type of explosives used.

Training requirements for EODU personnel are detailed in Section B.12.

B.20.d Transportation

Suspected waste explosives are transported to the EODU in designated vehicles that are equipped with radio communications and fire extinguishers. DOT-required placards are placed on front, rear, and both sides of the vehicle while transporting explosives.

Suspected waste explosives are handled and transported in containers as received from the generator or in approved containers (wood, metal, fiber, or other acceptable material, lined with nonconductive materials and equipped with tight-fitting covers).

The EODU Operations Supervisor is directly contacted for pickup of suspected waste explosives from generators located on the NTS. The EODU Operations Supervisor determines which explosives are waste and which are useable, separating them accordingly. The type and quantity of explosives delivered to the EODU are then recorded in the EODU Facility Operating Record.

B.20.e Waste Storage

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B.20.f Surface Water Run-On and Runoff Control

(1) Run-On

[Content of one paragraph removed from public view.]

(2) Runoff

Runoff is prevented by the natural structure of the EODU area which consists of a pit formed by previous detonations. Precipitation falling inside the pit is allowed to evaporate. The detonation area surrounding the pit is bermed with native soils.

B.20.g Environmental Performance Standards [40 CFR 270.23(b)(c)]

According to **40 CFR 264.601;** and **270.23(b)** and **(c)**, the following information is provided concerning the environmental performance standards that must be maintained to protect human health and the environment:

- Information on the type of waste managed, treatment method, types and quantities of emissions or releases, and the extent of migration or dispersion of the waste in various media.
- Detailed assessment of the potential pathways of exposure to humans or environmental receptors to hazardous waste or constituents and the potential magnitude and nature of such exposures.
- Evaluation of how the migration of waste constituents in the air, surface water, groundwater, and soils is prevented.

(1) Waste Characteristics

The wastes treated at the EODU are explosives capable of detonation or explosive reaction if subjected to a strong initiating source **[40 CFR 261.23(a)(6),(7),** and **(8)]**. NNSA/NSO has evaluated the air emissions capable of being released during normal operations using typical explosive materials as described in Section B.2. In addition, NNSA/NSO has characterized the immediate soils within and adjacent to the treatment zone as described in Section B.20.f.

(2) Treatment Method

The waste explosives exhibit the characteristic of reactivity and are subject to the Land Disposal Restriction Technology Based Standard identified in **40 CFR 268.40**, "Treatment Standards for Hazardous Wastes," as deactivation [explosive subcategory based on **261.23(a)(6),(7),** and **(8)**]. Historically, treatment at the EODU included the open burning of explosive materials which is now prohibited.

B.20.g.1 Protection of Groundwater and Subsurface Environment – Hydrogeologic Assessment [40 CFR 270.23(b)(c)]

(1) Patterns of Rainfall

The EODU is located in an arid area which provides a favorable hydrogeologic setting for waste operations. Average annual rainfall at the EODU is approximately 10 cm (4 in) as recorded for the Frenchman Flat area. High evaporation rates occur at the Area 11 EODU and are comparable to those observed for the Frenchman Flat Basin. The basin's annual potential evapotranspiration rate is more than ten times higher than the annual precipitation. Low rainfall and high evaporation minimizes the potential of groundwater recharge that could provide a pathway for constituent migration.

(2) Hydrologic and Geologic Characteristics

Four hydrogeologic units underlie the EODU (Winograd and Thordarson, 1975). The deepest of these units, the lower carbonate aquifer, contains groundwater at a depth of approximately 550 to 610 m (1,800 to 2,000 ft) below ground surface and is assumed to be the destination of potential contaminants that may migrate downward from the unit. Two of the hydrogeologic units above the lower carbonate aquifer (the welded tuff aquifer and the tuff aquitard) are fractured. As a result, water movement in these units would be expected to occur primarily through fractures and not through pores. The other unit, the bedded tuff aquifer, reportedly transmits groundwater through pores instead of fractures.

Characterization of existing groundwater quality at the site is not proposed because it is unlikely that contamination of groundwater has occurred as a result of unit activities. Depth to groundwater, the presence of a tuff aquitard beneath the site, and the limited amount of combustion products likely to be present, suggest that the potential for groundwater contamination from past unit activities is exceedingly low.

(3) Proximity To and Withdrawal Rates of Current and Potential Users

[Content of one paragraph removed from public view.]

(4) Regional Land Use Patterns

Because of the hazards associated with treating (detonating) the waste explosives, a 1.6-km (1-mi) exclusion zone exists around the EODU prohibiting other industrial activities. When the EODU is not in operation, maintenance and site characterization activities may occur within the exclusion zone.

(5) Constituent Effects on Domestic Animals and Root Zone of Vegetation

Food chain crops are not grown in the vicinity of the EODU and domestic animals are not located on the NTS. Potential impacts on other vegetation from deposition of waste constituents in the root zone is minimal due to the location of the unit, types of constituents anticipated to be released, and the sparse vegetation present in the region.

B.20.g.2 Protection of Surface Water, Wetlands, and Soil Surface

The surface water and soil surface performance standard addresses the potential for human health or the environment to be adversely impacted because hazardous constituents have migrated from the EODU via surface water or soil.

(1) Existing Water Quality (Surface Waters)

There are no surface water bodies, including ephemeral streams or wetlands, on or near the Area 11 EODU.

Surface water flooding from channels and run-on from slope wash is not significant at the EODU because it is located on a ridge top. Water drains away from the EODU, except from direct rainfall in the detonation pit. No standing water is present. Surrounding drainage is ephemeral and completely dependent on rainfall. Consequently, surface water contributes very limited capability to transport contaminants and is not of concern.

(2) Existing Soil

In February 2010, NNSA/NSO completed the “2009 Soil Characterization Report for the EODU, Nevada Test Site” (Exhibit 4). This characterization activity was conducted in support of the EODU permit application. The characterization included sampling and analyzing the surface and subsurface soils in and around the detonation pit. The analytical data (Table 1 and Figure 1 of Exhibit 4) indicate that explosive residues were present in the detonation pit and on the detonation pad. Toxicity Characteristic Leachate Procedure (TCLP) metal constituents were present at all the sample locations. The release of these constituents is attributed to historic activities, primarily the open burning of explosive material that is now prohibited. This soil characterization activity is required to be repeated every five years over the active life of the unit.

(3) Risk Assessment

Due to the nature of the treatment (deactivation via detonation), it is unlikely that reactive waste will migrate beyond the treatment zone. The current prohibition on open burning of explosive materials eliminates the generation of explosive residues. Wastes are in solid form and are present in the detonation pit only for brief periods of time before treatment. The remote location of the EODU and the concentrations of constituents in the soil present a minimal exposure risk to humans. Domestic animals and crops are not present within the NTS and the adjacent NTTR.

B.20.g.3 Air Quality

The EODU is located within Nevada Intrastate Air Quality Control Region 147 (AQCR-147) [Content of one paragraph removed from public view.]

Specific operating conditions for the EODU are noted in BT. System 72 of the Class II Air Quality Operating Permit (AP9711-2557). Operating parameters (for treating waste explosives) are limited to only those items which are approved under the provisions of the Hazardous Waste Permit NEV HW-0021. Reporting requirements include:

- Proposed detonations will be submitted to the Bureau of Air Pollution Control at least 30 days before treatment.
- Detonation shall not proceed without prior written approval from the Bureau Chief.
- Analysis of each treatment will be submitted to the Bureau of Air Pollution Control within 60 calendar days of completion the treatment.

PM_{10} sampling shall be conducted at an appropriate safe distance from the detonation site each day a detonation occurs. Records of monitoring shall be maintained in a contemporaneous log that includes:

- Calendar date
- Total detonation rate of explosive material in tons
- Total daily hours of operation
- Corresponding average hourly detonation rate in tons/hr

There are no significant sources of sulfur dioxide (SO_2), nitrogen oxide (NO_x), or carbon monoxide (CO) at the NTS. The nearest source is Las Vegas, Nevada, approximately 100 km (62 mi) to the southeast. Instances of high total suspended particulate (TSP) in remote areas are usually caused by high winds. The limited activities conducted at the EODU will have minimal short-term local effects on priority pollutants or TSP concentrations and no effect on offsite priority pollutants or TSP concentrations.

According to the Area 11 EODU site characterization program, the potential air emissions generated from detonation activities were modeled and reported to the NDEP (November 1995 and March 2002). The modeling data indicated that the emissions would result in no significant impact to human health or the environment.

B.20.h Environmental Risk Assessment

Due to the nature of the treatment (deactivation via detonation), it is unlikely that reactive waste will migrate beyond the treatment zone. The current prohibition on open burning of explosive materials eliminates the generation of explosive residues. Wastes are in solid form and are present in the detonation pit for only brief periods of time before treatment. The remote location of the Area 11 EODU and the minuscule concentrations of constituents in the immediate soils present a minimal exposure risk to humans. Domestic animals and crops are not present within the NTS and the adjacent NTTR. The lengthy distance to groundwater makes the unit an insignificant potential migration for existing low-risk constituents that could be leached from soils by the infrequent precipitation.

Some wildlife is present on the NTS and could potentially come in contact with the airborne soils from the Area 11 EODU. Until the amount and type of waste constituents present in the soil are further characterized, the potential for adverse impact to wildlife is not known. Likewise, the sparse vegetation of the area undoubtedly is exposed to waterborne and/or airborne soil particles from the EODU site, but the significance of this exposure is not presently known.

B.20.i Site Characterization

This section presents data gathered by NNSA/NSO to evaluate potential contamination in the vicinity of the EODU.

B.20.i.1 Air Modeling Plan

Potential air emissions generated from detonation activities at the Area 11 EODU were calculated using a specialized dispersion model that would address the unique dispersion characteristics associated with open detonation (OD) activities. This was accomplished using the Open Burn/Open Detonation Dispersion Model (OBODM). The OBODM has been approved by the EPA specifically for modeling OD and open burn (OB) emission sources.

OBODM is intended for modeling emissions from OB/OD of obsolete munitions and solid propellants at DoD and DOE facilities.

The modeling simulated detonations as instantaneous releases. The effective release height of the initial cloud was calculated by the model. The modeling was conducted using worst-case emissions for both short-term and annual scenarios. These worst-case pollutant emissions were identified from emission factors derived from studies conducted at Dugway Proving Grounds.

After appropriate background concentrations were added, the modeled concentrations for each pollutant were compared with the national and Nevada ambient air quality standards. Results indicated that maximum modeled EODU concentrations were well below the national and Nevada ambient air quality standards for criteria pollutants.

The dispersion model used conservative parameters to present a maximum emission. If the types of waste explosives change or the maximum quantity changes to the extent that the model is not applicable, NNSA/NSO will reissue the report.

Information was generated for two scenarios: a standard-case detonation (45 kg [100 lb]) and a worst-case detonation (1,875 kg [4,130 lb]). The material to be detonated was assumed to be Detagel Water-Gel Explosives, the most common explosives detonated at the site. Rate and quantification of re-entrained dust was estimated based on literature established for blasting emissions associated with mining activities.

B.20.i.2 Sampling Plan to Characterize Existing Soil Conditions

In January 1995, the NNSA/NSO conducted an initial characterization of the existing soil conditions at the EODU. This investigation was repeated in November 1999, 2004, and 2009 (Exhibit 4). Characterization will be repeated every five years over the life of the unit and before closure of the unit. In addition, this investigation outlines the specific tasks to be performed and methods to be used in characterizing the extent of soil contamination, if present, resulting from past activities at the EODU. This plan was designed on the basis of information regarding past site operations.

(1) Objectives and Scope

The sampling objective of each site investigation is to generate data to evaluate the EODU site conditions. A report presenting the results of each characterization study will be submitted to NDEP.

Because the vast majority of explosives detonated at the unit are either water-gel or slurry explosives, the sampling plan is designed to characterize existing potential soil contamination that may be associated with these compounds. Water-gel explosives are composed primarily of ammonium nitrate, sodium nitrate, ammonium perchlorate, hexamine nitrate, aluminum, and water. Slurry explosives are composed primarily of nitroglycerin, sodium nitrate, nitrocellulose, carbonaceous material, sulfur, and antacid (Exhibit 1).

However, few data are available regarding the explosion products of water-gel and slurry explosives. Based on discussions with a representative of the U.S. Army Toxic and Hazardous Waste Division, it appears that potential contaminants associated with these explosives would be minor amounts of undetonated explosives.

The scope of each investigation involves obtaining samples from the detonation pit, detonation pad, and the immediate area near the pad. Historically, the detonation pit has been disturbed by past detonations and the periodic backfilling of the area. Samples are collected from two locations within the existing pit and from two locations adjacent to the pit. Additional samples are collected from a location immediately southeast of the detonation area where constituents appear most likely to migrate after a detonation. In addition, background samples are obtained from a location approximately 30 m (100 ft) to northwest of the unit.

Samples are collected as described in Exhibit 4, properly sealed, labeled, and placed in an ice chest. The samples, with the completed chain of custody and laboratory request forms, are shipped or delivered to the approved laboratory for analysis as soon as possible.

(2) Chemical Analysis

Sample locations and the number of samples will be selected following procedures described in the EPA publication "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846 (latest edition). Table 9 provides information and the rationale for the EODU site characterization analytical methods. PETN (water-gel) and nitroglycerin analysis can be obtained by adjusting the instrumental parameters of EPA Method 8330. Background samples will not be analyzed by EPA Methods 8330 or 8332 because the background is assumed to be zero.

Other potential contaminants may have originated from explosive metal casings containing copper and/or zinc. In addition, MSDSs (Exhibit 1) indicate that squibs, detonating cord boosters, and blasting caps may contain lead, mercury, and/or selenium. Therefore, samples are collected and analyzed for TCLP metals using EPA Method 1311. To evaluate the hazardous waste characteristics of the soil, samples are collected and analyzed for ignitability using EPA Method 1010.

Also, to be consistent with other site characterization projects and due to the possibility of petroleum previously being open-burned in the area, samples are collected and analyzed by EPA Method 8015M TPH (Diesel Range only). Labels containing the following information will be affixed to all samples: sample number, sample depth, date and time of sampling, sample collector's name, and the name of the unit.

Table 9 Area 11 EODU Site Characterization Analytical Methods Rationale

Type of Waste Explosive Treated/Active Ingredients	Analytical Methods/Rationale
Water-Gel Explosives (PETN)	EPA Method 8330/8332 For the detection of Active Ingredients (D003). EPA Method 1010 – Ignitability For the detection of Ignitable Waste (D001).
TNT	EPA Method 8330/8332 For the detection of Active Ingredients (D003).
RDX pellets	EPA Method 8330/8332 For the detection of Active Ingredients (D003).
Small Arms Ammunition (RDX, HMX, TNT, Heavy Metals)	EPA Method 8330/8332 For the detection of Active Ingredients (D003). EPA Method 1010 - Ignitability For the detection of Ignitable Waste (D001). EPA Method 1311 - TCLP Metals For the detection of metals found in explosive formulations.
Blasting Caps, Boosters, Squibs (RDX, HMX, TNT, PETN)	EPA Method 8330/8332 For the detection of Active Ingredients (D003). EPA Method 1311 - TCLP Metals For the detection of metal found in explosive formulations. EPA Method 1010 - Ignitability For the detection of Ignitable Waste (D001).

Type of Waste Explosive Treated/Active Ingredients	Analytical Methods/Rationale
Black Powder (RDX, HMX, TNT, PETN)	EPA Method 8330/8332 For the detection of Active Ingredients (D003). EPA Method 1010 - Ignitability For the detection of Ignitable Waste (D001).
Propellants (Ammonium Perchlorate)	EPA Method 1010 - Ignitability For the detection of Ignitable Waste (D001). EPA Method 8015 (Diesel Range only) For the detection of total petroleum hydrocarbons (TPH).

(3) Data Reduction and Evaluation

Data generated during site characterization generally consists of field and laboratory data. This data is organized and evaluated in terms of (1) the presence of contaminated soils on site, (2) the chemical nature of identified contaminants in soil, (3) physical properties of the shallow subsurface material in the unit vicinity, and (4) the need for additional characterization of the site.

The analytical soil results will be evaluated as to the chemical nature of any identified soil contamination. Concentrations of contaminants detected are compared to background concentrations of the same compounds to determine false positive/false negative validity. Subsequent to the reduction and evaluation of the field and laboratory data, an evaluation of the need for additional characterization of the EODU is determined.

(4) Report Preparation

A report will summarize the results of the sampling and analysis of the existing soil conditions at the EODU and will be submitted to the NDEP as Exhibit 4 in this Part B Application.

Figure 8 View of the Storage Area from the Detonation Pit
Not available for public view
Figure 9 View of Storage Area
Not available for public view
Figure 10 EODU Firing Point
Not Available for public view

EXHIBIT 4 2009 SOIL CHARACTERIZATION REPORT FOR THE EODU, NEVADA TEST SITE

[Content of one paragraph and one photograph removed from public view.]

DOE/NV/25946--894

2010 SOIL CHARACTERIZATION REPORT FOR THE AREA 11 EXPLOSIVE ORDNANCE DISPOSAL UNIT NEVADA TEST SITE

Prepared for
U.S. Department of Energy
National Nuclear Security Administration
Nevada Site Office

Prepared by
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ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
DOE/NV	U.S. Department of Energy, Nevada Operations Office
EMS	Environmental Management System
EODU	Explosive Ordnance Disposal Unit
EPA	Environmental Protection Agency
HMX	Cyclotetramethylenetetranitramine
NDEP	Nevada Division of Environmental Protection
NTS	Nevada Test Site
PETN	Pentaerythritol Tetranitrate
RCRA	Resource Conservation and Recovery Act
RDX	Cyclotrimethylenetrinitramine
TCLP	Toxicity Characterization Leaching Procedure
TNT	Trinitrotoluene

1.0 Introduction

The Explosive Ordnance Disposal Unit (EODU), located in Area 11 of the Nevada Test Site (NTS), is an explosive detonation unit for the treatment of onsite generated waste explosives that are hazardous waste as defined under Title 40 Code of Federal Regulations (CFR) Part 261.23(a) (6), (7), and (8), and also 40 CFR 265.382.

The EODU began operations on May 12, 1965, for the open burning and detonation of waste explosives. In the 1980s open burning of waste explosives was discontinued. In May 1995, the Nevada Division of Environmental Protection (NDEP) issued a Resource Conservation and Recovery Act (RCRA) Permit (NEV HW0009) to the U.S. Department of Energy, Nevada Operations Office (DOE/NV) for the thermal treatment of waste explosives at the EODU. This unit is currently operated according to the RCRA Part B Permit (NEV HW0021, November 2005), the NTS Class II Air Quality Operating Permit (AP9711-2557), U.S. Department of Energy orders, and other applicable federal and state regulations.

[One sentence removed from public view.] The EODU consists of three graded areas including a detonation pit surrounded by an earthen pad approximately 20 meters (61 feet) by 30 meters (98 feet); a storage magazine, which is also used as a satellite accumulation area for waste explosives; and a firing point that is located approximately 1.4 kilometers (0.86 miles) west of the detonation pad on the access road.

Most of the explosives detonated at the EODU are water-gel (Pentaerythritol Tetranitrate [PETN]) and slurry explosives. Other explosives detonated include Trinitrotoluene (TNT), Cyclotrimethylenetrinitramine (RDX) pellets, cyclotetramethylenetetranitramine (HMX), small arms ammunition, solid rocket propellant, and black powder. Explosive waste is generated by tunneling and construction activities, high explosives testing, experimental explosives testing, special projects, and the security force firing range.

No radioactive or radioactive-contaminated materials are accepted or detonated at the EODU. The unit has an annual operations capacity of 1,870 kilograms (4,123 pounds) of waste explosive. The process design capacity of the EODU is approximately 45.4 kilograms/hour (100 pounds/hour).

In 1994, both NDEP and DOE/NV agreed that soil samples should be taken from the detonation pit to determine the impact to soils from historic operations. In January 1995, DOE/NV submitted the first characterization report. This characterization indicated the presence of Toxicity Characterization Leaching Procedure (TCLP) metals and explosive residues. The RCRA Permit issued in May 1995 required that this characterization be repeated on a five-year cycle.

2.0 Purpose

This soil characterization report summarizes sampling activities and analytical results, provides copies of laboratory data reports, and meets the requirements of Section IV.G.2 of the Permit (NEV HW0021, November 2005) and Sections P.3.d.7.b and P.3.n of the Permit Application (DOE/NV--1053-VOL 4, May 2005).

3.0 Scope

The objective of soil characterization is to attempt to establish baseline conditions and to determine if the continued operations of the EODU are adversely impacting the environment adjacent to the unit. The characterization data may also provide supporting data for the eventual closure of the unit. Four areas were identified for sampling: (1) the detonation pad, (2) the detonation pit, (3) the area designated as downwind, and (4) the area designated as background.

4.0 Monitoring Activities

The soil sampling was conducted on November 3, 2009. Personnel conducting the sampling were briefed on unit conditions and operations safety by the EODU Operations Supervisor prior to entering the unit. Sampling locations are noted in Figure 1. The background location selected was approximately 31 meters (100 feet) northwest of the detonation pit.

The surface and subsurface samples were collected from each location in a systematic manner. After surface gravel and debris were removed, clean stainless steel trowels were used to gather the surface sample from approximately 0 to 15 centimeters (0–6 inches) below the surface. Each subsurface sample was collected from approximately 15 to 30 centimeters (6–12 inches) below the surface in the same manner as the surface sample. All samples were immediately containerized, labeled, and placed in a cooler with ice. Chain of custody procedures were followed as prescribed by Environmental Protection Agency (EPA) Publication SW-846.

Samples from each location were analyzed for the following constituents using EPA-approved methods. The background location was not required to be sampled for explosives residue.

Constituent	Analytical Method
Explosive Residues (nitroglycerin)	8332
PETN, RDX, HMX, TNT	8330
TCLP Metals	6010
Ignitability (flashpoint)	1010
Nitrates	300.0
Total Petroleum Hydrocarbon (diesel range)	8015M

5.0 Analytical Results

A summary of the sample results are provided in Table 1. Variations in the sample results from previous sampling events are indicative of re-grading of the detonation pad every one to two years. Non-detect concentrations recorded on laboratory documentation indicate the analytical method's reporting limit.

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Figure 1. Area 11 EODU Sampling Locations 2010

Table 1. Area 11 EODU Analytical Results

Sample Date: November 3, 2009

Method	Analyte	Unit	Sample Concentrations											
			Background		Downwind		Detonation Pad (North)		Detonation Pad (South)		Detonation Pit (West)		Detonation Pit (East)	
			Surface	Subsurface	Surface	Subsurface	Surface	Subsurface	Surface	Subsurface	Surface	Subsurface	Surface	Subsurface
Sample No: EODU0400##			11	12	7	8	9	10	1	2	5	6	3	4
8330	HMX	ug/kg	NS	NS	ND	ND	1,280	915	ND	ND	732	1,100	808	628
	RDX	ug/kg	NS	NS	ND	ND	10,700	5,580	ND	ND	3,670	5,000	2,140	2,450
	PETN	ug/kg	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	12,300	ND
	TNT	ug/kg	NS	NS	ND	ND	ND	ND	ND	ND	ND(J)	ND(J)	370	ND
8332	Nitroglycerin	ug/kg	NS	NS	ND	ND	ND	ND	ND	ND	ND	790	7,950	3,240
8015M	TPH (Diesel)	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND(J)	ND(J)	6,550	ND (J)
6010	Arsenic	ug/L	ND	ND	32.9(JD)	32.1(JD)	68(JD)	51.3(JD)	78.7(JD)	110(D)	83.9(JD)	84.4(JD)	466(JD)	38.3(JD)
	Barium	ug/L	225(D)	215(D)	125(D)	224(D)	128(D)	93.8(D)	25(D)	32(D)	110(D)	110(D)	126(D)	114(D)
	Cadmium	ug/L	ND	ND	ND	ND	3.4(JD)	ND	ND	ND	ND	10.7(JD)	4.2(JD)	7.3(JD)
	Chromium	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	8.1(JD)	8.5(JD)	ND	7.7(JD)
	Lead	ug/L	42.7(D)	ND	ND	ND	103(D)	364(D)	ND	ND	95.5(D)	179(D)	1,100(D)	1,580(D)
	Mercury	ug/L	ND	ND	ND	0.08(J)	ND	ND	ND	ND	ND	34.2(D)	31(JD)	ND
	Selenium	ug/L	ND	ND	ND	ND	53.8(JD)	36.2(JD)	ND	ND	ND	ND	ND	ND
	Silver	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1010	Ignitability	°F	All samples were heated to 200°F and did not ignite.											
300.0	Nitrates	mg/kg	12.3	4.2	14.9	10.3	747	320	10.3	9.1	122	96.9	57.9	35.1

NS - Not Sampled

ND - None Detected

J - Present below detection limit (estimated value)

D - Identified as a secondary dilution factor

Notes - Surface/subsurface samples from locations other than "Background" were analyzed for explosive residues, which resulted in two sample designations for these locations.

6.0 Conclusions

In accordance with Section P.3.d.7.b.3 of Volume 4 of the Permit Application, the data has been organized and evaluated in terms of the following:

1. **The Presence of Contaminated Soils on Site** – Soil contamination has been identified in the four sampling events (1995, 2000, 2005, and 2009).
2. **The Chemical Nature of Identified Contaminants in the Soil** – Explosive residues, TCLP metals, nitrates, and nitroglycerin were detected in the samples. The background sample contained barium and lead, while arsenic and chromium (detected in 2005) were absent. Cadmium was detected in fewer samples and at lower levels than in 2005. The detonation pit samples as a group exhibited the highest concentrations of explosive residue as expected. Variability between previous sampling events and the 2009 results can be attributed to re-grading of the detonation pad, a normal maintenance activity.
3. **Physical Properties of the Shallow Subsurface Material in the Unit Vicinity** – The shallow subsurface material is colluvium.
4. **The Need for Additional Characterization of the Site** – Additional characterization of the site is not needed at this time. Sampling under the Part B Permit will continue on a five-year schedule until closure.

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

Other federal laws that apply to operations at the EODU are as follows:

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

- Clean Air Act – Air dispersion modeling for the EODU and other NTS facilities was conducted in March 2002 as part of the NTS air permit renewal application package. Results of the modeling as reported to NDEP indicated that emissions from treatment of wastes at the EODU resulted in no significant impact to human health or the environment.

  In addition, NNSA/NSO provides NDEP with a treatment plan for each detonation event occurring at the EODU. Particulate monitoring is also conducted as part of NTS Class II Air Quality Operating Permit AP9711-2557.

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

According to **40 CFR 270.10(j)** an exposure information report for this operational unit is not required.

B.20.k Compliance Schedule [40 CFR 270.33]

The following required information was not included in this application and will be submitted by the following dates.

Due Date	**Item**
02/2015	Soil Characterization

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

EODU operations constitute treatment, not land disposal; therefore, a groundwater monitoring plan is not required.

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 characterization.