Final

Camp Allen Landfill RI Report
Norfolk Naval Base
Norfolk, Virginia

Volume II
Appendix A-L

03.13-07/01/94-00593

Prepared For:

Department of the Navy
Atlantic Division
Naval Facilities
Engineering Command
Norfolk, Virginia

Under the

LANTDIV CLEAN Program

Comprehensive Long-Term
Environmental Action Navy

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July 1994

Baker
Baker Environmental, Inc

FOSTER WHEELER
FOSTER WHEELER ENVIRESPONSE, INC.

WESTON
MANAGERS DESIGNERS/CONSULTANTS

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03.13-07/01/94-00593

Draft Final
Remedial Investigation Report

Camp Allen Landfill
Norfolk Naval Base

Norfolk, Virginia

Appendix Volume II
Appendices A through L

Prepared For:

Department of the Navy
Chesapeake Division
Naval Facilities
Engineering Command

Washington, D.C.

Under the

LANTDIV CLEAN Program

Comprehensive Long-Term
Environmental Action Navy

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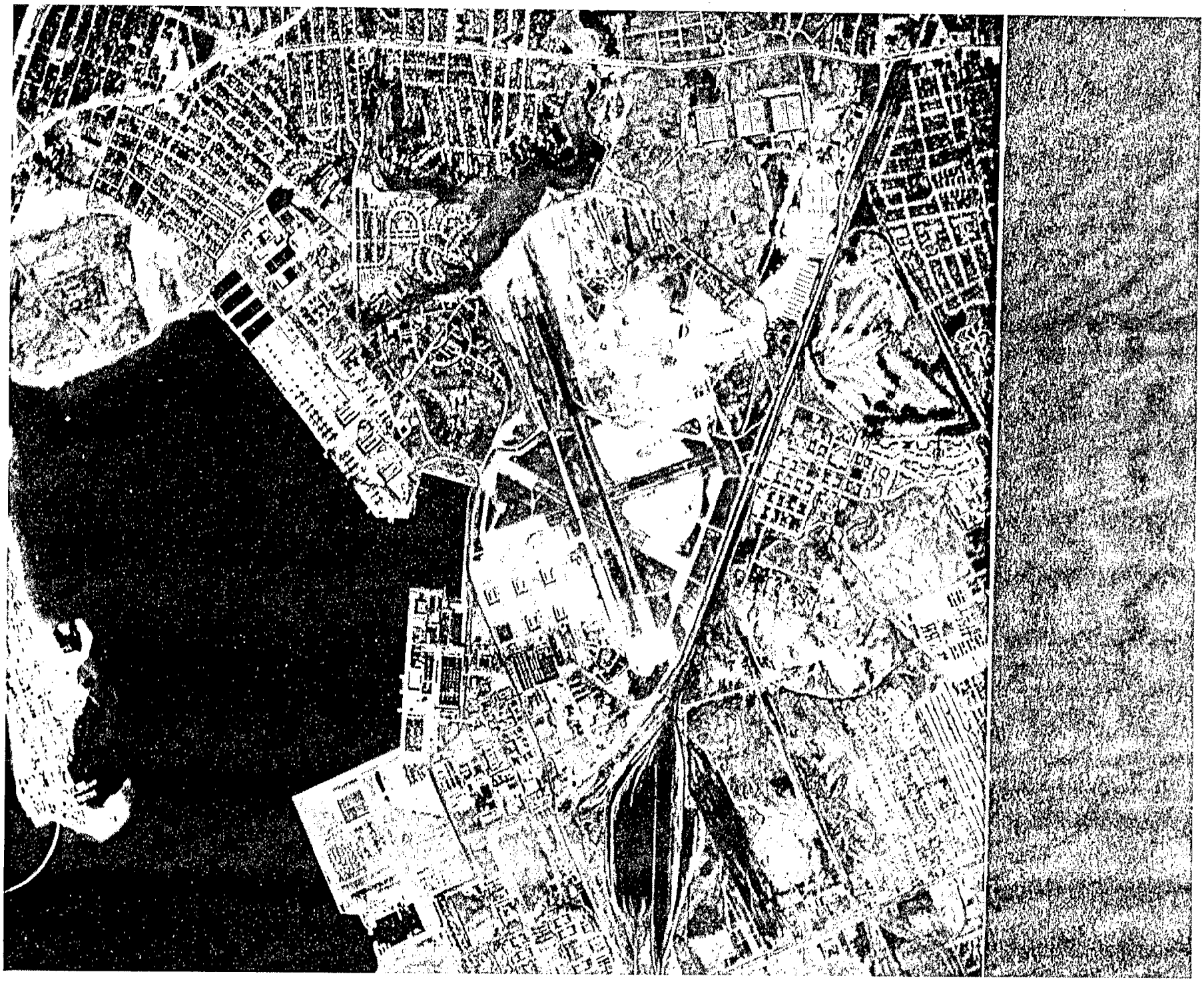
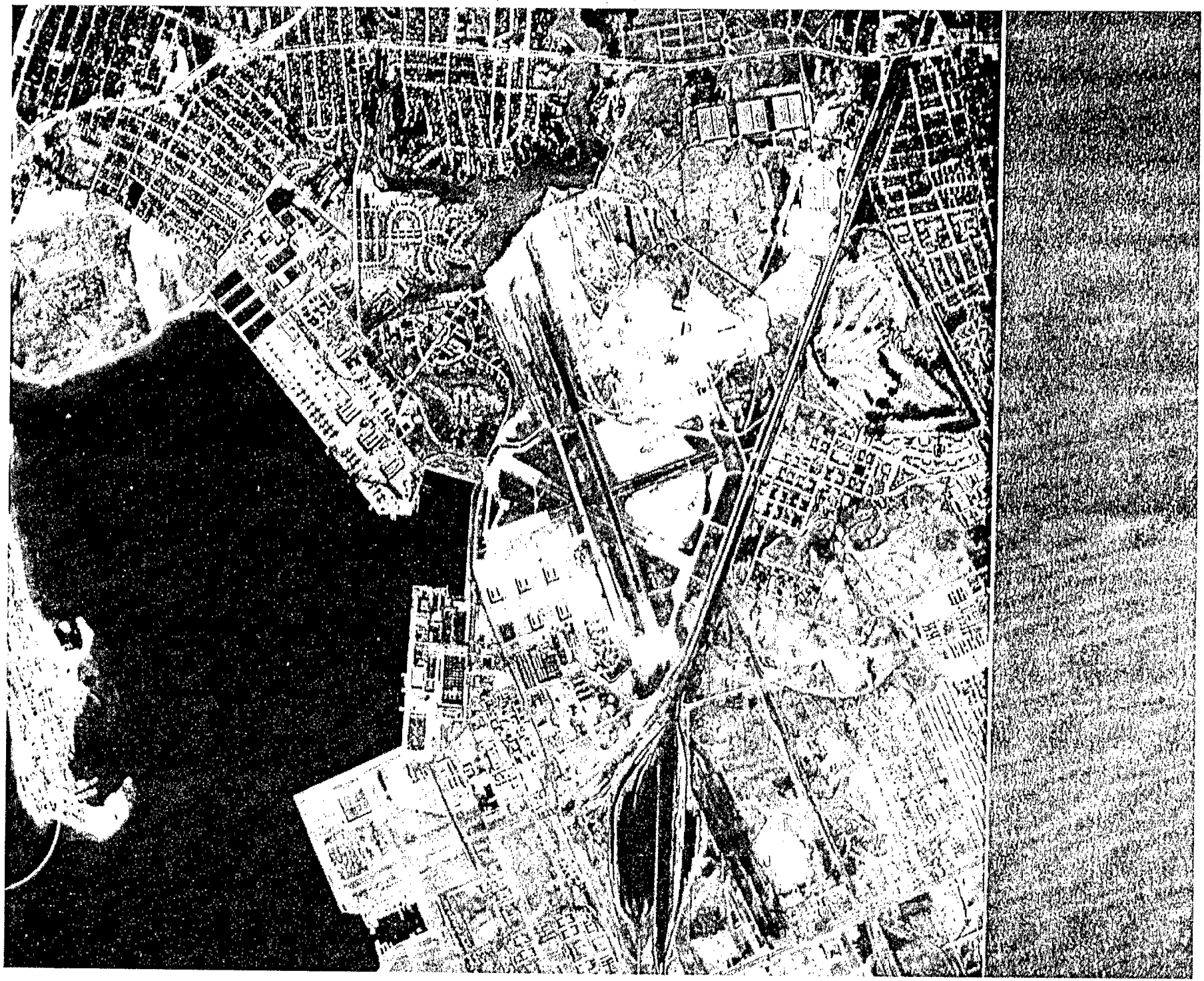
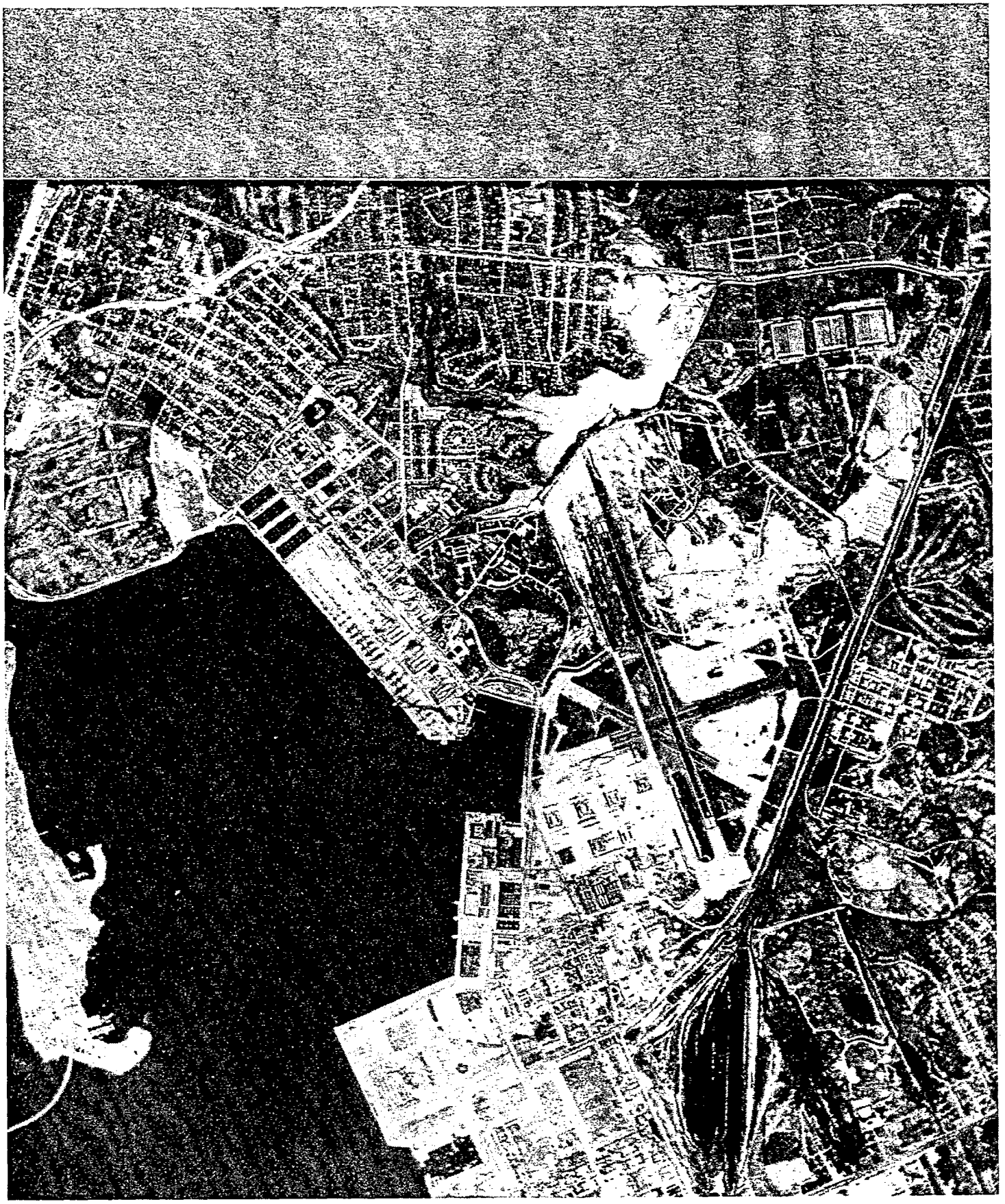
APPENDICES

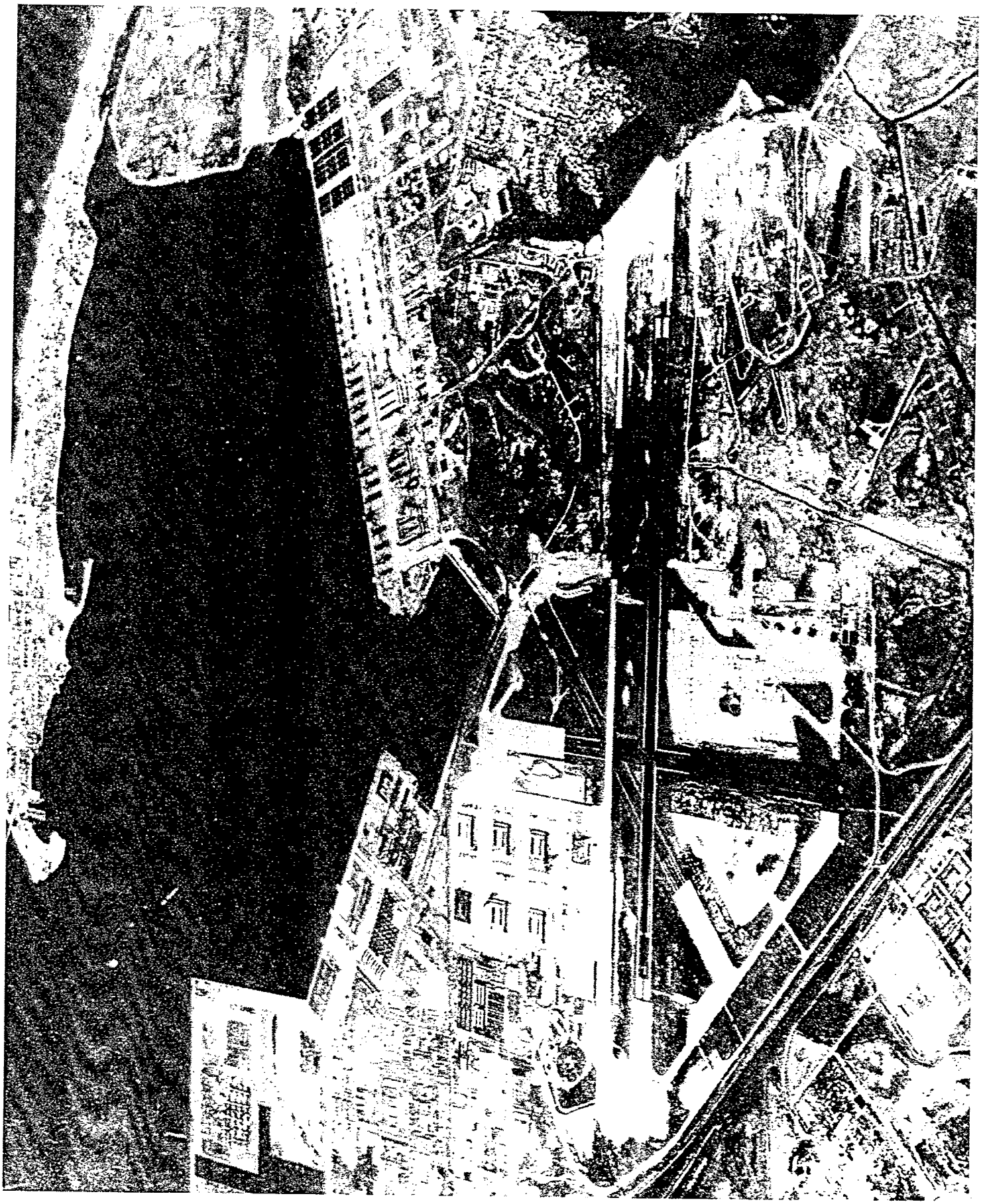
APPENDIX A

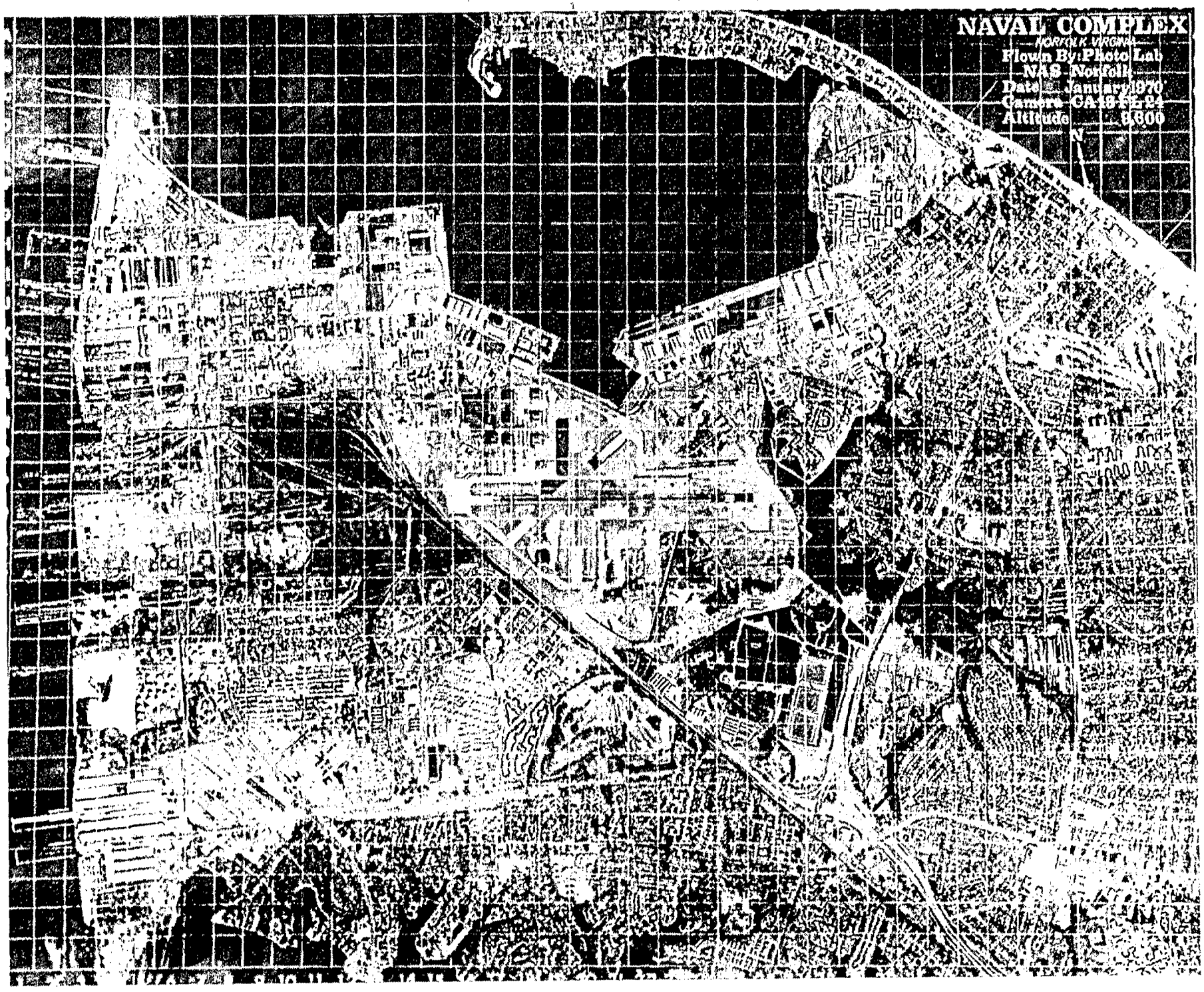
APPENDIX A
HISTORIC SITE PHOTOGRAPHS







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NORFOLK, VIRGINIA
Flown By: Photo Lab
NAS Norfolk
Date: January 1970
Camera: CA 19 FH 24
Altitude: 8800
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APPENDIX B

APPENDIX B
NATIONAL VOLATILE ORGANIC COMPOUNDS DATABASE REPORT FOR THE VIRGINIA AREA

Summary of Specific Ambient Volatile
Organic Compounds for the State of Virginia

CAS NAME: 1,1,1-TRICHLOROETHANE

CONCENTRATION PPB	SAMPLE METHOD	ANALYTICAL METHOD	SITE TYPE	CITY	STATE	NUMBER OF SAMPLES	NUMBER LESS MQL	SAMPLE DURATION
0.009	ABSCART	GC/MS	UR	FRONT ROYAL	VA	8	7	DA
0.080	ABSCART	GC/MS	UR	FRONT ROYAL	VA	9	6	DA
0.000	ABSCART	GC/MS	UR	FRONT ROYAL	VA	9	9	DA

Source: National Ambient Volatile Organic Compounds Database

Summary of Specific Ambient Volatile
Organic Compounds for the State of Virginia

CAS NAME: 1,2,4-TRIMETHYLBENZENE

CONCENTRATION PPB	SAMPLE METHOD	ANALYTICAL METHOD	SITE TYPE	CITY	STATE	NUMBER OF SAMPLES	NUMBER LESS MQL	SAMPLE DURATION
0.811	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.691	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.583	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.712	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.776	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.743	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.320	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.556	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.616	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.937	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.807	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.829	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.710	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.364	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR

Source: National Ambient Volatile Organic Compounds Database

Summary of Specific Ambient Volatile
Organic Compounds for the State of Virginia

CAS NAME: 1,2,4-TRIMETHYLBENZENE

CONCENTRATION PPB	SAMPLE METHOD	ANALYTICAL METHOD	SITE TYPE	CITY	STATE	NUMBER OF SAMPLES	NUMBER LESS MQL	SAMPLE DURATION
0.720	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.388	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.920	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.248	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.888	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.634	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.361	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.098	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.512	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.690	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR

Source: National Ambient Volatile Organic Compounds Database

Summary of Specific Ambient Volatile
Organic Compounds for the State of Virginia

CAS NAME: 1,2-DIMETHYLBENZENE

CONCENTRATION PPB	SAMPLE METHOD	ANALYTICAL METHOD	SITE TYPE	CITY	STATE	NUMBER OF SAMPLES	NUMBER LESS MQL	SAMPLE DURATION
0.570	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.406	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.403	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.482	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.626	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.540	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.166	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.420	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.505	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.677	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.777	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.097	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.595	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.139	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR

Source: National Ambient Volatile Organic Compounds Database

Summary of Specific Ambient Volatile
Organic Compounds for the State of Virginia

CAS NAME: 1,2-DIMETHYLBENZENE

CONCENTRATION PPB	SAMPLE METHOD	ANALYTICAL METHOD	SITE TYPE	CITY	STATE	NUMBER OF SAMPLES	NUMBER LESS MQL	SAMPLE DURATION
0.502	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.300	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.740	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.904	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.649	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.571	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.767	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.623	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.451	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.843	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR

Source: National Ambient Volatile Organic Compounds Database

Summary of Specific Ambient Volatile
Organic Compounds for the State of Virginia

CAS NAME: 1,4-DICHLOROBENZENE

CONCENTRATION PPB	SAMPLE METHOD	ANALYTICAL METHOD	SITE TYPE	CITY	STATE	NUMBER OF SAMPLES	NUMBER LESS MQL	SAMPLE DURATION
0.000	ABSCART	GC/MS	UR	FRONT ROYAL	VA	8	8	DA
0.001	ABSCART	GC/MS	UR	FRONT ROYAL	VA	9	8	DA

Source: National Ambient Volatile Organic Compounds Database

Summary of Specific Ambient Volatile
Organic Compounds for the State of Virginia

CAS NAME: 1,4-DIMETHYLBENZENE

CONCENTRATION PPB	SAMPLE METHOD	ANALYTICAL METHOD	SITE TYPE	CITY	STATE	NUMBER OF SAMPLES	NUMBER LESS MQL	SAMPLE DURATION
1.491	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.055	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.097	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.285	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.867	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.574	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.380	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.077	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.441	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.831	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.653	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
3.475	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.380	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
3.208	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR

Source: National Ambient Volatile Organic Compounds Database

Summary of Specific Ambient Volatile
Organic Compounds for the State of Virginia

CAS NAME: 1,4-DIMETHYLBENZENE

CONCENTRATION PPB	SAMPLE METHOD	ANALYTICAL METHOD	SITE TYPE	CITY	STATE	NUMBER OF SAMPLES	NUMBER LESS MQL	SAMPLE DURATION
1.427	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.831	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.934	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
2.145	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.799	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.286	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
2.000	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.219	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.071	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
2.228	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR

Source: National Ambient Volatile Organic Compounds Database

Summary of Specific Ambient Volatile
Organic Compounds for the State of Virginia

CAS NAME: BENZENE

CONCENTRATION PPB	SAMPLE METHOD	ANALYTICAL METHOD	SITE TYPE	CITY	STATE	NUMBER OF SAMPLES	NUMBER LESS MQL	SAMPLE DURATION
1.257	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.802	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.937	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.173	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.668	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.317	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.428	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.940	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.967	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.518	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.582	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
2.092	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.348	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
3.090	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR

Source: National Ambient Volatile Organic Compounds Database

Summary of Specific Ambient Volatile
Organic Compounds for the State of Virginia

CAS NAME: BENZENE

CONCENTRATION PPB	SAMPLE METHOD	ANALYTICAL METHOD	SITE TYPE	CITY	STATE	NUMBER OF SAMPLES	NUMBER LESS MQL	SAMPLE DURATION
1.438	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.782	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.735	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.898	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.758	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.140	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.692	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.158	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.827	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.875	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR

Source: National Ambient Volatile Organic Compounds Database

Summary of Specific Ambient Volatile
Organic Compounds for the State of Virginia

CAS NAME: DICHLOROMETHANE

CONCENTRATION PPB	SAMPLE METHOD	ANALYTICAL METHOD	SITE TYPE	CITY	STATE	NUMBER OF SAMPLES	NUMBER LESS MQL	SAMPLE DURATION
3.982	ABSCART	GC/MS	UR	FRONT ROYAL	VA	8	1	DA
20.650	ABSCART	GC/MS	UR	FRONT ROYAL	VA	9	0	DA
0.486	ABSCART	GC/MS	UR	FRONT ROYAL	VA	9	3	DA

Source: National Ambient Volatile Organic Compounds Database

Summary of Specific Ambient Volatile
Organic Compounds for the State of Virginia

CAS NAME: ETHENYLBENZENE

CONCENTRATION PPB	SAMPLE METHOD	ANALYTICAL METHOD	SITE TYPE	CITY	STATE	NUMBER OF SAMPLES	NUMBER LESS MQL	SAMPLE DURATION
0.657	ABSCART	GCFIDFPD	SD	WAYNESBORO	VA	1	0	>DA
1.009	ABSCART	GCFIDFPD	SD	WAYNESBORO	VA	1	0	>DA
0.524	ABSCART	GCFIDFPD	SD	WAYNESBORO	VA	3	0	>DA
5.400	ABSCART	GCFIDFPD	SD	WAYNESBORO	VA	1	0	>DA
0.446	ABSCART	GCFIDFPD	SD	WAYNESBORO	VA	1	0	>DA
2.195	ABSCART	GCFIDFPD	SD	WAYNESBORO	VA	2	0	>DA

Source: National Ambient Volatile Organic Compounds Database

Summary of Specific Ambient Volatile
Organic Compounds for the State of Virginia

CAS NAME: ETHYLBENZENE

CONCENTRATION PPB	SAMPLE METHOD	ANALYTICAL METHOD	SITE TYPE	CITY	STATE	NUMBER OF SAMPLES	NUMBER LESS MQL	SAMPLE DURATION
0.494	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.335	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.362	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.416	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.613	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.495	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.135	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.366	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.427	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.555	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.492	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.854	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.405	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.993	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR

Source: National Ambient Volatile Organic Compounds Database

Summary of Specific Ambient Volatile
Organic Compounds for the State of Virginia

CAS NAME: ETHYLBENZENE

CONCENTRATION PPB	SAMPLE METHOD	ANALYTICAL METHOD	SITE TYPE	CITY	STATE	NUMBER OF SAMPLES	NUMBER LESS MQL	SAMPLE DURATION
0.436	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.245	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.585	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.670	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.556	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.380	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.584	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.365	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.285	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.666	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR

Source: National Ambient Volatile Organic Compounds Database

Summary of Specific Ambient Volatile
Organic Compounds for the State of Virginia

CAS NAME: METHYLBENZENE

CONCENTRATION PPB	SAMPLE METHOD	ANALYTICAL METHOD	SITE TYPE	CITY	STATE	NUMBER OF SAMPLES	NUMBER LESS MQL	SAMPLE DURATION
3.863	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.854	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
2.703	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
2.670	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
34.643	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
5.223	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
0.811	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
2.699	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
5.490	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
3.493	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
3.479	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
5.203	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
2.749	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
8.803	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR

Source: National Ambient Volatile Organic Compounds Database

Summary of Specific Ambient Volatile
Organic Compounds for the State of Virginia

CAS NAME: METHYLBENZENE

CONCENTRATION PPB	SAMPLE METHOD	ANALYTICAL METHOD	SITE TYPE	CITY	STATE	NUMBER OF SAMPLES	NUMBER LESS MQL	SAMPLE DURATION
3.151	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
1.814	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
4.617	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
5.443	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
4.454	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
2.877	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
13.306	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
2.776	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
4.617	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR
4.911	PRESSCAN	GCFIDFPD	UR	RICHMOND	VA	1	0	<HR

Source: National Ambient Volatile Organic Compounds Database

Summary of Specific Ambient Volatile
Organic Compounds for the State of Virginia

CAS NAME: TETRACHLOROETHENE

CONCENTRATION PPB	SAMPLE METHOD	ANALYTICAL METHOD	SITE TYPE	CITY	STATE	NUMBER OF SAMPLES	NUMBER LESS MQL	SAMPLE DURATION
0.005	ABSCART	GC/MS	UR	FRONT ROYAL	VA	8	3	DA
0.072	ABSCART	GC/MS	UR	FRONT ROYAL	VA	9	1	DA
0.000	ABSCART	GC/MS	UR	FRONT ROYAL	VA	9	9	DA

Source: National Ambient Volatile Organic Compounds Database

Summary of Specific Ambient Volatile
Organic Compounds for the State of Virginia

CAS NAME: TRICHLOROMETHANE

CONCENTRATION PPB	SAMPLE METHOD	ANALYTICAL METHOD	SITE TYPE	CITY	STATE	NUMBER OF SAMPLES	NUMBER LESS MQL	SAMPLE DURATION
0.146	ABSCART	GC/MS	UR	FRONT ROYAL	VA	8	2	DA
0.533	ABSCART	GC/MS	UR	FRONT ROYAL	VA	9	2	DA
0.003	ABSCART	GC/MS	UR	FRONT ROYAL	VA	9	8	DA

Source: National Ambient Volatile Organic Compounds Database

APPENDIX C

APPENDIX C
FEDERAL AND STATE LISTED ENDANGERED AND THREATENED SPECIES IN VIRGINIA

Virginia Department of Game and Inland Fisheries

Federal and State Listed Endangered & Threatened Species in Virginia*

Common Name	Scientific Name	Status[1]
FRESHWATER FISHES:		
Blackbanded sunfish	*Enneacanthus chaetodon*	SE
Carolina darter	*Etheostoma collis*	ST
Duskytail darter	*Etheostoma sp.*	SE
Emerald shiner	*Notropis atherinoides*	ST
Greenfin darter	*Etheostoma chlorobranchium*	ST
Longhead darter	*Percina macrocephala*	ST
Orangefin madtom	*Noturus gilberti*	ST
Paddlefish	*Polyodon spathula*	ST
Roanoke logperch	*Percina rex*	FE
Sharphead darter	*Etheostoma acuticeps*	SE
Shortnose sturgeon	*Acipenser brevirostrum*	FE
Slender chub	*Erimystax cahni*	FT
Steelcolor shiner	*Cyprinella whipplei*	ST
Tennessee dace	*Phoxinus tennesseensis*	SE
Tippecanoe darter	*Etheostoma tippecanoe*	ST
Turquoise shiner	*Cyprinella monacha*	FT
Variegate darter	*Etheostoma variatum*	SE
Western sand darter	*Ammocrypta clara*	ST
Whitemouth shiner	*Notropis alborus*	ST
Yellowfin madtom	*Noturus flavipinnis*	FT
AMPHIBIANS:		
	Frogs	
Barking treefrog	*Hyla gratiosa*	ST
	Salamanders	
Eastern tiger salamander	*Ambystoma tigrinum*	SE
Mabee's salamander	*Ambystoma mabeei*	ST
Shenandoah salamander	*Plethodon shenandoah*	FE
REPTILES:		
	Lizards	
Eastern glass lizard	*Ophisaurus ventralis*	ST
	Snakes	
Canebrake rattlesnake	*Crotalus horridus atricaudatus*	SE

[1] FE = Federal Endangered; FT = Federal Threatened; FC = Federal Candidate; SE = State Endangered; ST = State Threatened

* Effective January 1, 1992

Virginia Department of Game and Inland Fisheries

Federal and State Listed Endangered & Threatened Species in Virginia*

Common Name	Scientific Name	Status[1]
	Turtles	
Atlantic green sea turtle	*Chelonia mydas*	FT
Bog turtle	*Clemmys muhlenbergii*	SE
Eastern chicken turtle	*Deirochelys reticularia*	SE
Hawksbill sea turtle	*Eretmochelys imbricata*	FE
Kemp's Ridley sea turtle	*Lepidochelys kempi*	FE
Leatherback sea turtle	*Dermochelys coriacea*	FE
Loggerhead sea turtle	*Caretta caretta*	FT
Wood turtle	*Clemmys insculpta*	ST
BIRDS:		
Bachman's sparrow	*Aimophila aestivalis*	ST
Bald eagle	*Haliaeetus leucocephalus*	FE
Bewick's wren	*Thryomanes bewickii*	SE
Gull-billed tern	*Sterna nilotica*	ST
Henslow's sparrow	*Ammodramus henslowii*	ST
Loggerhead shrike	*Lanius ludovicianus*	ST
Peregrine falcon	*Falco peregrinus*	FE
Piping plover	*Charadrius melodus*	FT
Red-cockaded woodpecker	*Picoides borealis*	FE
Roseate tern	*Sterna dougallii*	FE
Upland sandpiper	*Bartramia longicauda*	ST
Wilson's plover	*Charadrius wilsonia*	SE
MAMMALS:		
Delmarva Peninsula fox squirrel	*Sciurus niger cinereus*	FE
Dismal Swamp southeastern shrew	*Sorex longirostris fisheri*	FT
Eastern big-eared bat	*Plecotus rafinesquii macrotis*	SE
Eastern cougar	*Felis concolor couguar*	FE
Gray bat	*Myotis grisescens*	FE
Indiana bat	*Myotis sodalis*	FE
Northern flying squirrel	*Glaucomys sabrinus*	FE
Rock vole	*Microtus chrotorrhinus*	SE
Snowshoe hare	*Lepus americanus*	SE
Virginia big-eared bat	*Plecotus townsendii virginianus*	FE
Water shrew	*Sorex palustris*	SE
MOLLUSKS:		
	Freshwater Mussels	
Appalachian monkeyface mussel	*Quadrula sparsa*	FE
Atlantic pigtoe mussel	*Fuscanaia masoni*	ST

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Virginia Department of Game and Inland Fisheries

Federal and State Listed Endangered & Threatened Species in Virginia*

Common Name	Scientific Name	Status[1]
Birdwing pearlymussel	*Lemiox rimosus*	FE
Black sandshell mussel	*Ligumia recta*	ST
Brook floater mussel	*Alasmidonta varicosa*	SE
Cracking pearlymussel	*Hemistena lata*	FE
Cumberland bean mussel	*Villosa trabalis*	FE
Cumberland combshell mussel	*Epioblasma brevidens*	SE
Cumberland monkeyface mussel	*Quadrula intermedia*	FE
Deertoe mussel	*Truncilla truncata*	SE
Dromedary pearlymussel	*Dromus dromas*	FE
Dwarf wedgemussel	*Alasmidonta heterodon*	FE
Elephant-ear mussel	*Elliptio crassidens*	SE
Fanshell mussel	*Cyprogenia stegaria (=irorata)*	FE
Fine-rayed pigtoe mussel	*Fusconaia cuneolus*	FE
Fragile papershell mussel	*Leptodea fragilis*	ST
Green blossom mussel	*Epioblasma torulosa gubernaculum*	FE
James spinymussel	*Pleurobema collina*	FE
Little-wing pearlymussel	*Pegias fabula*	FE
Ohio pigtoe mussel	*Pleurobema cordatum*	SE
Oyster mussel	*Epioblasma capsaeformis*	SE
Pimpleback mussel	*Quadrula pustulosa pustulosa*	ST
Pink mucket mussel	*Lampsilis abrupta (=orbiculata)*	FE
Pink pigtoe mussel	*Pleurobema rubrum*	SE
Purple bean mussel	*Villosa perpurpurea*	SE
Purple lilliput mussel	*Toxolasma lividus*	SE
Rough pigtoe mussel	*Pleurobema plenum*	FE
Rough rabbitsfoot mussel	*Quadrula cylindrica strigillata*	ST
Sheepnose mussel	*Plethobasus cyphyus*	ST
Shiny pigtoe mussel	*Fusconaia cor*	FE
Slabside pearlymussel	*Lexingtonia dolabelloides*	ST
Slippershell mussel	*Alasmidonta viridis*	SE
Snuffbox mussel	*Epioblasma triquetra*	SE
Spectaclecase mussel	*Cumberlandia monodonta*	SE
Tan riffleshell mussel	*Epioblasma florentina walkeri*	FE
Tennessee heelsplitter mussel	*Lasmigona holstonia*	SE

Freshwater and Land Snails

Brown supercoil	*Paravitrea septadens*	ST
Rubble coil	*Helicodiscus lirellus*	SE
Shaggy coil	*Helicodiscus diadema*	SE
Spiny riversnail	*Io fluvialis*	ST
Spirit supercoil	*Paravitrea hera*	SE
Unthanks cavesnail	*Holsingeria unthanksensis*	SE
Virginia coil	*Polygyriscus virginicus*	FE

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* Effective January 1, 1992

Virginia Department of Game and Inland Fisheries

Federal and State Listed Endangered & Threatened Species in Virginia*

Common Name	Scientific Name	Status[1]
FRESHWATER CRUSTACEANS:		
Madison Cave amphipod	*Stygobromus stegerorum*	SE
Madison Cave isopod	*Anrolina lira*	FT
MILLIPEDES:		
Ellett Valley pseudotremia	*Pseudotremia cavernarum*	ST
Laurel Creek xystodesmid	*Sigmoria whiteheadi*	ST
MARINE MAMMALS:		
Blue whale	*Balaenoptera musculus*	FE
Fin whale	*Baleanoptera physalus*	FE
Florida manatee	*Trichechus manatus*	FE
Humpback whale	*Megaptera novaeangliae*	FE
Northern right whale	*Eubalaena glacialis*	FE
Sei whale	*Balaenoptera borealis*	FE
Sperm whale	*Physeter catodon*	FE

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APPENDIX D

APPENDIX D
CHECKLISTS FOR FAUNA, FLORA, AND WILDLIFE

CAMP ALLEN AREA - DOCUMENTED WILDLIFE SPECIES

Species documented as occurring in and around the Camp Allen Areas A and B.

Birds (1)

Common Name	Scientific Name
Mallard	*Anas platyrhynchos*
Brown pelican	*Pelecanus occidentalis*
Glaucous gull	*Larus hyperboreus*
Herring gull	*Larus argentatus*
Common tern	*Sterna hirundo*
Great blue heron	*Ardea herodias*
Snowy egret	Egretta thula
Killdeer	Charadrius vociferus
Spotted sandpiper	Actitis macularia
Peregrine falcon (2),(3)	Falco peregrinus
Morning dove	Zenaida macroura
Common nighthawk	Chordeiles minor
Barn swallow	Hirundo rustica
American crow	Corvus brachyrhynchos
Blue jay	Cyanocitta cristata
White breasted nuthatch	Sitta carolinensis
Northern mockingbird	Mimus polyglottos
American robin	Turdus migratorius
Prothonotary warbler	Protonotaria citrea
Pine warbler	Dendroica pinus
Red winged blackbird	Agelaius phoeniceus
Common grackle	Quiscalus quiscula
European starling	Sturnus vulgaris
House sparrow	Passer domesticus
Northern cardinal	Cardinalis
Indigo bunting	Passerina cyanea
Chipping sparrow	Spizella passerina

Reptiles and Amphibians (1)

Snapping turtle	Chelydra serpentina
Stinkpot	Sternotherus odoratus
Eastern mud turtle	Kinosternon subrubrum
Eastern cottonmouth (4)	Agkistrodon piscivorus
Northern copperhead (4)	Agkistrodon contortrix mokasen
Southern copperhead (4)	Agkistrodon contortrix

Mammals (1)

Red fox	Vulpes fulva
Raccoon	Procyon lotor
Eastern chipmunk	Tamias striatus
Eastern gray squirrel	Sciurus carolinensis
Eastern cottontail	Sylvilagus floridanus

Aquatic

Fish

Mosquitofish	Gambusia affinis

Invertebrates

Crustaceans

Fiddler crab (5)	Uca minax

Botanical

Plants

Cyperus sp.	Meadow foxtail
Large salt marsh aster	Broomsedge
Soft-stem rush	Smartweed
Phragmites	Black cherry
Smooth paspalum	Asiatic dayflower
Saltmarsh fleabane	Sweetgum
Marsh foxtail	Willow
Purple top sedge	False nettle
Goldenrod sp.	Hydrocotyle
American threesquare	English platain
Poison ivy	Dwarf spikerush
Japanese honeysuckle	Dock
Smooth sumac	Groundsel tree

(1) All species identified in the Camp Allen area were supplemented with the aid of Peterson Field Guides (Peterson, 1980), (Conant, 1975), and (Burt/Grossenheider, 1976).

(2) Species identified through conversations with Navy personnel.

(3) Species has been identified by both the United States Fish and Wildlife Service and the Virginia Department of Game and Inland Fisheries as being a Federally Endangered species.

(4) Species identified through discussions with Navy personnel.

(5) Note, Fiddler crab identification was based on visual observation compared with anatomical and color identification markings utilizing the Guide to Identification of Marine and Esturine Invertebrates (Gosner, 1971).

NATIVE AND NATURALIZED FAUNA OF VIRGINIA

Virginia Department of Game and Inland Fisheries

1991 Official Listing of Native and Naturalized Fauna of Virginia

Common Name	Scientific Name	Status[1]
FRESHWATER FISHES:		
Alewife	*Alosa pseudoharengus*	
American brook lamprey	*Lampetra appendix*	H
American eel	*Anguilla rostrata*	
American shad	*Alosa sapidissima*	
Appalachia darter	*Percina gymnocephala*	
Ashy darter	*Etheostoma cinereum*	H
Atlantic sturgeon	*Acipenser oxyrhynchus*	SSC
Banded darter	*Etheostoma zonale*	H
Banded killifish	*Fundulus diaphanus*	
* Banded pygmy sunfish	*Elassoma zonatum*	
Banded sculpin	*Cottus carolinae*	H
* Banded sunfish	*Ennaecanthus obesus*	
* Bigeye chub	*Notropis amblops*	
Bigeye jumprock	*Moxostoma ariommum*	H
* Bigmouth chub	*Nocomis platyrhynchus*	H
Black bullhead	*Ameiurus melas*	
* Black crappie	*Pomoxis nigromaculatus*	
Black jumprock	*Moxostoma cervinum*	
Black redhorse	*Moxostoma duquesnei*	H
Black sculpin	*Cottus baileyi*	H
Blackbanded sunfish	*Enneacanthus chaetodon*	SE
* Blacknose dace	*Rhinichthys atratulus*	
Blackside darter	*Percina maculata*	H
* Blotched chub	*Erimystax insignis*	H
Blotchside logperch	*Percina burtoni*	SSC
Blue catfish	*Ictalurus furcatus*	
Blueback herring	*Alosa aestivalis*	
Bluebreast darter	*Etheostoma camurum*	SSC
* Bluegill	*Lepomis macrochirus*	
* Bluehead chub	*Nocomis leptocephalus*	
Blueside darter	*Etheostoma jessiae*	
* Bluespotted sunfish	*Enneacanthus gloriosus*	
Bluestone sculpin	*Cottus (undescribed)*	
* Bluntnose minnow	*Pimephales notatus*	
Bowfin	*Amia calva*	
* Bridle shiner	*Notropis bifrenatus*	SSC
Brook silverside	*Labidesthes sicculus*	SSC
* Brook trout	*Salvelinus fontinalis*	
Brown bullhead	*Ameiurus nebulosus*	
* Brown trout	*Salmo trutta*	
* Bull chub	*Nocomis raneyi*	
* Bullhead minnow	*Pimephales vigilax*	H
Candy darter	*Etheostoma osburni*	SSC
Carolina darter	*Etheostoma collis*	ST
Central stoneroller	*Campostoma anomalum*	

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Virginia Department of Game and Inland Fisheries

1991 Official Listing of Native and Naturalized Fauna of Virginia

Common Name	Scientific Name	Status[1]
* Chain pickerel	*Esox niger*	
* Channel catfish	*Ictalurus punctatus*	
Channel darter	*Percina copelandi*	SSC
* Comely shiner	*Notropis amoenus*	
* Common carp	*Cyprinus carpio*	
* Common shiner	*Luxilus cornutus*	
* Creek chub	*Semotilus atromaculatus*	
Creek chubsucker	*Erimyzon oblongus*	
* Crescent shiner	*Luxilus cerasinus*	
* Cutlips minnow	*Exoglossum maxillingua*	
* Dollar sunfish	*Lepomis marginatus*	
Dusky darter	*Percina sciera*	H
Duskytail darter	*Etheostoma sp.*	SE
Eastern mosquitofish	*Gambusia holbrooki*	
Eastern mudminnow	*Umbra pygmaea*	
* Eastern silvery minnow	*Hybognathus regius*	
Emerald shiner	*Notropis atherinoides*	ST
* Fallfish	*Semotilus corporalis*	
Fantail darter	*Etheostoma flabellare*	
* Fathead minnow	*Pimephales promelas*	
* Fatlips minnow	*Phenacobius crasislabrum*	SSC
* Fieryblack shiner	*Cyprinella pyrrhomelas*	
Flat bullhead	*Ameiurus platycephalus*	H
Flathead catfish	*Pylodictis olivaris*	
Flier	*Centrarchus macropterus*	
Fourspine stickleback	*Apeltes quadracus*	
Freshwater drum	*Aplodinotus grunniens*	H
Gilt darter	*Percina evides*	H
Gizzard shad	*Dorosoma cepedianum*	
Glassy darter	*Etheostoma vitreum*	
Golden redhorse	*Moxostoma erythrurum*	
* Golden shiner	*Notemigonus crysoleucas*	
* Goldfish	*Carassius auratus*	
* Green sunfish	*Lepomis cyanellus*	
Greenfin darter	*Etheostoma chlorobranchium*	ST
Greenside darter	*Etheostoma blennioides*	
Harelip sucker	*Lagochila lacera*	
Hickory shad	*Alosa mediocris*	H
* Highback chub	*Hybopsis hypsinotus*	H
* Highfin shiner	*Notropis altipinnis*	H
Hogchoker	*Trinectes maculatus*	
Inland silverside	*Menidia beryllina*	
* Ironcolor shiner	*Notropis chalybaeus*	H
Johnny darter	*Etheostoma nigrum*	
Kanawha darter	*Etheostoma kanawhae*	H
* Kanawha minnow	*Phenacobius teretulus*	FC
Lake chubsucker	*Erimyzon sucetta*	H
* Largemouth bass	*Micropterus salmoides*	

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Virginia Department of Game and Inland Fisheries

1991 Official Listing of Native and Naturalized Fauna of Virginia

Common Name	Scientific Name	Status[1]
Least brook lamprey	*Lampetra aepyptera*	H
Lined topminnow	*Fundulus lineolatus*	H
* Longear sunfish	*Lepomis megalotis*	
Longfin darter	*Etheostoma longimanum*	H
Longhead darter	*Percina macrocephala*	ST
* Longnose dace	*Rhinichthys cataractae*	
Longnose gar	*Lepisosteus osseus*	
Margined madtom	*Noturus insignis*	
* Mimic shiner	*Notropis volucellus*	
* Mirror shiner	*Notropis spectrunculis*	H
Mottled sculpin	*Cottus bairdi*	
Mountain brook lamprey	*Ichthyomyzon greeleyi*	H
Mountain madtom	*Noturus eleutherus*	H
* Mountain redbelly dace	*Phoxinus oreas*	
* Mountain shiner	*Lythrurus lirus*	H
* Mud sunfish	*Acantharchus pomotis*	H
* Muskellunge	*Esox masquinongy*	
* New River shiner	*Notropis scabriceps*	
Northern hogsucker	*Hypentelium nigricans*	
Northern logperch	*Percina caprodes semifasciata*	
* Northern pike	*Esox lucius*	
Northern studfish	*Fundulus catenatus*	H
Ohio lamprey	*Ichthyomyzon bdellium*	H
Olive darter	*Percina squamata*	
Orangefin madtom	*Noturus gilberti*	ST
Orangethroat darter	*Etheostoma spectabile*	
Paddlefish	*Polyodon spathula*	ST
* Pearl dace	*Margaricus margarita*	H
Piedmont darter	*Percina crassa*	H
Pirate perch	*Aphredoderus sayanus*	
* Popeye shiner	*Notropis ariommus*	SSC
Potomac sculpin	*Cottus girardi*	H
* Pumpkinseed	*Lepomis gibbosus*	
Quillback	*Carpiodes cyprinus*	
Rainbow darter	*Etheostoma caeruleum*	H
* Rainbow trout	*Parasalmo mykiss*	
* Redbreast sunfish	*Lepomis auritus*	
* Redear sunfish	*Lepomis microlophus*	
Redfin pickerel	*Esox americanus*	
Redline darter	*Etheostoma rufilineatum*	H
* Redlip shiner	*Notropis chiliticus*	H
River carpsucker	*Carpiodes cyprinus*	
* River chub	*Nocomis micropogon*	
River redhorse	*Moxostoma carinatum*	SSC
Riverweed darter	*Etheostoma podostemone*	H
* Roanoke bass	*Ambloplites cavifrons*	SSC
Roanoke darter	*Percina roanoka*	H
Roanoke hogsucker	*Hypentelium roanokense*	H

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Common Name	Scientific Name	Status[1]
Roanoke logperch	*Percina rex*	FE
* Rock bass	*Ambloplites rupestris*	
* Rosefin shiner	*Lythrurus ardens*	
* Rosyface shiner	*Notropis rubellus*	
* Rosyside dace	*Clinostomus funduloides*	
Roughhead shiner	*Notropis semperasper*	SSC
Rustyside sucker	*Moxostoma hamiltoni*	SSC
* Saffron shiner	*Notropis rubricroceus*	H
* Sand shiner	*Notropis stramineus*	H
* Sandbar shiner	*Notropis scepticus*	
* Satinfin shiner	*Cyprinella analostana*	
Sauger	*Stizostedion canadense*	SSC
Sawcheek darter	*Etheostoma serrifer*	H
Sea lamprey	*Petromyzon marinus*	
Sharphead darter	*Etheostoma acuticeps*	SE
Sharpnose darter	*Percina oxyrhyncha*	H
* Sheepshead minnow	*Cyprinodon variegatus*	
Shield darter	*Percina peltata*	
Shorthead redhorse	*Moxostoma macrolepidotum*	
Shortnose sturgeon	*Acipenser brevirostrum*	FE
Silver redhorse	*Moxostoma anisurum*	
* Silver shiner	*Notropis photogenis*	
* Silverjaw minnow	*Ericymba buccata*	H
Slender chub	*Erimystax cahni*	FT
Slimy sculpin	*Cottus cognatus*	H
Smallfin redhorse	*Moxostoma robustum*	H
* Smallmouth bass	*Micropterus dolomieui*	
Snail bullhead	*Ameirus brunneus*	H
Snubnose darter	*Etheostoma simorteum*	
* Southern redbelly dace	*Phoxinus erythrogaster*	
* Speckled chub	*Macrhybosis aestivalis*	
Speckled darter	*Etheostoma stigmaeum*	H
Speckled killifish	*Fundulus rathbuni*	SSC
* Spotfin shiner	*Cyprinella spiloptera*	
* Spottail shiner	*Notropis hudsonius*	
Spotted bass	*Micropterus punctulatus*	H
Spotted darter	*Etheostoma maculatum*	H
* Stargazing minnow	*Phenacobius uranops*	H
Steelcolor shiner	*Cyprinella whipplei*	ST
Stonecat	*Noturus flavus*	SSC
* Streamline chub	*Erimystax dissimilis*	H
Stripeback darter	*Percina notogramma*	
* Striped bass	*Morone saxatilis*	
* Striped shiner	*Luxilus chrysocephalus*	H
Stripetail darter	*Etheostoma kennicotti*	
* Suckermouth minnow	*Phenacobius mirabilis*	H
Suckermouth redhorse	*Moxostoma papillosum*	
* Swallowtail shiner	*Notropis procne*	

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Virginia Department of Game and Inland Fisheries

1991 Official Listing of Native and Naturalized Fauna of Virginia

Common Name	Scientific Name	Status[1]
Swamp darter	*Etheostoma fusiforme*	
Swampfish	*Chologaster cornuta*	H
Swannanoa darter	*Etheostoma swannanoa*	H
Tadpole madtom	*Noturus gyrinus*	
Tangerine darter	*Percina aurantiaca*	H
* Telescope shiner	*Notropis telescopus*	
Tennessee dace	*Phoxinus tennesseensis*	SE
* Tennessee shiner	*Notropis leucoides*	
Tennessee snubnose darter	*Etheostoma simoterum*	H
Tessellated darter	*Etheostoma olmstedi*	
* Thicklip chub	*Cyprinella labrosa*	H
Threadfin shad	*Dorosoma petenensis*	
Threespine stickleback	*Gasterosteus aculeatus*	
Tippecanoe darter	*Etheostoma tippecanoe*	ST
* Tonguetied minnow	*Exoglossum laurae*	
Torrent sucker	*Moxostoma rhothoecum*	
Trout-perch	*Percopsis omiscomaycus*	H
Turquoise shiner	*Cyprinella monacha*	FT
Variegate darter	*Etheostoma variatum*	SE
* Walleye	*Stizostedion vitreum vitreum*	
* Warmouth	*Lepomis gulosus*	
* Warpaint shiner	*Luxilus coccogenis*	H
Western sand darter	*Ammocrypta clara*	ST
* White bass	*Morone chrysops*	H
White catfish	*Ameiurus catus*	
* White crappie	*Pomoxis annularis*	
White perch	*Morone americana*	
* White shiner	*Luxilus albeolus*	
White sucker	*Catostomus commersoni*	
* Whitefin shiner	*Cyprinella niveus*	
Whitemouth shiner	*Notropis alborus*	ST
* Whitetail shiner	*Notropis galacturus*	H
Wounded darter	*Etheostoma vulneratum*	
Yellow bullhead	*Ameiurus natalis*	
Yellow perch	*Perca flavescens*	
Yellowfin madtom	*Noturus flavipinnis*	FT

AMPHIBIANS:

Frogs

American toad	*Bufo americanus americanus*	
Barking treefrog	*Hyla gratiosa*	ST
Brimley's chorus frog	*Pseudacris brimleyi*	
Bullfrog	*Rana catesbeiana*	
Carpenter frog	*Rana virgatipes*	SSC
Cope's gray treefrog	*Hyla chrysoscelis*	

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Eastern narrowmouth toad	*Gastrophryne carolinensis*	
Eastern spadefoot toad	*Scaphiopus holbrooki holbrooki*	
Fowler's toad	*Bufo woodhousii fowleri*	
Gray treefrog	*Hyla versicolor*	
Green frog	*Rana clamitans melinota*	
Green treefrog	*Hyla cinerea*	
Little grass frog	*Limnaoedus ocularis*	H
Mountain chorus frog	*Pseudacris brachyphona*	
New Jersey chorus frog	*Pseudacris triseriata kalmi*	
Northern cricket frog	*Acris crepitans crepitans*	
Northern spring peeper	*Hyla crucifer crucifer*	
Oak toad	*Bufo quercicus*	SSC
Pickerel frog	*Rana palustris*	
Pine woods treefrog	*Hyla femoralis*	
Southern cricket frog	*Acris gryllus gryllus*	
Southern leopard frog	*Rana utricularia (=sphenocephala)*	
Southern toad	*Bufo terrestris*	
Squirrel treefrog	*Hyla squirrela*	
Upland chorus frog	*Pseudacris triseriata feriarum*	
Wood frog	*Rana sylvatica*	
	Salamanders	
Appalachian seal salamander	*Desmognathus monticola monticola*	
Atlantic Coastal Slimy salamander	*Plethodon chlorobryonis*	
Blackbelly salamander	*Desmognathus quadramaculatus*	
Blue Ridge red salamander	*Pseudotriton ruber nitidus*	
Blue Ridge spring salamander	*Gyrinophilus porphyritirus danielsi*	
Blue Ridge two-lined salamander	*Eurycea wilderae*	
Cave salamander	*Eurycea lucifuga*	
Cow Knob salamander	*Plethodon punctatus*	SSC
Cumberland Plateau salamander	*Plethodon kentucki*	
Cumberland salamander	*Desmognathus welteri*	H
Dwarf waterdog (or "waterdog")	*Necturus punctatus*	H
Eastern hellbender	*Cryptobranchus alleganiensis alleganiensis*	SSC
Eastern mud salamander	*Pseudotriton montanus montanus*	
Eastern tiger salamander (larvae commonly sold as "waterdogs" or "mudpuppies")	*Ambystoma tigrinum tigrinum*	SE
Four-toed salamander	*Hemidactylium scutatum*	
Greater siren (commonly sold as "Congo eel")	*Siren lacertina*	H
Green salamander	*Aneides aeneus*	H
Jefferson salamander	*Ambystoma jeffersonianum*	
Jordan's salamander	*Plethodon jordani*	
Kentucky spring salamander	*Gyrinophilus porphyriticus duryi*	
Lesser siren (commonly sold as "Congo eel")	*Siren intermedia intermedia*	H

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Longtail salamander	*Eurycea longicauda longicauda*	
Mabee's salamander	*Ambystoma mabeei*	ST
Many-lined salamander	*Stereochilus marginatus*	H
Marbled salamander	*Ambystoma opacum*	
Midland mud salamander	*Pseudotriton montanus diastictus*	
Mole salamander	*Ambystoma talpoideum*	SSC
Mountain dusky salamander	*Desmognathus ochrophaeus*	
Mudpuppy (often called "waterdogs")	*Necturus maculosus maculosus*	FC
Northern dusky salamander	*Desmognathus fuscus fuscus*	
Northern red salamander	*Pseudotriton ruber ruber*	
Northern slimy salamander	*Plethodon glutinosus*	
Northern spring salamander	*Gyrinophilus porphyriticus porphyriticus*	
Northern two-lined salamander	*Eurycea bislineata*	
Peaks of Otter salamander	*Plethodon hubrichti*	SSC
Pigmy salamander	*Desmognathus wrighti*	SSC
Ravine salamander	*Plethodon richmondi*	
Red-spotted newt	*Notophthalmus viridescens viridescens*	
Redback salamander	*Plethodon cinereus*	
Shenandoah salamander	*Plethodon shenandoah*	FE
Shovelnose salamander	*Leurognathus marmoratus*	SSC
Southern dusky salamander	*Desmognathus auriculatus*	
Southern two-lined salamander	*Eurycea cirrigera*	
Spotbelly salamander	*Plethodon welleri ventromaculatus*	SSC
Spotted salamander	*Ambystoma maculatum*	
Three-lined salamander	*Eurycea longicauda guttolineata*	
Two-toed amphiuma (commonly called "Congo eel")	*Amphiuma means*	
Valley and ridge salamander	*Plethodon hoffmani*	
Virginia seal salamander	*Desmognathus monticola jeffersoni*	
Wehrle's salamander	*Plethodon wehrlei*	
White-spotted slimy salamander	*Plethodon cylindraceus*	
Yonahlossee salamander	*Plethodon yonahlossee*	H
Zigzag salamander	*Plethodon dorsalis*	H

REPTILES:

Lizards

Broadhead skink	*Eumeces laticeps*	
Coal skink	*Eumeces anthracinus anthracinus*	H
Eastern glass lizard	*Ophisaurus ventralis*	ST
Eastern slender glass lizard	*Ophisaurus attenuatus longicaudus*	
Five-lined skink	*Eumeces fasciatus*	
Ground skink	*Scincella lateralis*	
Northern fence lizard	*Sceloporus undulatus hyacinthinus*	
Six-lined racerunner	*Cnemidophorous sexlineatus sexlineatus*	

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Southeastern five-lined skink	*Eumeces inexpectatus*	
	Snakes	
Barrier Island green snake	*Opheodrys aestivus conanti*	H
Black kingsnake	*Lampropeltis getula nigra*	H
Black rat snake	*Elaphe obsoleta obsoleta*	
Brown water snake	*Nerodia taxispilota*	
Canebrake rattlesnake	*Crotalus horrides atricaudatus*	SE
Corn snake	*Elaphe guttata guttata*	
Eastern cottonmouth	*Agkistrodon piscivorus piscivorus*	
Eastern earth snake	*Virginia valeriae*	
Eastern garter snake	*Thamnophis sirtalis sirtalis*	
Eastern glossy water snake	*Regina rigida rigida*	H
Eastern hognose snake	*Heterodon platirhinos*	
Eastern kingsnake	*Lampropeltis getula getula*	
Eastern milk snake	*Lampropeltis triangulum triangulum*	
Eastern mud snake	*Farancia abacura abacura*	
Eastern ribbon snake	*Thamnophis sauritus sauritus*	
Eastern smooth green snake	*Opheodrys vernalis vernalis*	H
Eastern worm snake	*Carphophis amoenus amoenus*	
Midland water snake	*Nerodia sipedon pleuralis*	
Mole kingsnake	*Lampropeltis calligaster rhombomaculata*	
Mountain earth snake	*Virginia valeriae pulchra*	SSC
Northern black racer	*Coluber constrictor constrictor*	
Northern brown snake	*Storeria dekayi dekayi*	
Northern copperhead	*Agkistrodon contortrix mokason*	
Northern pine snake	*Pituophis melanoleucus melanoleucus*	FC
Northern red-belly snake	*Storeria occipitomaculata occipitomaculata*	
Northern ringneck snake	*Diadophis punctatus edwardsii*	
Northern water snake	*Nerodia sipedon sipedon*	
Queen snake	*Regina septemvittata septemvittata*	
Rainbow snake	*Farancia erytrogramma erytrogramma*	
Red-belly water snake	*Nerodia erythrogaster erythrogaster*	
Rough earth snake	*Virginia striatula*	
Rough green snake	*Opheodrys aestivus aestivus*	
Scarlet kingsnake	*Lampropeltis triangulum elapsoides*	
Scarlet snake	*Cemophora coccinea*	
Southeastern crowned snake	*Tantilla coronata*	H
Southern copperhead	*Agkistrodon contortrix contortrix*	
Southern ringneck snake	*Diadophis punctatus punctatus*	
Timber rattlesnake	*Crotalus horrides horridus*	
	Turtles	
Atlantic green sea turtle	*Chelonia mydas mydas*	FT
Bog turtle	*Clemmys muhlenbergii*	SE

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* Common snapping turtle	*Chelydra serpentina serpentina*	
Cumberland slider	*Trachemys scripta troosti*	H
Eastern box turtle	*Terrapene carolina carolina*	
Eastern chicken turtle	*Deirochelys reticularia reticularia*	SE
Eastern mud turtle	*Kinosternon subrubrum subrubrum*	
Eastern painted turtle	*Chrysemys picta picta*	
Eastern spiny softshell turtle	*Trionyx (=Apalone) spinifera spinifera*	H
Hawksbill sea turtle	*Eretmochelys imbricata*	FE
Hieroglyphic turtle	*Pseudemys concinna hieroglyphica*	H
Kemp's Ridley sea turtle	*Lepidochelys kempi*	FE
Leatherback sea turtle	*Dermochelys coriacea coriacea*	FE
Loggerhead sea turtle	*Caretta caretta caretta*	FT
Map turtle	*Graptemys geographica*	H
Midland painted turtle	*Chrysemys picta marginata*	
Northern diamondback terrapin	*Malaclemys terrapin terrapin*	
Red-eared slider	*Trachemys scripta elegans*	
Redbelly turtle	*Pseudemys rubriventris*	
River cooter	*Pseudemys concinna*	
Spotted turtle	*Clemmys guttata*	
Stinkpot (=common musk turtle)	*Sternotherus odoratus*	
Striped mud turtle	*Kinosternon bauri*	
Stripeneck musk turtle	*Sternotherus minor peltifer*	
Wood turtle	*Clemmys insculpta*	ST
Yellowbelly slider	*Trachemys scripta scripta*	

BIRDS:

Acadian flycatcher	*Empidonax virescens*	
Alder flycatcher	*Empidonax alnorum*	SSC
American avocet	*Recurvirostra americana*	
American bittern	*Botaurus lentiginosus*	H
American black duck	*Anas rubripes*	
American coot	*Fulica americana*	H
American crow	*Corvus brachyrhynchos*	
American goldfinch	*Carduelis tristis*	
American kestrel	*Falco sparverius sparverius*	
American oystercatcher	*Haematopus palliatus*	
American redstart	*Setophaga ruticilla*	
American robin	*Turdus migratorius*	
American swallow-tailed kite	*Elanoides forficatus forficatus*	
American tree sparrow	*Spizella arborea*	
American white pelican	*Pelecanus erythrorhynchos*	
American wigeon	*Anas americana*	
American woodcock	*Scolopax minor*	
Anhinga	*Anhinga anhinga*	
Appalachian Bewick's wren	*Thryomanes bewickii altus*	SE
Arctic loon	*Gavia arctica*	

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Arctic peregrine falcon	*Falco peregrinus tundrius*	
Arctic tern	*Sterna paradisaea*	
Audubon's shearwater	*Puffinus lherminieri lherminiere*	
Bachman's sparrow	*Aimophila aestivalis*	ST
Bachman's warbler	*Vermivora bachmanii*	FE
Baird's sandpiper	*Calidris bairdii*	
Bald eagle	*Haliaeetus leucocephalus leucocephalis*	FE
Bank swallow	*Riparia riparia*	
Barn swallow	*Hirundo rustica*	
Barred owl	*Strix varia*	
Bay-breasted warbler	*Dendroica castanea*	
Belted kingfisher	*Ceryle alcyon*	
Black-and-white warbler	*Mniotilta varia*	
Black-bellied plover	*Pluvialis squatarola*	
Black-billed cuckoo	*Coccyzus erythropthalmus*	
Black-capped chickadee	*Parus atricapillus*	
Black-capped petrel	*Pterodroma hasitata*	
Black-crowned night-heron	*Nycticorax nycticorax hoactii*	H
Black-headed grosbeak	*Pheucticus melanocephalus*	
Black-legged kittiwake	*Rissa tridactyla*	
Black-necked stilt	*Himantopus mexicanus*	H
Black rail	*Laterallus jamaicensis*	H
Black scoter	*Melanitta nigra americana*	
Black skimmer	*Rynchops niger*	H
Black tern	*Chlidonias niger*	
Black-throated blue warbler	*Dendroica caerulescens*	
Black-throated green warbler	*Dendroica virens waynei*	
Black vulture	*Coragyps atratus*	
Blackburnian warbler	*Dendroica fusca*	H
Blackpoll warbler	*Dendroica striata*	
Blue-gray gnatcatcher	*Polioptila caerulea*	
Blue grosbeak	*Guiraca caerulea caerulea*	
Blue jay	*Cyanocitta cristata*	
Blue-winged teal	*Anas discors orphna*	H
Blue-winged warbler	*Vermivora pinus*	
Boat-tailed grackle	*Quiscalus major*	
Bobolink	*Dolichonyx oryzivorus*	H
Bonaparte's gull	*Larus philadelphia*	
Brant	*Branta bernicla brota*	
Brewer's blackbird	*Euphagus cyanocephalus*	
Bridled tern	*Sterna anaethetus*	
Broad-winged hawk	*Buteo platypterus*	
Brown creeper	*Certhia americana*	SSC
Brown-headed cowbird	*Molothrus ater*	
Brown-headed nuthatch	*Sitta pusilla*	
Brown pelican	*Pelecanus occidentalis carolinensis*	SSC
Brown thrasher	*Toxostoma rufum*	
Buff-breasted sandpiper	*Tryngites subruficollis*	

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Bufflehead	*Bucephala albeola*	
Canada goose	*Branta canadensis*	
Canada warbler	*Wilsonia canadensis*	
Canvasback	*Aythya valisineria*	
Cape May warbler	*Dendroica tigrina*	
Carolina chickadee	*Parus carolinensis*	
Carolina wren	*Thryothorus ludovicianus*	
Caspian tern	*Sterna caspia*	SSC
Cattle egret	*Bubulcus ibis*	
Cedar waxwing	*Bombycilla cedrorum*	
Cerulean warbler	*Dendroica cerulea*	
Chestnut-sided warbler	*Dendroica pensylvanica*	
Chimney swift	*Chaetura pelagica*	
Chipping sparrow	*Spizella passerina*	
Chuck-will's-widow	*Caprimulgus carolinensis*	
Clapper rail	*Rallus longirostris crepitans*	
Clay-colored sparrow	*Spizella pallida*	
Cliff swallow	*Hirundo pyrrhonota pyrrhonota*	
Common barn-owl	*Tyto alba pratincola*	SSC
Common black-headed gull	*Larus ridibundus*	
Common eider	*Somateria mollissima*	
Common goldeneye	*Bucephala clangula americana*	
Common grackle	*Quiscalus quiscula*	
Common ground dove	*Columbina passerina*	
Common loon	*Gavia immer*	
Common merganser	*Mergus merganser americanus*	H
Common moorhen	*Gallinula chloropus cachinnans*	SSC
Common nighthawk	*Chordeiles minor*	
Common raven	*Corvus corax*	
Common redpoll	*Carduelis flammea*	
Common snipe	*Gallinago gallinago*	
Common tern	*Sterna hirundo*	H
Common yellowthroat	*Geothlypis trichas brachidactylus*	
Connecticut warbler	*Oporornis agilis*	
Cooper's hawk	*Accipiter cooperii*	H
Cory's shearwater	*Calonectris diomedea borealis*	
Curlew sandpiper	*Calidris ferruginea*	
Dark-eyed junco	*Junco hyemalis*	
Dickcissel	*Spiza americana*	SSC
Double-crested cormorant	*Phalacrocorax auritus floridanus*	H
Dovekie	*Alle alle*	
Downy woodpecker	*Picoides pubescens medianus*	
Dunlin	*Calidris alpina hudsonia*	
Eared grebe	*Podiceps nigricollis*	
Eastern bluebird	*Sialia sialis*	
Eastern kingbird	*Tyrannus tyrannus*	
Eastern meadowlark	*Sturnella magna*	
Eastern phoebe	*Sayornis phoebe*	

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Eastern screech-owl	*Otus asio*	
Eastern wood pewee	*Contopus virens*	
Eurasian wigeon	*Anas penelope*	
European starling	*Sturnus vulgaris*	
Evening grosbeak	*Coccothaustes vespertinus*	
Field sparrow	*Spizella pusilla*	
Fish crow	*Corvus ossifragus*	
Forster's tern	*Sterna forsteri*	SSC
Fox sparrow	*Passerella iliaca*	
Franklin's gull	*Larus pipixcan*	
Fulvous whistling duck	*Dendrocygna bicolor*	
Gadwall	*Anas strepera*	H
Glaucous gull	*Larus hyperboreus*	
Glossy ibis	*Plegadis falcinellus*	SSC
Golden-crowned kinglet	*Regulus satrapa*	SSC
Golden eagle	*Aquila chrysaetos*	H
Golden-winged warbler	*Vermivora chrysoptera*	SSC
Grasshopper sparrow	*Ammodramus savannarum pratensis*	
Gray catbird	*Dumetella carolinensis*	
Gray-cheeked thrush	*Catharus minimus*	
Great black-backed gull	*Larus marinus*	
Great blue heron	*Ardea herodias herodias*	H
Great cormorant	*Phalacrocorax carbo*	
Great crested flycatcher	*Myiarchus crinitus*	
Great egret	*Casmerodius albus egretta*	SSC
Great horned owl	*Bubo virginianus*	
Great skua	*Catharacta skua*	
Greater flamingo	*Phoenicopterus ruber*	
Greater scaup	*Aythya marila*	
Greater shearwater	*Puffinus gravis*	
Greater snow goose	*Chen caerulescens atlanticus*	
Greater white-fronted goose	*Anser albifrons flavirostris*	
Greater yellowlegs	*Tringa melanoleuca*	
Green-backed heron	*Butorides striatus virescens*	
Green-winged teal	*Anas crecca carolinensis*	H
Gull-billed tern	*Sterna nilotica aranea*	ST
Hairy woodpecker	*Picoides villosus*	
Harlequin duck	*Histrionicus histrionicus*	
Harris' sparrow	*Zonotrichia querula*	
Henslow's sparrow	*Ammodramus henslowii susurrans*	ST
Hermit thrush	*Catharus guttatus*	SSC
Herring gull	*Larus argentatus*	
Hooded merganser	*Lophodytes cucullatus*	
Hooded warbler	*Wilsonia citrina*	
Horned grebe	*Podiceps auritus*	
Horned lark	*Eremophila alpestris*	H
House finch	*Carpodacus mexicanus*	
House sparrow	*Passer domesticus*	

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House wren	*Troglodytes aedon*	
Hudsonian godwit	*Limosa haemastica*	
Iceland gull	*Larus glaucoides*	
Indigo bunting	*Passerina cyanea*	
Kentucky warbler	*Oporornis formosus*	
Killdeer	*Charadrius vociferus*	
King eider	*Somateria spectabilis*	
King rail	*Rallus elegans*	H
Kirtland's warbler	*Dendroica kirtlandii*	FE
Lark bunting	*Calamospiza melanocorys*	H
Lark sparrow	*Chondestes grammacus*	
Laughing gull	*Larus atricilla*	
Leach's storm-petrel	*Oceanodroma leucorhoa*	
Least bittern	*Ixobrychus exilis exilis*	H
Least flycatcher	*Empidonax minimus*	
Least sandpiper	*Calidris minutilla*	
Least tern	*Sterna antillarum*	SSC
LeConte's sparrow	*Ammodramus leconteii*	
Lesser black-backed gull	*Larus fuscus*	
Lesser-golden plover	*Pluvialis dominica*	
Lesser scaup	*Aythya affinis*	
Lesser snow goose	*Chen caerulescens caerulescens*	
Lesser yellowlegs	*Tringa flavipes*	
Lincoln's sparrow	*Melospiza lincolnii*	
Little blue heron	*Egretta caerulea caerulea*	SSC
Little gull	*Larus minutus*	
Loggerhead shrike	*Lanius ludovicianus ludovicianus*	ST
Long-billed curlew	*Numenius americanus*	
Long-billed dowitcher	*Limnodromus scolopaceus*	
Long-eared owl	*Asio otus*	SSC
Louisiana waterthrush	*Seiurus motacilla*	
Magnolia warbler	*Dendroica magnolia*	SSC
Mallard	*Anas platyrhynchos*	
Manx shearwater	*Puffinus puffinus puffinus*	
Marbled godwit	*Limosa fedoa*	
Marsh wren	*Cistothorus palustris*	
Merlin	*Falco columbarius*	
Migrant loggerhead shrike	*Lanius ludovicianus migrans*	ST
Mississippi kite	*Ictinia mississippiensis*	
Mourning dove	*Zenaida macroura carolinensis*	
Mourning warbler	*Oporornis philadelphia*	SSC
Mute swan	*Cygnus olor*	
Nashville warbler	*Vermivora ruficapilla*	H
Northern bobwhite	*Colinus virginianus*	
Northern cardinal	*Cardinalis cardinalis*	
Northern flicker	*Colaptes auratus*	
Northern fulmar	*Fulmarus glacialis*	
Northern gannet	*Sula bassanus*	

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Northern goshawk	*Accipiter gentilis*	
Northern harrier	*Circus cyaneus*	SSC
Northern mockingbird	*Mimus polyglottos*	
Northern oriole	*Icterus galbula*	
Northern parula warbler	*Parula americana*	
Northern pintail	*Anas acuta acuta*	H
Northern rough-winged swallow	*Stelgidopteryx serripennis*	
Northern saw-whet owl	*Aegolius acadicus*	SSC
Northern shoveler	*Anas clypeata*	
Northern shrike	*Lanius excubitor*	
Northern waterthrush	*Seiurus noveboracensis*	H
Oldsquaw	*Clangula hyemalis*	
Olive-sided flycatcher	*Contopus borealis*	H
Orange-crowned warbler	*Vermivora celata*	
Orchard oriole	*Icterus spurius*	
Osprey	*Pandion haliaetus carolinensis*	
Ovenbird	*Seiurus aurocapillus*	
Painted bunting	*Passerina ciris ciris*	
Palm warbler	*Dendroica palmarum*	
Parasitic jaeger	*Stercorarius parasiticus*	
Pectoral sandpiper	*Calidris melanotos*	
Peregrine falcon	*Falco peregrinus*	FE
Philadelphia vireo	*Vireo philadelphicus*	
Pied-billed grebe	*Podilymbus podiceps*	H
Pileated woodpecker	*Dryocopus pileatus*	
Pine grosbeak	*Pinicola enucleator*	
Pine siskin	*Carduelis pinus*	
Pine warbler	*Dendroica pinus*	
Piping plover	*Charadrius melodus melodus*	FT
Pomarine jaeger	*Stercorarius pomarinus*	
Prairie warbler	*Dendroica discolor*	
Prothonotary warbler	*Protonotaria citrea*	
Purple finch	*Carpodacus purpureus*	SSC
Purple gallinule	*Porphyrula martinica*	
Purple martin	*Progne subis*	
Purple sandpiper	*Calidris maritima*	
Razorbill	*Alca torda*	
Red-bellied woodpecker	*Melanerpes carolinus*	
Red-breasted merganser	*Mergus serrator serrator*	
Red-breasted nuthatch	*Sitta canadensis*	SSC
Red-cockaded woodpecker	*Picoides borealis borealis*	FE
Red crossbill	*Loxia curvirostra*	SSC
Red-eyed vireo	*Vireo olivaceus*	
Red-headed woodpecker	*Melanerpes erythrocephalus*	
Red knot	*Calidris canutus rufus*	
Red-necked grebe	*Podiceps grisegena*	
Red-necked phalarope	*Phalaropus lobatus*	
Red phalarope	*Phalaropus fulicarius*	

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Red-shouldered hawk	*Buteo lineatus lineatus*	
Red-tailed hawk	*Buteo jamaicensis*	
Red-throated loon	*Gavia stellata*	
Red-winged blackbird	*Agelaius phoeniceus*	
Redhead	*Aythya americana*	
Ring-billed gull	*Larus delawarensis*	
Ring-necked duck	*Aythya collaris*	
Ring-necked pheasant	*Phasianus colchicus*	
Rock dove	*Columba livia*	
Rose-breasted grosbeak	*Pheucticus ludovicianus*	
Roseate tern	*Sterna dougallii*	FE
Rough-legged hawk	*Buteo lagopus johannis*	
Royal tern	*Sterna maxima maximus*	H
Ruby-crowned kinglet	*Regulus calendula*	
Ruby-throated hummingbird	*Archilochus colubris*	
Ruddy duck	*Oxyura jamaicensis*	
Ruddy turnstone	*Arenaria interpres morinella*	
Ruff	*Philomachus pugnax*	
Ruffed grouse	*Bonasa umbellus*	
Rufous-sided towhee	*Pipilo erythrophthalmus*	
Rusty blackbird	*Euphagus carolinus*	
Sanderling	*Calidris alba*	
Sandhill crane	*Grus canadensis*	
Sandwich tern	*Sterna sandvicensis acuflavidus*	SSC
Savannah sparrow	*Passerculus sandwichensis*	
Scarlet tanager	*Piranga olivacea*	
Scissor-tailed flycatcher	*Tyrannus forficatus*	
Seaside sparrow	*Ammodramus maritimus*	
Sedge wren	*Cistothorus platensis*	SSC
Semipalmated plover	*Charadrius semipalmatus*	
Semipalmated sandpiper	*Calidris pusilla*	
Sharp-shinned hawk	*Accipiter striatus velox*	
Sharp-tailed sparrow	*Ammodramus caudacutus*	SSC
Short-billed dowitcher	*Limnodromus griseus*	
Short-eared owl	*Asio flammeus*	H
Snow bunting	*Plectrophenax nivalis nivalis*	
Snowy egret	*Egretta thula*	H
Snowy owl	*Nyctea scandiaca*	
Solitary sandpiper	*Tringa solitaria*	
Solitary vireo	*Vireo solitarius*	
Song sparrow	*Melospiza melodia*	
Sooty shearwater	*Puffinus griseus*	
Sooty tern	*Sterna fuscata*	
Sora	*Porzana carolina*	H
Spotted sandpiper	*Actitis macularia*	H
Stilt sandpiper	*Calidris himantopus*	
Summer tanager	*Piranga rubra*	
Surf scoter	*Melanitta perspicillata*	

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Swainson's hawk	*Buteo swaisoni*	
Swainson's thrush	*Catharus ustulatus*	H
Swainson's warbler	*Limnothlypis swainsonii*	SSC
Swamp sparrow	*Melospiza georgiana*	H
Tennessee warbler	*Vermivora peregrina*	
Thick-billed murre	*Uria lomvia*	
Tree swallow	*Tachycineta bicolor*	
Tricolored heron	*Egretta tricolor*	SSC
Tufted titmouse	*Parus bicolor*	
Tundra swan	*Cygnus columbianus columbianus*	
Turkey vulture	*Cathartes aura*	
Upland sandpiper	*Batramia longicauda*	ST
Varied thrush	*Ixoreus naevius*	
Veery	*Catharus fuscescens*	
Vesper sparrow	*Pooecetes gramineus*	
Virginia rail	*Rallus limicola*	H
Warbling vireo	*Vireo gilvus gilvus*	
Water pipit	*Anthus spinoletta*	
Western grebe	*Aechmophorus occidentalis*	
Western kingbird	*Tyrannus verticalis*	
Western sandpiper	*Calidris mauri*	
Western tanager	*Piranga ludoviciana*	
Whimbrel	*Numenius phaeopus*	
Whip-poor-will	*Caprimulgus vociferus*	
White-breasted nuthatch	*Sitta carolinensis*	
White-crowned sparrow	*Zonotrichia leucophrys*	
White-eyed vireo	*Vireo griseus*	
White-faced ibis	*Plegadis chihi*	FC
White ibis	*Eudocimus albus*	H
White-rumped sandpiper	*Calidris fusicollis*	
White-tailed tropicbird	*Phaethon lepturus*	
White-throated sparrow	*Zonotrichia albicollis*	
White-winged black tern	*Chlidonias leucopterus*	
White-winged crossbill	*Loxia leucoptera*	
White-winged scoter	*Melanitta fusca deglandi*	
Wild turkey	*Meleagris gallopavo silvestris*	
Willet	*Catoptrophorus semipalmatus semipalmatus*	
Willow flycatcher	*Empidonax traillii*	
Wilson's phalarope	*Phalaropus tricolor*	
Wilson's plover	*Charadrius wilsonia wilsonia*	SE
Wilson's storm-petrel	*Oceanites oceanicus*	
Wilson's warbler	*Wilsonia pusilla*	
Winter wren	*Troglodytes troglodytes*	SSC
Wood duck	*Aix sponsa*	
Wood stork	*Mycteria americana*	
Wood thrush	*Hylocichla mustelina*	
Worm-eating warbler	*Helmitheros vermivorus*	
Yellow-bellied flycatcher	*Empidonax flaviventris*	SSC

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Yellow-bellied sapsucker	*Sphyrapicus varius*	H
Yellow-billed cuckoo	*Coccyzus americanus*	
Yellow-breasted chat	*Icteria virens virens*	
Yellow-crowned night-heron	*Nyctanassa violaceus violaceus*	SSC
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	
Yellow-nosed albatross	*Diomedea chlororhynchus*	
Yellow rail	*Coturnicops noveboracensis*	
Yellow-rumped warbler	*Dendroica coronata coronata*	
Yellow-throated vireo	*Vireo flavifrons*	
Yellow-throated warbler	*Dendroica dominica*	
Yellow warbler	*Dendroica petechia*	

MAMMALS:

Beaver	*Castor canadensis*	
Big brown bat	*Eptesicus fuscus fuscus*	
Black bear	*Ursus americanus americanus*	
Black fox squirrel	*Sciurus niger niger*	
Black rat	*Rattus rattus*	
Black-tailed jack rabbit	*Lepus californicus melanotis*	
Bobcat	*Lynx rufus rufus*	
Carolina beaver	*Castor canadensis carolinensis*	
Carolina Gapper's red-backed vole	*Clethrionomys gapperi carolinensis*	
Coastal Gapper's red-backed vole	*Clethrionomys gapperi maurus*	
Common eastern chipmunk	*Tamias striatus striatus*	
Common Gapper's red-backed vole	*Clethrionomys gapperi gapperi*	
Common golden mouse	*Ochrotomys nuttalli nuttalli*	
Common mink	*Mustela vison mink*	
Common muskrat	*Ondatra zibethicus zibethicus*	
Common pine vole	*Microtus pinetorum pinetorum*	
Common white-footed mouse	*Peromyscus leucopus leucopus*	
Cotton mouse	*Peromyscus gossypinus gossypinus*	H
Coyote	*Canis latrans*	
Dark meadow vole	*Microtus pennsylvanicus nigrans*	
Deer mouse	*Peromyscus maniculatus nubiterrae*	
Delmarva Peninsula fox squirrel	*Sciurus niger cinereus*	FE
Dismal Swamp short-tailed shrew	*Blarina brevicauda telmalestes*	H
Dismal Swamp southeastern shrew	*Sorex longirostris fisheri*	FT
Eastern big-eared bat	*Plecotus rafinesquii macrotis*	SE
Eastern cottontail	*Sylvilagus floridanus mallurus*	
Eastern cougar	*Felis concolor couguar*	FE
Eastern gray fox	*Urocyon cinereoargenteus cinereoargenteus*	
Eastern harvest mouse	*Reithrodontomys humulis virginianus*	
Eastern harvest mouse	*Reithrodontomys humulis humulis*	
Eastern mole	*Scalopus aquaticus aquaticus*	
Eastern pipistrelle	*Pipistrellus subflavus subflavus*	
Eastern spotted skunk	*Spilogale putorius putorius*	

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Eastern woodrat	*Neotoma floridana magister*	FC
Evening bat	*Nycticeius humeralis humeralis*	
Fisher	*Martes pennanti pennanti*	
Fisher's eastern chipmunk	*Tamias striatus fisheri*	
Florida bobcat	*Lynx rufus floridanus*	
Fox squirrel	*Sciurus niger rufiventer*	
Fox squirrel	*Sciurus niger vulpinus*	
Gray bat	*Myotis grisescens*	FE
Gray squirrel	*Sciurus carolinensis carolinensis*	
Hairy-tailed mole	*Parascalops breweri*	
Hispid cotton rat	*Sigmodon hispidus virginianus*	
Hitchen's eastern cottontail	*Sylvilagus floridanus hitchensi*	FC
Hoary bat	*Lasiurus cinereus cinereus*	H
House mouse	*Mus musculus*	
Howell's eastern mole	*Scalopus aquaticus howelli*	
Indiana bat	*Myotis sodalis*	FE
Kirtland's short-tailed shrew	*Blarina brevicauda kirtlandi*	
Large-toothed muskrat	*Ondatra zibethicus macrodon*	
Least shrew	*Cryptotis parva parva*	
Least weasel	*Mustela nivalis allegheniensis*	
Lewis' golden mouse	*Ochrotomys nuttalli aureolus*	
Little brown bat	*Myotis lucifugus lucifugus*	
Long-tailed shrew	*Sorex dispar dispar*	FC
Long-tailed weasel	*Mustela frenata noveboracensis*	
Marsh rabbit	*Sylvilagus palustris palustris*	SSC
Marsh rice rat	*Oryzomys palustris palustris*	
Masked shrew	*Sorex cinereus cinereus*	
Meadow jumping mouse	*Zapus hudsonius americanus*	
Meadow vole	*Microtus pennsylvanicus pennsylvanicus*	
Mearn's eastern cottontail	*Sylvilagus floridanus mearnsii*	
New England cottontail	*Sylvilagus transitionalis*	FC
Northern flying squirrel	*Glaucomys sabrinus fuscus*	FE
Northern flying squirrel	*Glaucomys sabrinus coloratus*	FE
Northern gray squirrel	*Sciurus carolinensis pennsylvanicus*	
Northern long-eared bat	*Myotis septentrionalis septentrionalis*	H
Northern short-tailed shrew	*Blarina brevicauda churchi*	
Northern white-footed mouse	*Peromyscus leucopus noveboracensis*	
Northern yellow bat	*Lasiurus intermedius floridanus*	
Norway rat	*Rattus norvegicus*	
Nutria	*Myocastor coypus*	
Pine vole	*Microtus pinetorum carbonarius*	
Pine vole	*Microtus pinetorum scalapsoides*	
Prairie deer mouse	*Peromyscus maniculatus bairdii*	
Pygmy shrew	*Sorex hoyi winnemana*	FC
Raccoon	*Procyon lotor maritimus*	
Raccoon	*Procyon lotor lotor*	
Rafinesque's big-eared bat	*Plecotus rafinesquii rafinesquii*	FC
Red bat	*Lasiurus borealis borealis*	

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Red fox	*Vulpes vulpes fulva*	
Red squirrel	*Tamiasciurus hudsonicus abieticola*	
Reddish fox squirrel	*Sciurus niger rufiventer*	
River otter	*Lutra canadensis lataxina*	SSC
Rock vole	*Microtus chrotorrhinus carolinensis*	SE
Seminole bat	*Lasiurus seminolus*	
Sika deer	*Cervus nippon nippon*	
Silver-haired bat	*Lasionycteris noctivagans*	H
Small-footed myotis	*Myotis leibii leibii*	FC
Small star-nosed mole	*Condylura cristata parva*	SSC
Smokey shrew	*Sorex fumeus fumeus*	
Snowshoe hare	*Lepus americanus virginianus*	SE
Southeastern shrew	*Sorex longirostris longirostris*	
Southern bog lemming	*Synaptomys cooperi helaletes*	H
Southern flying squirrel	*Glaucomys volans volans*	
Southern short-tailed shrew	*Blarina carolinensis carolinensis*	
Southwestern mink	*Mustela vison vison*	
Star-nosed mole	*Condylura cristata cristata*	H
Stone's southern bog lemming	*Synaptomys cooperi stonei*	
Striped skunk	*Mephitis mephitis elongata*	
Striped skunk	*Mephitis mephitis nigra*	
Talkative red squirrel	*Tamiasciurus hudsonicus loquax*	
Virginia big-eared bat	*Plecotus townsendii virginianus*	FE
Virginia opossum	*Didelphis virginiana virginiana*	
Water shrew	*Sorex palustris punctulatus*	SE
White-footed mouse (Pungo mouse)	*Peromyscus leucopus easti*	FC
White-tailed deer	*Odocoileus virginianus*	
Woodchuck	*Marmota monax monax*	
Woodland jumping mouse	*Napaeozapus insignis roanensis*	

MOLLUSKS:

Freshwater Mussels (partial)

Acornshell mussel	*Epioblasma haysiana*	
Alabama rainbow mussel	*Villosa nebulosa*	
Alewife floater mussel	*Anodonta implicata*	
Appalachian monkeyface mussel	*Quadrula sparsa*	FE
Atlantic pigtoe mussel	*Fuscanaia masoni*	ST
Birdwing pearlymussel	*Lemiox rimosus*	FE
Black sandshell mussel	*Ligumia recta*	ST
Brook floater mussel	*Alasmidonta varicosa*	SE
Carolina lance mussel	*Elliptio angustata*	
Carolina slabshell mussel	*Elliptio congaraea*	
Cracking pearlymussel	*Hemistena lata*	FE
Cumberland bean mussel	*Villosa trabalis*	FE
Cumberland combshell mussel	*Epioblasma brevidens*	SE

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Cumberland leafshell mussel	*Epioblasma stewardsoni*	
Cumberland moccasinshell mussel	*Medionidus conradicus*	
Cumberland monkeyface mussel	*Quadrula intermedia*	FE
Deertoe mussel	*Truncilla truncata*	SE
Dromedary pearlymussel	*Dromus dromas*	FE
Dwarf wedgemussel	*Alasmidonta heterodon*	FE
Eastern elliptio mussel	*Elliptio complanata*	
Eastern floater mussel	*Anodonta cataracta marginata*	
Eastern lampmussel	*Lampsilis radiata*	SSC
Eastern pondmussel	*Ligumia nasuta*	H
Elephant-ear mussel	*Elliptio crassidens*	SE
Elktoe mussel	*Alasmidonta marginata*	SSC
Fanshell mussel	*Cyprogenia stegaria (=irorata)*	FE
Fine-rayed pigtoe mussel	*Fusconaia cuneolus*	FE
Fluted kidneyshell mussel	*Ptychobranchus subtentum*	
Fluted shell mussel	*Lasmigona costata*	
Fragile papershell mussel	*Leptodea fragilis*	ST
Freshwater limpet snail	*Amnicola limosa*	
Giant floater mussel	*Anodonta grandis*	
Green blossom mussel	*Epioblasma torulosa gubernaculum*	FE
Green floater mussel	*Lasmigona subviridis*	SSC
James spinymussel	*Pleurobema collina*	FE
Kidneyshell mussel	*Ptychobranchus fasciolaris*	
Little-wing pearlymussel	*Pegias fabula*	FE
Long-solid mussel	*Fusconaia subrotonda*	
Mountain creekshell mussel	*Villosa vanuxemensis*	
Mucket mussel	*Actinonaias carinata (=ligamentina)*	
Notched rainbow mussel	*Villosa constricta*	
Ohio pigtoe mussel	*Pleurobema cordatum*	SE
Oyster mussel	*Epioblasma capsaeformis*	SE
Paper pondshell	*Anodonta imbecillis*	H
Pheasantshell mussel	*Actinonaias pectorosa*	
Pimpleback mussel	*Quadrula pustulosa pustulosa*	ST
Pink heelsplitter mussel	*Potamilus alatus*	
Pink mucket mussel	*Lampsilis abrupta (=orbiculata)*	FE
Pink pigtoe mussel	*Pleurobema rubrum*	SE
Pistolgrip mussel	*Tritogonia verrucosa*	
Plain pocketbook mussel	*Lampsilis cardium*	
Pocketbook mussel	*Lampsilis ovata*	
Pondhorn mussel	*Uniomerus tetralasmus*	
Purple bean mussel	*Villosa perpurpurea*	SE
Purple lilliput mussel	*Toxolasma lividus*	SE
Purple wartyback mussel	*Cyclonaias tuberculata*	
Pyramid pigtoe mussel	*Pleurobema pyramidatum*	
Rainbow mussel	*Villosa iris*	
Rayed bean mussel	*Villosa fabalis*	
Roanoke slabshell mussel	*Elliptio roanokensis*	SSC
Rough pigtoe mussel	*Pleurobema plenum*	FE

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Rough rabbitsfoot mussel	*Quadrula cylindrica strigillata*	ST
Round pigtoe mussel	*Pleurobema coccineum*	
Sheepnose mussel	*Plethobasus cyphyus*	ST
Shiny pigtoe mussel	*Fusconaia cor*	FE
Slabside pearlymussel	*Lexingtonia dolabelloides*	ST
Slippershell mussel	*Alasmidonta viridis*	SE
Snuffbox mussel	*Epioblasma triquetra*	SE
Southern pondhorn mussel	*Uniomerus obesus*	
Spectaclecase mussel	*Cumberlandia monodonta*	SE
Spike mussel	*Elliptio dilatata*	
Squawfoot mussel	*Strophitus undulatus*	
Tan riffleshell mussel	*Epioblasma florentina walkeri*	FE
Tennessee clubshell mussel	*Pleurobema oviforme*	FC
Tennessee heelsplitter mussel	*Lasmigona holstonia*	SE
Tennessee pigtoe mussel	*Fusconaia barnesiana*	SSC
Three-ridge mussel	*Amblema plicata plicata*	
Tidewater mucket	*Leptodea orcracea*	H
Triangle floater mussel	*Alasmidonta undulata*	
Virginia pigtoe mussel	*Lexingtonia subplana*	
Wavy-rayed lamp mussel	*Lampsilis fasciola*	
Yellow lampmussel	*Lampsilis cariosa*	SSC
Yellow lance mussel	*Elliptio lanceolata*	SSC

Freshwater and Land Snails (partial)

Alabama three-tooth	*Triodopsis alabamensis*	SSC
Amber glass	*Nesovitrea electrina*	H
Angular disc	*Discus catskillensis*	SSC
Balsam globe	*Mesodon andrewsae*	SSC
Barred supercoil	*Paravitrea seradens*	SSC
Bidentate dome	*Ventridens coelaxis*	H
Black mantleslug	*Pallifera hemphilli*	H
Black Mountains disc	*Discus nigrimontanus*	SSC
Black Mountains slitmouth	*Stenotrema altispira*	SSC
Black striate	*Striatura ferrea*	H
Blotchy mantleslug	*Megapallifera wetherbyi*	H
Bluegrass snaggletooth	*Gastrocopta clappi*	H
Bottle hornsnail	*Pleurocera gradata*	H
Brilliant glyph	*Glyphyalinia praecox*	SSC
Brown bellytooth	*Gastrodonta fonticula*	SSC
Brown globelet	*Mesodon kalmianus*	SSC
Brown spot	*Punctum blandianum*	H
Brown supercoil	*Paravitrea septadens*	ST
Brown walker	*Pomatiopsis cincinnatiensis*	H
Brownspotted mantleslug	*Philomyscus venustrus*	H
Budded three-tooth	*Triodpsis tennesseensis*	H
Buttress three-tooth	*Triodopsis rugosa*	SSC

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Capital vertigo	*Vertigo oscarinana*	H
Carinate slithmouth	*Stenotrema spinosum*	H
Cave coil	*Helicodiscus multidens*	H
Chesapeake ambersnail	*Oxyloma subrefusum*	SSC
Cinnamon covert	*Mesodon wheatleyi*	SSC
Coastal Plains disc	*Anguispira fergusoni*	H
Coastal-plain disc	*Anguispira jessica*	SSC
Comb supercoil	*Paravitrea dentilla*	SSC
Copper dome	*Ventridens theloides*	H
Crested snaggletooth	*Gastrocopta cristata*	SSC
Crested vertigo	*Vertigo pygmaea*	H
Crinkled ambersnail	*Succinea campestris*	SSC
Cumberland liptooth	*Polygyra plicata*	SSC
Cupped vertigo	*Vertigo clappi*	SSC
Delicate vertigo	*Vertigo bollesiana*	H
Depressed glyph	*Glyphyalinia virginica*	H
Dusky button	*Mesomphix capnodes*	H
Dusky fossaria	*Fossaria dalli*	H
Fine-ribbed striate	*Striatura milium*	SSC
Five-tooth vertigo	*Vertigo ventricosa*	SSC
Flat button	*Mesomphix subplanus*	H
Forest disc	*Discis cronkhitei*	H
Fragile ancylid	*Ferrissia fragilis*	H
Funnel supercoil	*Paravitrea mira*	H
Furrowed glyph	*Glyphyalinia luticola*	H
Glass spot	*Punctum vitreum*	H
Glassy grapeskin	*Vitrizonites latissimus*	H
Glossy covert	*Mesodon christyi*	SSC
Glossy dome	*Ventridens acerra*	H
Glossy supercoil	*Paravitrea placentula*	SSC
Golden dome	*Ventridens arcellus*	H
Gravel elmia	*Elimia catenaria*	H
Green dome	*Zonitoides elliotti*	SSC
Hanging Rock three-tooth	*Triodopsis pendula*	SSC
Hill glyph	*Glyphyalinia cumberlandiana*	H
Hollow dome	*Ventridens lasmodon*	H
Honey vertigo	*Vertigo tridentata*	H
Lambda snaggletooth	*Gastrocopta holzingeri*	H
Lamellate spot	*Punctum smithi*	H
Lowland pillsnail	*Euchemotrema leai*	SSC
Marsh slug	*Deroceras laeve*	H
Maryland glyph	*Glyphyalinia raderi*	SSC
Mimic threetooth	*Triodopsis fallax*	H
Natural Bridge supercoil	*Paravitrea pontis*	H
Obese thorn	*Carychium exiguum*	H
Oblong ancylid	*Ferrissia parallela*	H
Oldfield coil	*Helicodiscus inermis*	H
Onyx rocksnail	*Leptoxis praerosa*	H

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Pagoda hornsnail	*Pleurocera uncialis*	H
Pale glyph	*Glyphyalinia lewisiana*	H
Palmetto vertigo	*Vertigo oralis*	SSC
Piedmont pebblesnail	*Somatogyrus virginicus*	SSC
Piedmont pondsnail	*Stagnicola neopalustris*	H
Pinhole sand three-tooth	*Triodopsis messana*	SSC
Pittsylvania three-tooth	*Triodopsis burchi*	H
Proud globe	*Mesodon elevatus*	H
Pyramid dome	*Ventridens intertextus*	H
Ribbed striate	*Striatura exugua*	H
Round supercoil	*Paravitrea reesi*	H
Rounded dome	*Ventridens lawae*	SSC
Rubble coil	*Helicodiscus lirellus*	SE
Rust glyph	*Glyphyalinia picea*	SSC
Shaggy coil	*Helicodiscus diadema*	SE
Shagreen	*Mesodon inflectus*	H
Shale pebblesnail	*Somatogyrus pennsylvanicus*	H
Sharp sprite	*Promenetus exacuous*	H
Shrew supercoil	*Paravitrea blarina*	SSC
Silk hive	*Euconulus trochulus*	H
Slender supercoil	*Paravitrea subtilis*	SSC
Slim snaggletooth	*Gastrocopta pellucida*	SSC
Small-mouth vertigo	*Vertigo parvula*	H
Smooth button	*Mesomphix perlaevis*	H
Smooth coil	*Helicodiscus singleyanus*	H
Smooth-lipped sand three-tooth	*Triodopsis obsoleta*	H
Snaggletooth snail	*Gastrocopta tappaniana*	H
Snowhill ambersnail	*Catinella hubrichti*	SSC
Southern pinecone	*Strobilops texasianus*	H
Spider elmia	*Elimia arachnoidea*	H
Spike-lipped crater	*Mesodon sayanus*	H
Spiny riversnail	*Io fluvialis*	ST
Spirit supercoil	*Paravitrea hera*	SE
Spruce Knob three-tooth	*Triodopsis picea*	SSC
Suborb glyph	*Glyphyalinia sculptilis*	SSC
Swamp vertigo	*Vertigo teskeyae*	SSC
Tallus coil	*Helicodiscus triodus*	SSC
Temperate coil	*Helicodiscus shimeki*	SSC
Thin pillar	*Cochlicopa libricella*	H
Thin-lipped vallonia	*Vallonia perspectiva*	H
Threeridged valvata	*Valvata tricarinata*	H
Tight gapped shagreen	*Mesodon appressus*	H
Tiny liptooth	*Polygyra pusuloides*	SSC
Trumpet vellonia	*Vallonia parvula*	SSC
Tworidged valvata	*Valvata bicarinata*	H
Unthanks cavesnail	*Holsingeria unthanksensis*	SE
Variable mantleslug	*Pallifera varia*	H
Variable vertigo	*Vertigo gouldi*	H

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Virginia bladetooth	*Mesodon panselenus*	H
Virginia coil	*Polygyriscus virginicus*	FE
Virginia mantleslug	*Philomyscus virginicus*	H
Watercress snail	*Fontigens nickliniana*	H
Widespread column	*Pupilla muscorum*	SSC
Wilson ambersnail	*Succinea wilsoni*	SSC
Wrinkled button	*Mesomphix rugeli*	H
Yellow dome	*Ventridens pilsbryi*	H
Yellow globelet	*Mesodon clausus*	H

Freshwater Fingernailclams (partial)

Adam peaclam	*Pisidium adamsi*	H
Greater eastern peaclam	*Pisidium dubium*	H
Grooved fingernailclam	*Sphaerium simile*	
Herriongton fingernailclam	*Shaerium occidentale*	
Lake fingernailclam	*Musculium lacustre*	H
Long fingernailclam	*Musculium transversum*	
Perforated peaclam	*Pisidium punctatum*	H
Pond fingernailclam	*Musculium securis*	H
Ridge-beak peaclam	*Pisidium compressum*	
River fingernailclam	*Sphaerium fabale*	
Round peaclam	*Pisidium equilaterale*	H
Shiny peaclam	*Pisidium nitidium*	
Striate peaclam	*Pisidium punctiferum*	H
Striated fingernailclam	*Sphaerium striatinum*	H
Swamp fingernailclam	*Musculium partumeium*	
Triangular peaclam	*Pisidium variable*	H
Ubiquitous peaclam	*Pisidium casertanum*	
Walker peaclam	*Pisidum walkeri*	H

FRESHWATER CRUSTACEANS (partial):

Alleghany County cave amphipod	*Stygobromus hoffmani*	SSC
Appalachian Valley cave amphiod	*Crangonyx antennatus*	SSC
Bath County cave amphipod	*Stygobromus mundus*	SSC
Bigger's cave isopod	*Stygobromus biggersi*	SSC
Blue Ridge Mountain amphipod	*Stygobromus spinosus*	SSC
Burnsville Cove cave amphipod	*Stygobromus conradi*	SSC
* Chowan River crayfish	*Orconectes virginiensis*	H
Craig County cave amphipod	*Stygobromus estesi*	SSC
* Crayfish, no common name	*Cambarus caolinus*	H
* Crayfish, no common name	*Cambarus longirostris*	H
* Crayfish, no common name	*Cambarus parvoculus*	H
* Crayfish, no common name	*Cambarus sciotensis*	H
* Crayfish, no common name	*Fallicambarus fodiens*	H

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* Crayfish, no common name	*Orconectes obscurus*	H
* Crayfish, no common name	*Orconectes spinosus*	H
Cumberland cave amphipod	*Stygobromus cumberlandi*	SSC
* Devil crawfish	*Cambarus diogenes*	H
Ephemeral cave amphipod	*Stygobromus ephemerus*	SSC
Greenbriar Valley cave isopod	*Caecidotea holsingeri*	SSC
Groundwater amphipod	*Stygobromus tenuis*	SSC
Henrot's Cave isopod	*Caecidotea henroti*	SSC
Incurved cave isopod	*Caecidotea incurva*	SSC
Isopod, no common name	*Caecidotea bowmani*	SSC
James cave amphipod	*Stygobromus abditus*	SSC
Lee County cave isopod	*Lirceus usdagalun*	FC
Lee County cave amphipod	*Stygobromus leensis*	SSC
Luray Caverns amphipod	*Stygobromus pseudospinosus*	SSC
Madisons Cave amphipod	*Stygobromus stegerorum*	ST
Madisons Cave isopod	*Anrolina lira*	FT
Montgomery County cave amphipod	*Stygobromus fergusoni*	SSC
Morrisons's cave amphipod	*Stygobromus morrisoni*	SSC
New Castle Murder Hole amphipod	*Stygobromus interitus*	SSC
* New River riffle crayfish	*Cambarus chasmodactylus*	H
Northern Virginia well amphipod	*Stygobromus phreaticus*	SSC
Phreatic isopod	*Caecidotea phreatica*	SSC
Pittsylvania well amphipod	*Stygobromus obrutus*	SSC
Pizzini's amphipod	*Stygobromus pizzinii*	SSC
Powell Valley terr. cave isopod	*Amerigoniscus henroti*	SSC
Price's cave isopod	*Caecidotea pricei*	SSC
Racovitza's terrestrial cave isopod	*Miktoniscus racovitzae*	SSC
Rock Creek groundwater amphipod	*Stygobromus kenki*	SSC
Rockbridge County cave amphipod	*Stygobromus baroodyi*	SSC
Rye Cove isopod	*Lirceus culveri*	SSC
Shenandoah Valley cave amphipod	*Stygobromus gracilipes*	SSC
Southwestern Va. cave amphipod	*Stygobromus mackini*	SSC
Southwestern Va. cave isopod	*Caecidotea recurvata*	SSC
Tennessee Valley cave isopod	*Caecidotea richardsonae*	SSC
Tidewater amphipod	*Stygobromus indentatus*	SSC
Tidewater interstitial amphipod	*Stygobromus araeus*	SSC
Vandel's cave isopod	*Caecidotea vandeli*	SSC

MILLIPEDES (PARTIAL):

Ellett Valley pseudotremia	*Pseudotremia cavernarum*	ST
Laurel Creek xystodesmid	*Sigmoria whiteheadi*	ST
Millipede, no common name	*Abacion tesselatum*	H
Millipede, no common name	*Andrognathus corticarius*	H
Millipede, no common name	*Aniulus orientalis*	H
Millipede, no common name	*Aniulus sp. 1*	H
Millipede, no common name	*Apheloria tigana*	H

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Millipede, no common name	*Apheloria virginiensis montana*	H
Millipede, no common name	*Apheloria virginiensis virginiensis*	H
Millipede, no common name	*Auturus erythropygos*	SSC
Millipede, no common name	*Boraria infesta*	SSC
Millipede, no common name	*Brachoria cedra*	SSC
Millipede, no common name	*Brachoria dentata*	H
Millipede, no common name	*Brachoria ethotela*	H
Millipede, no common name	*Brachoria falcifera*	SSC
Millipede, no common name	*Brachoria hoffmani*	H
Millipede, no common name	*Brachoria insolita*	H
Millipede, no common name	*Brachoria laminata*	SSC
Millipede, no common name	*Brachoria mendota*	H
Millipede, no common name	*Brachoria separanda calcaria*	H
Millipede, no common name	*Brachoria separanda hamata*	H
Millipede, no common name	*Brachoria separanda versicolor*	H
Millipede, no common name	*Brachoria turneri*	SSC
Millipede, no common name	*Brachycybe lecontii*	H
Millipede, no common name	*Buotus carolinus*	H
Millipede, no common name	*Cambala hubrichtii*	H
Millipede, no common name	*Cambala minor*	H
Millipede, no common name	*Chaetaspis albus*	H
Millipede, no common name	*Cherokia georgiana latassa*	H
Millipede, no common name	*Cleidogona fidelitor*	H
Millipede, no common name	*Cleidogona hoffmani*	H
Millipede, no common name	*Cleidogona lachesis*	H
Millipede, no common name	*Cleidogona medialis*	H
Millipede, no common name	*Conotyla aeto*	H
Millipede, no common name	*Conotyla celeno*	H
Millipede, no common name	*Conotyla melinda*	H
Millipede, no common name	*Conotyla sp. 1*	H
Millipede, no common name	*Conotyla venetia*	H
Millipede, no common name	*Desmonus earlei*	H
Millipede, no common name	*Dixoria brooksi*	SSC
Millipede, no common name	*Dixoria coronata*	H
Millipede, no common name	*Dixoria fowleri*	H
Millipede, no common name	*Euryurus leachi fraternus*	H
Millipede, no common name	*Gyalostethus monticolens*	H
Millipede, no common name	*Nannaria conservata*	H
Millipede, no common name	*Nannaria ericacea*	H
Millipede, no common name	*Nannaria laminata*	H
Millipede, no common name	*Nannaria morrisoni*	H
Millipede, no common name	*Nannaria shenandoah*	H
Millipede, no common name	*Nannaria simplex*	H
Millipede, no common name	*Nannaria wilsoni*	H
Millipede, no common name	*Nopoiulus kochi*	H
Millipede, no common name	*Okeanobates americanus*	H
Millipede, no common name	*Onomeris underwoodi*	H
Millipede, no common name	*Orinisobates nigrior*	H

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Millipede, no common name	*Polyzonium rosalbum*	H
Millipede, no common name	*Polyzonium strictum*	H
Millipede, no common name	*Pseudopolydesmus paludicolous*	SSC
Millipede, no common name	*Pseudotremia alecto*	H
Millipede, no common name	*Pseudotremia armesi*	H
Millipede, no common name	*Pseudotremia momus*	H
Millipede, no common name	*Pseudotremia princeps*	H
Millipede, no common name	*Pseudotremia sublevis*	H
Millipede, no common name	*Pseudotremia tuberculata*	H
Millipede, no common name	*Pseudotremia valga*	H
Millipede, no common name	*Rudiloria kleinpeteri*	H
Millipede, no common name	*Rudiloria trimaculata tortua*	H
Millipede, no common name	*Scytonotus virginicus*	H
Millipede, no common name	*Semionellus placidus*	SSC
Millipede, no common name	*Sigmoria latior latior*	H
Millipede, no common name	*Striaria causeyae*	H
Millipede, no common name	*Striaria columbiana*	H
Millipede, no common name	*Striaria granulosa*	H
Millipede, no common name	*Striaria sp. a*	H
Millipede, no common name	*Thalassisobates littoralis*	H
Millipede, no common name	*Trichomeris sinuata*	H
Millipede, no common name	*Trichopetalum dux*	H
Millipede, no common name	*Trichopetalum lunatum*	H
Millipede, no common name	*Trichopetalum packardi*	H
Millipede, no common name	*Trichopetalum weyeriensis*	H
Millipede, no common name	*Trichopetalum whitei*	H
Millipede, no common name	*Uroblaniulus canadensis*	H
Millipede, no common name	*Uroblaniulus jerseyi*	H
Millipede, no common name	*Uroblaniulus sp. 1*	H
Millipede, no common name	*Virgoilus minutus*	H

MARINE MAMMALS:

Antillean beaked whale	*Mesoplodon europaeus*	
Atlantic bottlenose	*Tursiops truncatus*	
Atlantic pilot whale	*Globicephala melaena*	
Blue whale	*Balaenoptera musculus*	FE
Bryde's whale	*Balaenoptera edeni*	
California sea lion	*Zalophus californianus*	
Dense-beaked whale	*Mesoplodon densirostris*	
Dwarf sperm whale	*Kogia simus*	
False killer whale	*Pseudorca crassidens*	
Fin whale	*Baleanoptera physalus*	FE
Florida manatee	*Trichechus manatus*	FE
Goose-beaked whale	*Ziphius cavirostris*	
Grampus	*Grampus griseus*	
Harbor porpoise	*Phocoena phocoena*	

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Harbor seal	*Phoca vitulina vitulina*	
Humpback whale	*Megaptera novaeangliae*	FE
Killer whale	*Orcinus orca*	
Minke whale	*Balaenoptera acutorostrada*	
Northern right whale	*Eubalaena glacialis*	FE
Pygmy sperm whale	*Kogia breviceps*	
Rough-toothed dolphin	*Steno bredanensis*	
Saddleback dolphin	*Delphinus delphis*	
Sei whale	*Balaenoptera borealis*	FE
Short-finned pilot whale	*Globicephala macrorhynchus*	
Sperm whale	*Physeter catodon*	FE
Spinner dolphin	*Stenella longirostris*	
Spotted dolphin	*Stenella plagiodon*	
Striped dolphin	*Stenella caeruleoalba*	
True's beaked whale	*Mesoplodon mirus*	
White-sided dolphin	*Lagenorhynchus acutus*	

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PROBABLE EASTERN UNITED STATES - WILDLIFE SPECIES

Eastern species of birds, reptiles, amphibians, mammals, crustaceans, fish, and plants that have been documented as being in the area of the Norfolk Naval Base and/or that have a probability of being there due to the species geographical ranges and migratory pathways.

BIRDS

Common Name	Scientific Name
Ducks, Ducklike and Miscellaneous Swimming Birds (1)	
Common loon	Gavia immer
Red-throated loon	Gavia stellata
Horned grebe	Podiceps auritus
Pied-billed grebe	Podilymbus podiceps
Double-crested cormorant	Phalacrocorax auritus
Snow goose	Chen caerulescens
Canada goose	Branta canadensis
American black duck	Anas rubripes
Brant	Branta bernicla
Gadwall	Anas strepera
Mallard	Anas platyrhnchos
Common pintail	Anas acuta
American widgeon	Anas americana
Wood duck	Aix sponsa
Northern shoveler	Anas clypeata
Blue-winged teal	Anas discors
Green-winged teal	Anas crecca
White-winged scoter	Melanitta deglandi
Surf scoter	Melanitta perspicillata
Black scoter	Melanitta nigra
Oldsquaw	Clangula hyemalis
Canvasback	Aythya valisineria
Ring-necked duck	Aythya collaris
Lesser scaup	Aythya affinis
Greater scaup	Aythya marila
Common goldeneye	Bucephala clangula
Bufflehead	Bucephala albeola
Ruddy duck	Oxyura jamaicensis
Red-breasted merganser	Mergus serrator
Hooded merganser	Lophodytes cucullatus
American coot	Fulica americana
Common gallinule	Gallinula chloropus
Seabirds, Gulls (1)	
Brown pelican	Pelecanus occidentalis
Glaucous gull	Larus hyperboreus
Iceland gull	Larus glaucoides
Herring gull	Larus argentatus
Ring-billed gull	Larus delawarensis
Greater black-backed gull	Larus marinus
Laughing gull	Larus atricilla
Bonaparte's gull	Larus philadelphia

Little tern	Sterna albifrons
Common tern	Sterna hirundo
Forster's tern	Sterna forsteri
Black skimmer	Rynchops niger

Long-legged Wading Birds (1)

Great blue heron	Ardea herodias
Little blue heron	Florida caerulea
Louisiana heron	Hydranassa tricolor
Great egret	Casmerodius albus
Snowy egret	Egretta thula
Cattle egret	Bubulcus ibis
Black-crowned night heron	Nycticorax nycticorax
Yellow-crowned night heron	Nyctanassa violacea
Green heron	Butorides striatus
Least bittern	Ixobrychus exilis
American bittern	Botaurus lentiginosus
Glossy ibis	Plegadis falcinellus

Smaller Wading Birds (1)

Virginia rail	Rallus limicola
King rail	Rallus elegans
Clapper rail	Rallus longirostris
Sora	Porzana carolina
Black rail	Laterallus jamaicensis
American oystercatcher	Haematopus palliatus
American avocet	Recurvirostra americana
Black bellied plover	Pluvialis squatarola
Ruddy turnstone	Arenaria interpres
Semipalmated plover	Charadrius semipalmatus
Piping plover	Charadrius melodus
Wilson's plover	Charadrius wilsonia
Killdeer	Charadrius vociferus
American woodcock	Philohela minor
Common snipe	Capella gallinago
Short-billed dowitcher	Limnodromus scolopaceus
Willet	Catoptrophorus semipalmatus
Greater yellowlegs	Tringa melanoleuca
Lesser yellowlegs	Tringa flavipes
Sanderling	Calidris alba
Dunlin	Calidris alpina
Purple sandpiper	Calidris maritima
Least sandpiper	Calidris minutilla
Western sandpiper	Calidris mauri

Fowl-like Birds (1)

Wild turkey	Meleagris gallopavo
Common bobwhite	Colinus virginianus

Birds of Prey (1)

Sharp-shinned hawk	Accipiter striatus
Cooper's hawk	Accipiter cooperii
Northern harrier	Circus cyaneus
Red-tailed hawk	Buteo jamaicensis
Red-shouldered hawk	Buteo lineatus
Broad-winged hawk	Buteo platypterus
Bald eagle	Haliaeetus leucocephalus
Osprey	Pandion haliaetus
Turkey vulture	Cathartes aura
Black vulture	Coragyps atratus
American kestrel	Falco sparverius
Merlin	Falco columbarius
Peregrine falcon	Falco peregrinus
Short-eared owl	Asio flammeus
Common screech owl	Otus asio
Long-eared owl	Asio otus
Great horned owl	Bubo virginianus
Barred owl	Strix varia
Barn owl	Tyto alba

Nonpasserine Land Birds (1)

Mourning dove	Zenaida macroura
Yellow-billed cuckoo	Coccyzus americanus
Common nighthawk	Chordeiles minor
Chuck-will's-widow	Caprimulgus carolinensis
Ruby-throated hummingbird	Archilochus colubris
Belted kingfisher	Megaceryle alcyon
Red-headed woodpecker	Melanerpes erythrocephalus
Pileated woodpecker	Dryocopus pileatus
Common flicker	Colaptes auratus
Red-bellied woodpecker	Melanerpes carolinus
Red-cockaded woodpecker	Picoides borealis
Yellow-bellied sapsucker	Sphyrapicus varius
Downy woodpecker	Picoides pubescens
Hairy woodpecker	Picoides villosus

Passerine Birds (1)

Eastern kingbird	Tyrannus tyrannus
Great crested flycatcher	Myiarchus crinitus
Eastern pewee	Contopus virens
Eastern phoebe	Sayornis phoebe
Acadian flycatcher	Empidonax virescens
Horned lark	Eremophila alpestris
Water pipit	Anthus spinoletta
Purple martin	Progne subis
Barn swallow	Hirundo rustica
Tree swallow	Iridoprocne bicolor
Chimney swift	Chaetura pelagica
Fish crow	Corvus ossifragus
American crow	Corvus brachyrhynchos

Blue jay	Cyanocitta cristata
Carolina chickadee	Parus carolinensis
Tufted titmouse	Parus bicolor
White-breasted nuthatch	Sitta carolinensis
Red-breasted nuthatch	Sitta canadensis
Brown-headed nuthatch	Sitta pusilla
Brown creeper	Certhia familiaris
House wren	Troglodytes aedon
Winter wren	Troglodytes troglodytes
Carolina wren	Thryothorus ludovicianus
Marsh wren	Cistothorus palustris
Sedge wren	Cistothorus platensis
Golden-crowned kinglet	Regulus satrapa
Ruby-crowned kinglet	Regulus calendula
Blue-gray gnatcatcher	Polioptila caerulea
Brown thrasher	Toxostoma rufum
Gray catbird	Dumetella carolinensis
Northern mockingbird	Mimus polyglottos
Eastern bluebird	Sialia sialis
American robin	Turdus migratorius
Hermit thrush	Catharus guttatus
Wood thrush	Hylocichla mustelina
Loggerhead shrike	Lanius ludovicianus
Cedar waxwing	Bombycilla cedrorum
Red-eyed vireo	Vireo olivaceus
Yellow-throated vireo	Vireo flavifrons
White-eyed vireo	Vireo griseus
Solitary vireo	Vireo solitarius
Prothonotary warbler	Protonotaria citrea
Northern parula warbler	Parula americana
Yellow-throated warbler	Dendroica dominica
Black-and-white warbler	Mniotilta varia
Yellow-rumped warbler	Dendroica coronata
Pine warbler	Dendroica pinus
Prairie warbler	Dendroica discolor
Palm warbler	Dendroica palmarum
Yellow warbler	Dendroica petechia
Swainson's warbler	Limnothlypis swainsonii
Hooded warbler	Wilsonia citrina
Kentucky warbler	Oporornis formosus
Common yellowthroat	Geothlypis trichas
Yellow breasted chat	Icteria virens
Louisiana waterthrush	Seiurus motacilla
Ovenbird	Seiurus aurocapillus
Red-winged blackbird	Agelaius phoeniceus
Brown-headed cowbird	Molothrus ater
Rusty blackbird	Euphagus carolinus
Common grackle	Quiscalus quiscula
Boat-tailed grackle	Quiscalus major
Eastern meadowlark	Sturnella magna
European starling	Sturnus vulgaris
Orchard oriole	Icterus spurius
Northern oriole	Icterus galbula
Summer tanager	Piranga rubra

House sparrow	Passer domesticus
Northern junco	Junco oreganus
Northern cardinal	Cardinalis cardinalis
Purple finch	Carpodacus purpureus
American goldfinch	Carduelis tristis
Pine siskin	Carduelis pinus
Blue grosbeak	Guiraca caerulea
Indigo bunting	Passerina cyanea
Rufous-sided towhee	Pipilo erythrophthalmus
White-throated sparrow	Zonotrichia albicollis
Chipping sparrow	Spizella passerina
Field sparrow	Spizella pusilla
Swamp sparrow	Melospiza georgiana
Fox sparrow	Passerella iliaca
Song sparrow	Melospiza melodia
Vesper sparrow	Pooecetes gramineus
Savannah sparrow	Passerculus sandwichensis
Henslow's sparrow	Ammodramus henslowii
Sharp-tailed sparrow	Ammospiza caudacuta
Seaside sparrow	Ammospiza maritima

REPTILES AND AMPHIBIANS

Turtles (1)

Snapping turtle	Chelydra serpintina
Spotted turtle	Clemmys guttata
Stinkpot	Sternotherus odoratus
Eastern mud turtle	Kinosternon subrubrum subrubrum
Northern diamondback terrapin	Malaclemys terrapin terrapin
Eastern painted turtle	Chrysemys picta picta
River cooter	Chrysemys concinna concinna
Florida cooter	Chrysemys floridana floridana
Yellow bellied pond slider	Chrysemys scripta scripta
Eastern box turtle	Terrapene carolina carolina
Eastern chicken turtle	Deirochelys reticularia

Lizards and Skinks (1)

Northern fence lizard	Sceloporus undulatus hyacinthinus
Ground skink	Scincella lateralis
Five-lined skink	Eumeces fasciatus
Broad-headed skink	Eumeces laticeps
Southeastern five-lined skink	Eumeces inexpectatus
Six-lined racerunner	Cnemidophorus sexlineatus sexlineatus
Slender glass lizard	Ophisayrus ventralis

Snakes (1)

Northern water snake	Natrix sipedon sipedon
Red-bellied water snake	Natrix erythrogaster eryythrogaster
Brown water snake	Natrix taxispilota
Eastern glossy water snake	Natrix rigida
Eastern garter snake	Thamnophis sirtalis sirtalis
Eastern ribbon snake	Thamnophis sauritus sauritus
Rough earth snake	Virginia striatula
Eastern smooth earth snake	Virginia valeriae
Northern red-bellied snake	Storeria occipitomaculata
Midland brown snake	Storeria dekayi dekayi
Northern brown snake	Storeria dekayi dekayi
Eastern hognose snake	Heterodon platyrhinos
Eastern worm snake	Carphophis amoenus amoenus
Southern ringneck snake	Diadophis punctatus punctatus
Rough green snake	Opheodrys aestivus
Rainbow snake	Farancia erytrogramma
Eastern mud snake	Farancia abacura
Northern black racer snake	Coluber constrictor constrictor
Black rat snake	Elaphe obsoleta obsoleta
Corn snake	Elaphe guttata guttata
Northern scarlet snake	Cemophora coccinea
Eastern milk snake	Lampropeltis triangulum triangulum
Scarlet kingsnake	Lampropeltis triangulum elapsoides
Mole snake	Lampropeltis calligaster rhombomaculata
Eastern kingsnake	Lampropeltis getulus getulus
Eastern cottonmouth snake	Agkistrodon piscivorus piscivorus
Northern copperhead snake	Agkistrodon contortrix mokasen
Southern copperhead snake	Agkistrodon contortrix contortrix
Canebrake snake	Crotalus horridus atricaudatus

Salamanders (1)

Two-toed amphiuma salamander	Amphiuma means
Dwarf waterdog	Necturus punctatus
Red-spotted newt	Notophthalmus viridescens viridescens
Eastern tiger salamander	Ambystoma tigrinum tigrinum
Spotted salamander	Ambystoma maculatum
Marbled salamander	Ambystoma opacum
Southern dusky salamander	Desmognathus auriculatus
Northern red salamander	Pseudotriton ruber ruber
Eastern mud salamander	Pseudotriton montanus montanus
Many lined salamander	Stereochilus marginatus
Slimy salamander	Plethodon glutinosus glutinosus
Red-backed salamander	Plethodon cinereus cinereus
Four-toed salamander	Hemidactylium scutatum
Southern two-lined salamander	Eurycea bislineata bislineata
Three-lined long-tailed salamander	Eurycea longicauda guttolineata

Toads and Frogs (1)

Eastern spadefoot toad	Scaphiopus holbrooki holbrooki
Eastern narrow-mouthed toad	Gastrophryne olivacea
Woodhouse's toad	Bufo woodhousei woodhousei
Oak toad	Bufo quercicus
Barking treefrog	Hylactophryne augusti latrans
Northern spring peeper	Hyla crucifer
Green treefrog	Hyla cinera
Squirrel treefrog	Hyla squirella
Pine woods treefrog	Hyla femoralis
Gray treefrog	Hyla versicolor
Little grass frog	Limnaoedus ocularis
Upland chorus frog	Pseudacris triseriata feriarum
Northern cricket frog	Acris crepitans crepitans
Southern cricket frog	Acris gryllus gryllus
Green frog	Rana clamitans melanota
Bullfrog	Rana catesbeiana
Southern leopard frog	Rana utricularia
Pickerel frog	Rana palustris
Carpenter frog	Rana virgatipes

MAMMALS

Pouched Mammals (1)

Opossum	Didelphis marsupialis

Shrews and Moles (1)

Southeastern shrew	Sorex longirostris
Least shrew	Cryptotis parva
Shorttail shrew	Blarina brevicauda
Starnose mole	Condylura cristata
Eastern mole	Scalopus aquaticus

Bats (1)

Keen myotis	Myotis keeni
Little brown myotis	Myotis lucifugus
Silver-haired bat	Lasionycteris noctivagans
Eastern pipistrel	Pipistrellus subflavus
Red bat	Lasiurus borealis
Big brown bat	Eptesicus fuscus
Hoary bat	Lasiurus cinereus
Seminole bat	Lasiurus seminolus
Eastern yellow bat	Lasiurus intermedius
Eastern big-eared bat	Plecotus rafinesquei

Carnivors (1)

Raccoon	Procyon lotor
Longtail weasel	Mustela frenata
Mink	Mustela vison

River otter	Lutra canadensis
Stripped skunk	Mephitis mephitis
Red fox	Vulpes fulva
Gray fox	Urocyon cinereoargeneteus

Gnawing Mammals (1)

Woodchuck	Marmota monax
Eastern chipmunk	Tamias striatus
Eastern gray squirrel	Sciurus carolinensis
Eastern fox squirrel	Sciurus niger
Southern flying squirrel	Glaucomys volans
Beaver	Castor canadensis
Eastern harvest mouse	Reithrodontomys humulis
White-footed mouse	Peromyscus leucopus
Cotton mouse	Peromyscus gossypinus
Golden mouse	Peromyscus nuttalli
Rice rat	Oryzomys palustris
Hispid cotton rat	Sigmodon hispidus
Southern bog lemming	Synaptomys cooperi
Meadow vole	Microtus pennsylvanicus
Pine vole	Pitymys pinetorum
Muskrat	Ondatra zibethica
Meadow jumping mouse	Zapus hudsonius

Pikas, Hares, and Rabbits (1)

Eastern cottontail	Sylvilagus floridanus
Marsh rabbit	Sylvilagus palustris

Even-Toed Hoofed Mammals (1)

Whitetailed deer	Odocoileus virginianus

AQUATIC

Fish (3)

American eel	Anguilla rostrata
Conger eel	Conger americanus
Blueback herring	Alosa aestivalis
Alewife	Alosa pseudoharengus
American shad	Alosa sapidissima
Atlantic menhaden	Brevoortia tyrannus
Gizzard shad	Dorosoma cepedianum
Bay anchovy	Anchoa mitchilli
Striped anchovy	Anchoa hepsetus
Chain pickerel	Esox niger
Inshore lizardfish	Synodus foetens
Carp	Cyprinus carpio
Golden shiner	Notemigonus crysoleucas
White catfish	Ictalurus catus
Yellow bullhead	Ictalurus natalis
Brown bullhead	Ictalurus nebulosus

Channel catfish	Ictalurus punctatus
Oyster toadfish	Opsanus tau
Clingfish	Gobiesox spp.
Skilletfish	Gobiesox strumosus
Goosefish	Lophius americanus
Red hake	Urophycis chus
Spotted hake	Urophycis regius
Striped cusk-eel	Rissola marginata
Mummichog	Fundulus heteroclitus
Banded killifish	Fundulus diaphanus
Striped killifish	Fundulus majalis
Mosquitofish	Gambusia affinis
Rough silverside	Membras martinica
Tidewater silverside	Menidia beryllina
Atlantic silverside	Menidia menidia
Lined seahorse	Hippocampus erectus
Northern pipefish	Syngnathus fuscus
White perch	Morone americanus
Striped bass	Morone saxatilis
Black seabass	Centropristis striata
Pumpkinseed	Lepomis gibbosus
Bluegill	Lepomis macrochirus
Redear sunfish	Lepomis microlophus
Black crappie	Pomoxis nigromaculatus
Yellow perch	Perca flavescens
Bluefish	Pomatomus saltatrix
Weakfish	Cynoscion regalis
Spot	Leiostomus xanthurus
Kingfish	Menticirrhus spp.
Atlantic croaker	Micropogon undulatus
Tautog	Tautoga onitis
White mullet	Mugil curema
Striped blenny	Chasmodes saburrae
Feather blenny	Hypsoblennius hentzi
Sand lance	Ammodytes spp.
Naked goby	Gobiosoma bosci
Seaboard goby	Gobiosoma ginsburgi
Green goby	Microgobius thalassinus
Atlantic mackerel	Scomber scombrus
Butterfish	Peprilus triacanthus
Northern searobin	Prionotus carolinus
Striped searobin	Prionotus evolans
Smallmouth flounder	Etropus microstomus
Summer flounder	Paralichthys dentatus
Windowpane	Scophthalmus aquosus
Winter flounder	Pseudopleuronectes americanus
Hogchoker	Trinectes maculatus
Blackcheek tonguefish	Symphurus plagiusa
Northern puffer	Sphoeroides maculatus

INVERTEBRATES

Crustaceans (2)

Fiddler crab	Uca minax

BOTANICAL

Plants (3)

Cyperus sp.	Meadow foxtail
Large salt marsh aster	Broomsedge
Soft-stem rush	Smartweed
Phragmites	Black cherry
Smooth paspalum	Asiatic dayflower
Saltmarsh fleabane	Sweetgum
Marsh foxtail	Willow
Purple top sedge	False nettle
Goldenrod sp.	Hydrocotyle
American threesquare	English platain
Poison ivy	Dwarf spikerush
Japanese honeysuckle	Dock
Smooth sumac	Groundsel tree

(1) All species listed are based on information obtained from the Peterson Field Guides, utilizing maps and plates showing specie seasonal geographic ranges and migratory pathways (Peterson, 1980), (Conant, 1975), and (Burt/Grossenheider, 1976).

(2) Fiddler crab identification was based on visual observation compared with anatomical and color identification markings utilizing the Guide to Identification of Marine and Estuarine Invertebrates (Gosner, 1971).

(3) All listings of fish and plant species were obtained from the Fish and Wildlife Plan for Norfolk Naval Base (USDI, United States Fish and Wildlife Service, 1988).

APPENDIX E

APPENDIX E
GEOPHYSICAL REPORT

GEOPHYSICAL INVESTIGATION OF CAMP ALLEN LANDFILL AREAS A AND B NAVAL BASE, NORFOLK, VIRGINIA

CONTRACT TASK ORDER 0084

Prepared For:

BAKER ENVIRONMENTAL, INC.
Coraopolis, Pennsylvania

Prepared By:

WESTON GEOPHYSICAL CORPORATION

MARCH 1993

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A Geophysical Data

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1.0 INTRODUCTION AND OBJECTIVES

A multidisciplinary geophysical survey was undertaken at the Camp Allen Landfill to characterize subsurface conditions at and around the landfill. The Camp Allen Landfill is subdivided into Areas A and B, which are separated by the Salvage Yard. The objective of the geophysical activities at Area A was to map a suspected buried drainage channel by evaluating the continuity of a clay layer, which sometimes acts as a confining unit between the uppermost aquifer (Columbia Group) and the Yorktown Aquifer. Electromagnetic (EM) terrain conductivity profiling, electrical resistivity soundings, and borehole geophysical logging were utilized to achieve this objective. At Area B, non-invasive geophysical techniques were used to delineate areas of buried waste and metal objects and to identify potential drilling hazards at specific subsurface boring locations. Electromagnetic terrain conductivity, magnetometry, and ground penetrating radar were used to accomplish these objectives.

2.0 METHODS OF INVESTIGATION

2.1 Survey Control

Geophysical data obtained during the survey of Area A were referenced by taped distance measurements to monitoring wells, roads, fences, and other physical and cultural features on site. Figure 2-1 shows Area A, including surface structures (present at the time of the survey), and geophysical traverses, point test locations, and wells.

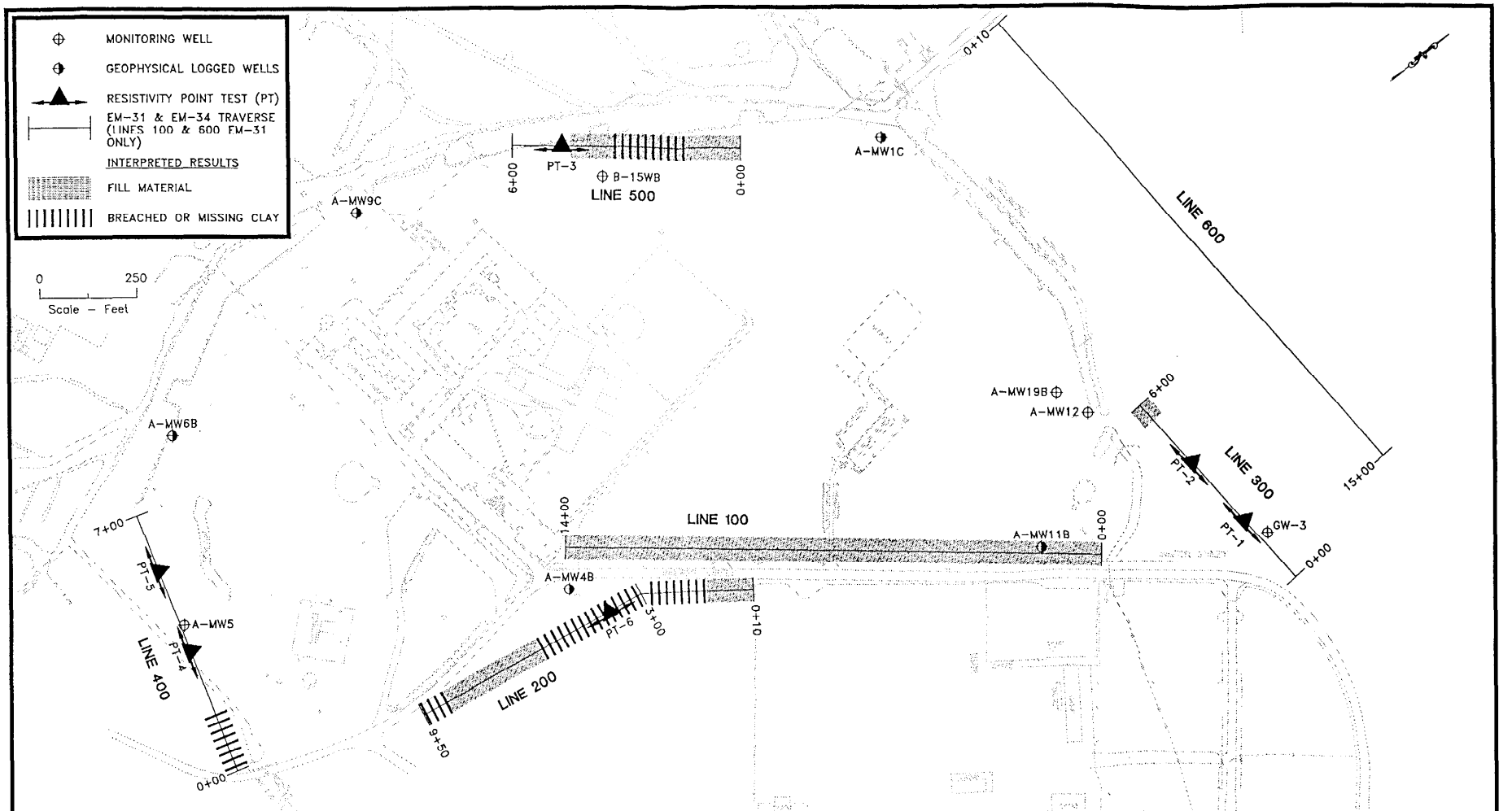
A 20 x 20-foot survey grid was established on Area B using the fence along the west side of the site as reference, i.e., a base line. Over the extent of Area B, the survey grid served as lines of geophysical coverage. The geophysical investigation was extended beyond the landfill perimeter to the south into a vacant, grassy field to determine if the landfill extended into this area. Figure 2-2 shows Area B, including surface structures (present at the time of the survey), and specific lines of geophysical coverage and proposed boring locations.

Surveys to clear borehole locations at Area B were conducted along orthogonal lines of coverage centered at the proposed boring location.

2.2 Electromagnetic Terrain Conductivity

The conductivity of subsurface materials is determined by measuring the response of the ground to an induced magnetic field. Factors affecting in-situ conductivity include porosity, moisture content, clay content, and the conductivity of subsurface fluids and materials. Former excavations or landfill boundaries may be detected through measurement of lateral variations in soil conductivity. This method may also be used to infer the presence of buried metal objects, such as drums, tanks, or utilities.

Electromagnetic (EM) terrain conductivity profiling was performed at both Areas A and B to delineate buried debris and to locate buried metal objects, as well as to map the lateral extent of a suspected clay thought to be present beneath the uppermost aquifer at Area A. Instrumentation utilized during this survey included Geonics models EM-31 and EM-34. The EM-31 is a fixed coil device with a maximum investigative depth of approximately 15 feet. EM-31 data were acquired in the vertical dipole mode at 5-foot intervals along each traverse. Conductivity and in-phase measurements were performed at each station to more confidently



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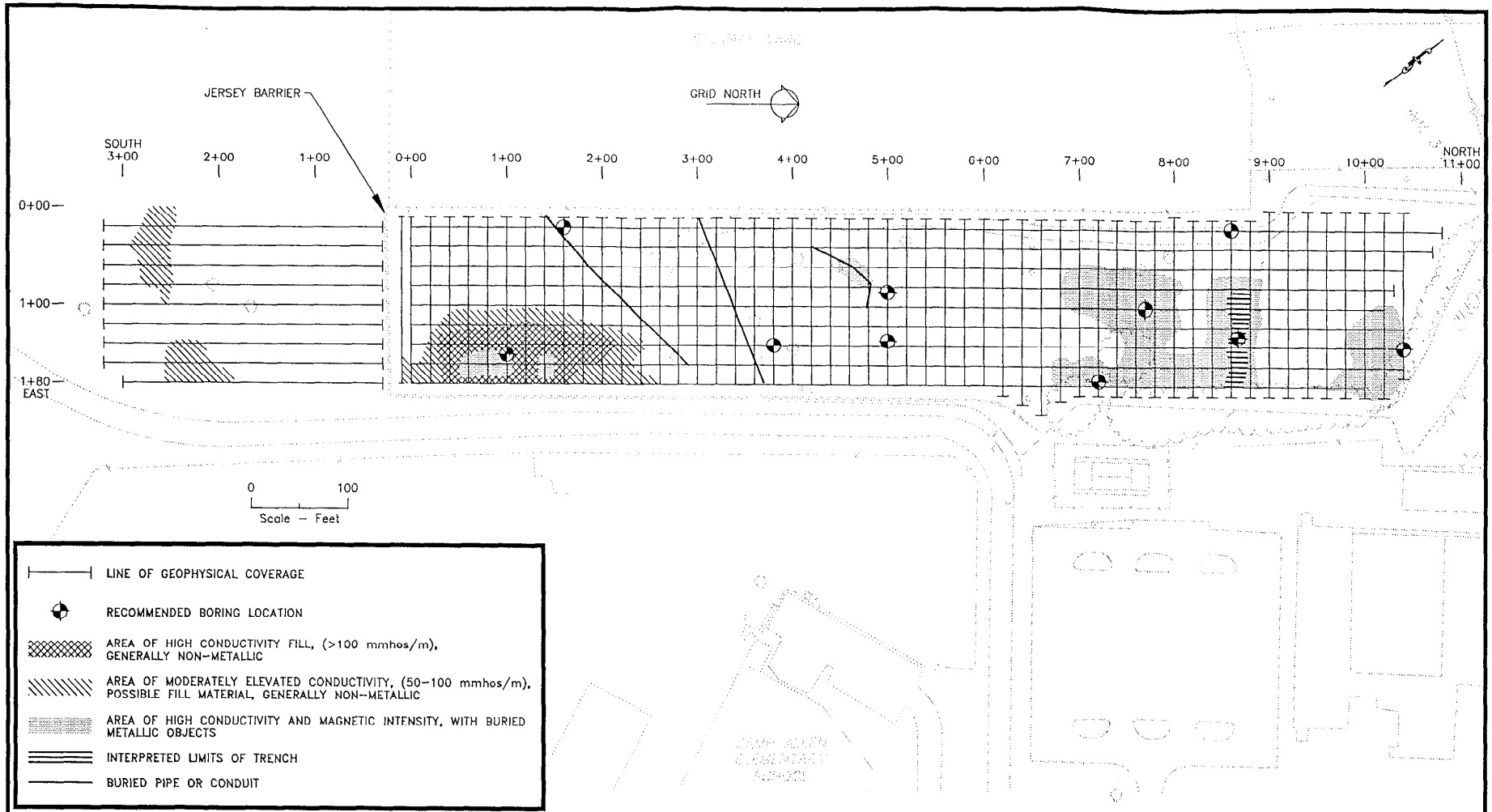
AREA A
GEOPHYSICAL COVERAGE, INTERPRETED EM AND POINT TEST RESULTS

SCALE GRAPHIC | DATE 2/93

FIGURE 2-1



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GEOPHYSICAL INVESTIGATION
CAMP ALLEN LANDFILL – AREAS A AND B
NORFOLK, VIRGINIA
PREPARED FOR BAKER ENVIRONMENTAL, INC

WESTON GEOPHYSICAL CORP.
Coraopolis, Pennsylvania

Baker
Baker Environmental, Inc.
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AREA B
GEOPHYSICAL COVERAGE, INTERPRETED EM AND MAGNETIC RESULTS

SCALE GRAPHIC | DATE 2/93

FIGURE
2–2

distinguish metallic objects from nonmetallic objects or natural earth materials with high electrical conductivity.

Both the quadrature-phase (terrain conductivity) and in-phase components of the EM field were measured in the vertical dipole mode. The quadrature-phase component provides a measurement of soil conductivity in units of millimhos/meter (mmhos/m), while the in-phase component is measured in parts per thousand (ppt) of the primary magnetic field.

The EM-34 was operated using a 10-meter coil separation in both the horizontal and vertical dipole modes. The investigative depths for the EM-34 are approximately 25 feet in the horizontal dipole mode, and 50 feet in the vertical dipole mode. These depth ranges were judged to be sufficient to detect the confining clay unit at its anticipated maximum depth of about 30 feet.

EM-31 data were recorded using a digital data logger and downloaded to a portable computer prior to contouring and interpretation. EM-34 data were noted in a field logbook, and profiled prior to interpretation.

2.3 Magnetometry

Magnetic profiling was performed to complement the interpretation of subsurface debris and objects within Area B. A digital proton precession magnetometer, Geometrics model G-856X, was utilized during this survey. Magnetic data were acquired at 20-foot stations along parallel lines spaced at twenty feet. A magnetic base station was reoccupied at approximately one hour intervals during the survey to facilitate adjustment of the data for natural daily variations due to solar activity. Perturbations to the ambient magnetic field are indicative of nearby ferrous metal, the magnitude of which are a function of the mass of the metal object.

The magnetic data were downloaded to a portable computer, corrected for diurnal drift, and both profiled and contoured prior to interpretation. The magnetic contour map was then compared to EM conductivity and in-phase data to determine whether specific EM anomalies were caused by ferrous or nonferrous buried objects or fill.

2.4 Ground Penetrating Radar

Ground penetrating radar (GPR) is an electromagnetic survey technique that reveals a graphic cross-sectional view of subsurface stratigraphy and buried objects (i.e., drums, pipelines, tanks, boulders, etc.). Data acquisition is continuous along lines of coverage and a graphic recorder provides an immediate view of the data, yielding both horizontal (lateral) and vertical (depth) control information. Penetration (typically 2-8 feet) and resolution are determined by the frequency of the antenna, but overall effectiveness of GPR can be limited by highly reflective materials such as water-saturated clay, salt, slag, or highly conductive materials.

GPR profiling was completed with analog instrumentation consisting of a GSSI SIR-7 mainframe, Adtek graphic recorder, and 500 megahertz antenna. This antenna was selected to provide high-resolution recordings of objects within a few feet of the ground surface.

GPR profiles were obtained along grids centered at ten proposed boring locations, with additional traverses completed, if needed, to identify boring locations that were relatively free of buried objects. Drilling was to be completed within the waste materials and direct contact with buried objects was to be avoided. Recommendations regarding each proposed boring's proximity to buried wastes or objects were provided to Baker Environmental during the geophysics field program to allow for boring locations to be moved as needed for personnel safety.

2.5 Electrical Resistivity Soundings

Electrical resistivity soundings were acquired at selected positions around Area A to aid in definition of the presence or absence of the confining clay layer. Each Wenner array sounding consisted of twelve or thirteen resistivity measurements, using electrode separations ranging from 2 to 100 feet. An ABEM Terrameter SAS-300B resistivity instrument served as both the transmitter and receiver during this survey.

Resistivity measurements were recorded on data sheets in the field and "geoelectrical" stratigraphy subsequently determined utilizing computer modeling techniques. The thickness and electrical resistivities of strata beneath each sounding position were then correlated with EM terrain conductivity and borehole geophysical logging results to infer the presence or absence of the confining clay layer.

2.6 Borehole Geophysical Logging

Geophysical logging of monitoring wells was undertaken using digital instrumentation, a Robertson Portalogger, with a combination natural gamma and inductive conductivity sonde. Naturally occurring radioactive minerals, such as potassium, is common in clay as a result of weathering processes. The inductive conductivity system, similar to surface electromagnetic conductivity profiling, measures the electrical conductivity of the strata 20-30 inches outside the borehole.

Both types of logs are obtainable through PVC casing without any appreciable adverse affect. However, only gamma logs can be obtained in steel cased holes, where the steel acts as a very conductive medium preventing investigation of materials beyond the borehole.

As each well was logged, data were recorded on both magnetic diskette and hardcopy to provide duplicate data storage and immediate field examination of the data. The geophysical logs were compared with stratigraphic descriptions, where available, and the resistivity and EM terrain conductivity results to interpret the presence or absence of the confining clay layer.

3.0 RESULTS

3.1 Area A

Electrical resistivity soundings, EM terrain conductivity profiling, and borehole geophysical logging were utilized in an effort to determine the continuity of a clay layer and to identify a possible drainage channel(s) that may have breached the confining clay layer in the vicinity of Area A. Figure 2-1 shows the positions of resistivity soundings, EM traverses, and monitoring wells that were geophysically-logged during this survey.

3.1.1 Resistivity Soundings

Resistivity sounding data and computer modeling results are presented in Attachment A. Each sounding diagram includes the field data (solid line), numerically modeled curve (dashed line), and a description of the layer thicknesses and resistivities used to generate the modeled curve.

Six soundings were completed at the positions shown on Figure 2-1. Sounding positions were determined in the field after examining EM terrain conductivity data. Electrode separations were constrained by roadways, swamps, buried utilities, or other physical barriers or sources of electrical interference. Soundings were not attempted along Lines 100 and 600 due to the proximity of landfill materials and a chain-link fence, respectively, which would have been sources of interference and rendered those sounding data unfit for interpretation.

The modeled layers for each of the point tests, along with the corresponding resistivity values and thicknesses are provided in Table 3-1. Total depths of investigation ranged from 18 to 47 feet and were primarily a function of the maximum electrode spacing and the resistivity of the subsurface material at each point test. Analysis of the modeled resistivity data entailed identifying the presence or absence of low-resistivity (on the order of 20 ohm-feet) strata, interpreted to be indicative of clay. Summary interpretations for each of the soundings and comparison to lithologic logs for nearby borings are as follows:

TABLE 3-1

RESISTIVITY (POINT TEST) SOUNDINGS ALONG WITH MODELED LAYER RESISTIVITY VALUES AND THICKNESS

Point Test	Layer No.	Resistivity (ohm-feet)	Thickness (feet)	Depth to Bottom (feet)
PT-1	1	971	0.8	0.8
	2	20	1.2	2.0
	3	500	15.7	17.7
	4	129	Unknown*	--
PT-2	1	514	0.9	0.9
	2	66	4.5	5.4
	3	400	3.8	9.2
	4	21	12.4	21.6
	5	1,319	Unknown*	--
PT-3	1	62	3.2	3.2
	2	18	34.9	38.1
	3	203	Unknown*	--
PT-4	1	1,495	0.7	0.7
	2	24	40.0	40.7
	3	88	Unknown*	--
PT-5	1	16	5.0	5.0
	2	7	24.3	29.3
	3	8	Unknown*	--
PT-6	1	8,914	2.1	2.1
	2	524	4.6	6.7
	3	151	40.0	46.7
	4	88	Unknown*	--

* The thickness of this layer in the model cannot be determined without increasing the electrode spacing.

Sounding Interpretation

PT-1 Clay layer interpreted between depths of 1 to 2 feet. Monitoring well GW-3, located 60 feet east of sounding PT-1, did not encounter clay between ground surface and the end of the boring at 24 feet (investigation depth = 18 feet).

PT-2 A conductive layer, possibly clay, is inferred between depths of 9 to 22 feet. Well A-MW12, the closest monitoring well for which lithologic logs were available, encountered clay between a depth of 15 feet and the end of the boring at 20 feet (investigation depth = 22 feet).

PT-3 Clay is inferred between depths of 3 to 38 feet. Well B-15WB is 100 feet from the point test and encountered clay and silt from 4 to 18 feet (investigation depth = 38 feet).

PT-4 A clay layer is inferred between depths of about 1 to 41 feet. Nearby well A-MW5 encountered clay between ground surface and the end of boring at a depth of 25 feet (investigation depth = 41 feet).

PT-5 A clay layer is interpreted from near ground surface to a depth of 29 feet, which is also consistent with well A-MW5 (investigation depth = 29 feet).

PT-6 Resistivity values are relatively high for all layers with clay absent to a depth of at least 46 feet. Near-surface high-resistivity material may be granular fill. A 40-foot thick layer of intermediate resistivity material (150 ohm-feet) may represent water-saturated sand. Well A-MW4B is 150 feet from the point test and encountered a clay layer between depths of 37 to 48 feet (investigation depth = 46 feet).

The abrupt variation in interpreted clay thickness between soundings PT-1 and PT-2, which were only 200 feet apart, indicate a the variability of the lithologies within the Columbia Group.

Only sounding PT-6 did not detect significant clay layer thicknesses within 40 feet of the ground surface.

3.1.2 EM Terrain Conductivity

EM terrain conductivity measurements were completed along the traverses shown on Figure 2-1 in an effort to determine the lateral limits of suspected drainage channels. The drainage channel(s), if present, would be represented by lower conductivity values where the clay had been eroded as compared to where the clay layer remained intact, i.e., on either side of the drainage channel.

As a basis for interpretation of the EM data and for comparison between lines, relatively low values of conductivity along the profile, typically values less than 60 mmhos/m, have been established as indicative of the absence of the confining clay layer and the presence of a drainage channel. The line profiles are provided in Attachment A and summary interpretations for each EM traverse are provided below.

Line 100

Line 100 was located on the northwest side of Ingersol Street, and was intended to be positioned between the perimeter of Area A and power lines that parallel the roadway. The high conductivities and erratic nature of the data indicate that numerous metal objects underlie most of this traverse and that the landfill extends closer to the roadway than was originally thought. Due to the interference caused by these landfill materials, no conclusions can be obtained regarding the absence or presence of the confining clay layer on this side of Ingersol Street. EM-34 profiling was not performed along this traverse due to anticipated interference from the landfill and power lines.

Line 200

This traverse was located across Ingersol Street from the Brig and was expected to be in a region free of landfill materials. The EM-31 and -34 data profiles indicate that fill, including metal objects, was encountered between stations 0+00 through 1+20 and 6+00 through 8+80. The presence or absence of the confining clay layer in these areas of fill is masked by the erratic EM conductivities caused by the fill itself.

Excluding the areas of fill, EM conductivity values were consistently less than 30 mmhos/m between stations 1+25 to 6+00, indicating a general absence of clay and the possibility of a drainage channel. At station 4+00, the resistivity sounding PT-6 model showed no clay to at

least a depth of 46 feet. Well A-MW4B (at 120 feet right of station 4+50) indicated an 11-foot layer of clay between depths of 37 to 48 feet.

Line 300

EM conductivity data from Line 300, located northeast of the landfill, indicates the presence of large metallic objects in the vicinity of stations 5+60 through 6+00. However, a gradational boundary between sand and clay may be inferred from resistivity soundings PT-1 and PT-2 along Line 300, and may also be evident in the conductivity increase from station 3+00 to 4+00. EM-31 conductivity values increase from background levels of 20 to 30 mmhos/m (between stations 0+00 and 3+00) to 80 to 100 mmhos/m upstation of 4+00. The clay layer in the Columbia Group could thus be thin on the low station end of Line 300, as modeled by PT-1 at station 2+00, and gradually thicken between station 3+00 to 4+00, as modeled by PT-2 at station 4+00. No inferences can be made about the confining clay unit as depths of investigation here were relatively shallow, 15 to 20 feet below ground surface.

Line 400

Line 400 was located to the south of the landfill. A power line crossing at station 1+50 and 3+50 adversely affected EM measurements in the vertical dipole mode. Conductivity values on the order of 60 mmhos/m and less, consistent with the presence of a drainage channel, were measured between stations 0+00 and approximately 1+50.

The conductivity peak centered near Station 2+50 on both the EM-31 and EM-34 (HDM) profiles is coincident with a surface drainage channel which Line 400 crossed. The elevated conductivity values near the surface channel may be due to locally increased water saturation of near surface materials or the presence of relatively higher conductive materials/fluids in the channel.

Resistivity soundings PT-4 and PT-5 both modeled a thick clay layer present at station 3+30 and at station 5+50. The conductivity data profiles reflected a region of higher conductivity between stations 4+00 through 7+00, in the vicinity of PT-5. These elevated conductivities may represent more highly saturated clay, or possibly landfill leachate.

Line 500

Line 500 was located at the northwest perimeter of the landfill in a marshy area. EM-34 (VDM) data were erratic, indicative of the proximity to landfill materials. Similarly, the EM-31 data indicate possible landfill materials - of limited thickness - at the low station end of Line 550, from station 0+00 to 4+50. Natural materials and the absence of buried debris are indicated by the smooth EM-31 data profile from station 4+50 to 6+00. A large buried metallic object is interpreted between stations 2+50 to 2+75.

EM-34 HDM measurements exhibit relatively low conductivity values between station 1+50 to 3+30, consistent with a possible breach in the confining clay layer. Higher conductivity values at the ends of Line 500, i.e., downstation of 1+50 and upstation of 3+30, indicate the presence of clay. Resistivity sounding PT-3 at station 4+75 modeled a clay layer between depths of 3 to 38 feet. Boring B-15WB (at 62 feet east of station 3+90) encountered clay and silt from 4 to 18 feet below grade.

Line 600

EM-31 conductivity values along Line 600 north of the landfill were uniform and consistently less than 20 mmhos/m, indicative of clean sandy overburden to depths of 15 to 20 feet. Proximity of a chain-link fence to this traverse and the potential of interference prevented collection of reliable EM-34 or resistivity sounding data.

3.1.3 Borehole Geophysical Logging

Monitoring wells A-MW1C, A-MW4B, A-MW6B, A-MW9C, and A-MW11B were logged with a combination natural gamma and EM induction sonde during this project. Logging was attempted at well B-1W, but the PVC riser pipe was of smaller diameter than the logging sonde and thus the sonde could not be admitted to the well. Logs obtained during this project are presented in Attachment A.

The gamma log provides a record of the total gamma radiation detected in a borehole and is presented in terms of counts per second versus depth. The inductive conductivity log, similar to surface EM conductivity profiling, provides a vertical record of strata conductivity in terms of mmhos/m versus depth.

Depths of clay strata (feet below ground surface) interpreted from the gamma and conductivity logs are provided in Table 3-2. Clay beds noted on the lithologic logs are included for comparison. Also noted are the bentonite (clay) seals used in installation of the monitoring wells. Correlation between the reported depth of the bentonite seals and the geophysical logs was poor for the wells installed as part of previous site investigations (wells A-MW4B and A-MW6B).

3.2 Area B

Non-invasive geophysical techniques were used for subsurface characterization to delineate areas of buried debris and metal objects within the landfill. In addition, specific boring locations were investigated for identification of potential drilling hazards. The results of the geophysical surveys at Area B are discussed in the following subsections.

3.2.1 Subsurface Characterization

A combination of EM terrain conductivity and magnetometry was performed to delineate areas containing buried debris and metal objects. EM terrain conductivity data were acquired at 5-foot stations along 20-foot gridded traverses throughout the fenced portion of Area B. Magnetic measurements were obtained throughout the same region at 20-foot gridded stations. Following completion of the initial EM survey, additional EM coverage was obtained south of the Jersey barriers to determine whether landfill materials extended outside the fenced perimeter of Area B.

Figure 2-2 presents the lines of geophysical coverage and interpreted results, depicting locations of buried metal and electrically conductive fill materials. Contour maps of conductivity and magnetic intensity values are provided in Attachment A.

Two buried utilities (pipes or conduits) were interpreted crossing the southcentral portion of the landfill based on the EM survey results. The more northern utility had been previously located and identified (as a water line) by the Camp Allen Public Works Command (PWC) prior to the geophysical survey. The results of the EM survey correspond with the location of the water line given by the PWC at the western edge of the landfill, but show the water line to be approximately 30 feet north of the location marked by the PWC at the eastern edge of the landfill.

TABLE 3-2

DEPTH TO CLAY LAYER(S) INTERPRETED FROM GEOPHYSICAL LOG AND LITHOLOGIC LOG

Well	Interpreted Clay Strata from Gamma and Conductivity Logs (depth, feet)	Clay Strata and Description from Lithologic Logs (depth, feet)
A-MW1C		14.0 - 18.5
	25.5 - 29.0	27.0 - 40.0
	30.0 - 37.0	
	42.0 - 44.0	No Sample
	103.5 - 106.5	Sand
	110.0 - 119.0	115.0 - 118.0**
	125.0 - 126.5*	Sand
		132.0 - 137.0
		EOH @ 137.0
Possible degraded water quality 61.5 - 83.0 based on increased values of conductivity.		
A-MW4B	33.0 - 38.0	37.0 - 40.0
		40.0 - 42.0**
	49.0 - 50.0*	Silty Sand
		EOH @ 60.0
A-MW6B	28.0 - 39.0	26.5 - 35.0
	52.0 - 53.0*	Silty Sand
		46.0 - 48.0**
		EOH @ 60.0
A-MW9C		6.0 - 8.0
	26.5 - 29.0	
	30.0 - 32.0	12.0 - 42.0
	36.5 - 39.5	
	94.0 - 100.0	97.0 - 101.0**
	101.0 - 109.0*	Sand
		EOH @ 137.0
A-MW11B	37.0 - 43.0	35.0 - 53.5
		36.5 - 42.0**
		EOH @ 64.0

EOH = End of hole

* Bottom of borehole encountered during logging.

** Placement of bentonite during well installation.

The more southern buried utility crossing the landfill was not identified. The linear feature on the easterly side of the landfill between stations 4+00N to 5+00N may be the remains of an abandoned utility or buried pipe, or associated with other buried metal and ferrous metal objects detected in this area.

Buried metal and ferrous metal objects were also interpreted throughout much of the northeast corner of the landfill, as shown on Figure 2-2. A concentration of ferrous objects was located at the northeastern corner of the survey grid; these objects likely extend beyond the survey grid into thickly vegetated terrain near the pond.

A localized concentration of metal objects inferred from EM data near 8+75N, 0+85E through 1+80E is consistent with the dimensions of a backfilled trench previously reported. The position of this inferred trench is denoted on Figure 2-2.

Two broad areas of elevated EM conductivity values were observed that are consistent with electrically conductive fill. The first area is located at the eastern limit of the landfill between stations 0+0N to 2+30N. Unusually high EM conductivity values were measured, ranging from 50 to 250 mmhos/m. Localized magnetic and EM in-phase anomalies indicative of metal objects were detected at the southeast corner of the landfill, centered near Line 1+60E from stations 0+50N to 1+50N.

A second area of elevated EM conductivity values, ranging from 50 to 100 mmhos/m, was observed south of the Jersey barriers and trending east-west across the survey area as shown on Figure 2-2. Although magnetic data were not acquired south of the Jersey barriers, the absence of EM in-phase anomalies indicates the area to be relatively absent of metal objects. The elevated conductivity values may be related to a local change in overburden lithology or moisture content, or possibly to slightly conductive fill materials.

3.2.2 Drilling Hazard Survey

Ground penetrating radar (GPR) profiling was accomplished at ten proposed boring locations within Area B to identify buried waste materials that could impede drilling activities. At least two GPR traverses were obtained at each proposed boring location; the traverses intersected at the boring and extended 10 feet towards the north, south, east, and west. Additional traverses were obtained where needed in an effort to identify safe drilling locations.

Table 3-3 lists the boring positions examined during this task and suggested relocation positions, if any. Many of the proposed borings, and the suggested nearby relocation positions, are in the vicinity of interpreted metal objects as shown on Figure 2-2. A copy of this table was provided to Baker Environmental's on-site personnel at the conclusion of the field program to expedite the soil boring program.

TABLE 3-3

SUMMARY OF PROPOSED BORING LOCATIONS WITHIN AREA B, AND RELOCATION POSITIONS BASED ON GPR PROFILING RESULTS

Boring No.	Proposed Boring Location	Suggested Relocation
1	100N, 150E	
2	160N, 20E	
3	380N, 140E	
4	480N, 80E	500N, 85E *
5	500N, 140E	500N, 135E
6	720N, 175E	
7	770N, 100E	
8	870N, 130E	867N, 130E
9	1040N, 140E	*
10	860N, 20E	

* Entire area appears to contain numerous buried metal objects.

4.0 SUMMARY AND CONCLUSIONS

The objective of the geophysical survey undertaken at the Camp Allen Landfill was to characterize various subsurface conditions at and around Areas A and B.

4.1 Area A

In order to map a suspected buried drainage channel(s) at Area A, the continuity of the confining clay layer underlying the upper aquifer was evaluated utilizing electromagnetic (EM) terrain conductivity profiling, electrical resistivity soundings, and borehole geophysical logging.

Resistivity soundings and EM terrain conductivity profiling indicate that the confining clay layer may have been absent or been breached by drainage channels at three locations:

- East of Area A, as evidenced by the low conductivity values along Line 200 (stations 1+25 through 6+00) and by the modeled layers for PT-6 (station 4+00) which showed no clay layer within 40 feet of ground surface.

- Southeast of Area A, as evidenced by the low conductivity values along Line 200 (stations 8+80 through 9+50) and Line 400 (stations 0+00 through 1+50).

- Northwest of Area A, as evidenced by the low conductivity values along Line 500 (stations 1+00 through 3+30).

Also, thin clay (one foot) was noted at sounding PT-1, and 13 feet of clay at sounding PT-2. These data indicate a rapid lateral variation in the clay layer, however, the maximum investigative depths are 18 to 22 feet, and the confining clay may be present at greater depths.

Geophysical logs and lithologic descriptions substantiate the locations identified above, where the confining clay layer may have been absent or been breached by drainage channels, as follows:

- East of Area A, the geophysical and lithologic logs for boring A-MW4B (located approximately 120 feet west of Line 200 at station 4+50) indicates no clay to a depth of at least 37 feet. The clay at A-MW4B is thin (3 feet thick).

- Southeast of Area A, lithologic logs for borings B-1W and B-2, nearest the high-station end of Line 200 and the low-station end of Line 400, indicate no clay to a depth of 24 feet.

4.2 Area B

In order to delineate areas of buried debris and metal objects and to identify potential drilling hazards at specific boring locations, electromagnetic (EM) terrain conductivity profiling, magnetometry, and ground penetrating radar (GPR) surveys were conducted at Area B.

EM and magnetic survey results indicate several suspected disposal locations:

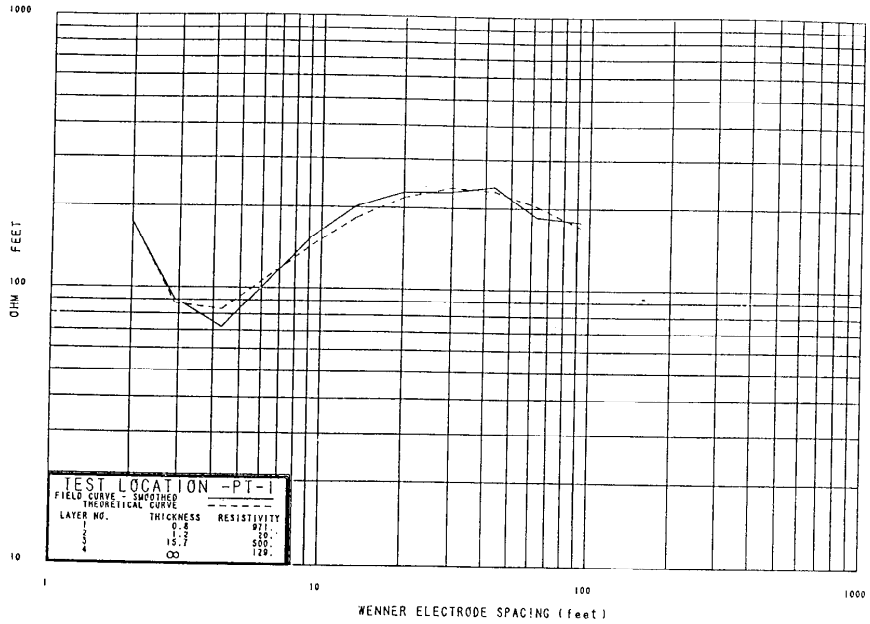
- Fill materials with limited amounts of buried metal objects were identified at the southeast corner of the landfill, immediately north and west of the Jersey barrier. This fill material exhibits unusually high EM conductivity values.

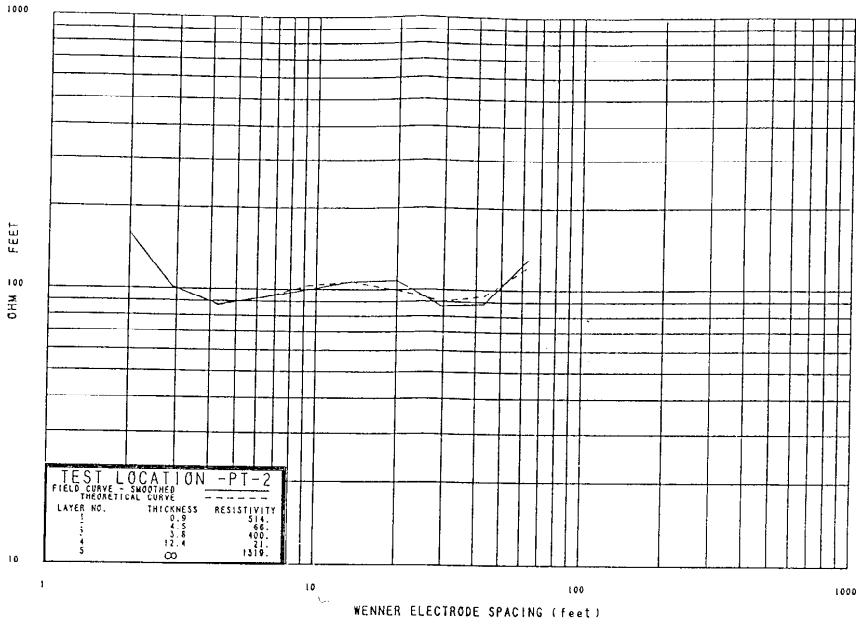
- A widespread area of disposal was delineated at the northeast corner of the landfill. Buried metallic objects were identified throughout an approximately 120 by 350-foot region. These objects probably extend to the north of the geophysical survey grid into thick vegetation surrounding the pond.

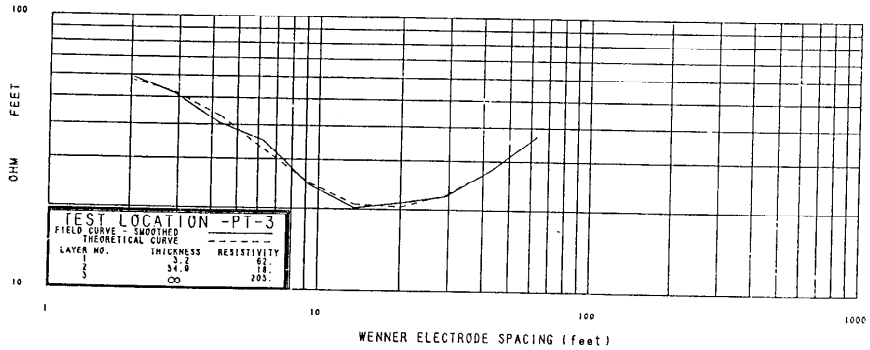
- Within the northeast corner disposal area, a west to east trending concentration of buried metal objects, with approximate dimensions of 20 by 100 feet, is interpreted to be an old disposal trench.

- An area of moderately elevated EM conductivity was noted trending west to east across the survey grid, south of the Jersey barriers and outside the suspected limits of the landfill. This area may represent local variations in overburden lithology or moisture content, or possibly an area of backfill.

GPR profiling at ten proposed boring locations within the landfill resulted in recommendations to move three borings in an effort to avoid buried objects.







prepared by P. G.	GEOPHYSICAL INVESTIGATION CAMP ALLEN LANDFILL - AREAS A AND B NORFOLK, VIRGINIA prepared for BAKER ENVIRONMENTAL, INC.	Area A Resistivity Soundings PT-1, PT-2, and PT-3
checked by MB		Weston Geophysical — Fig. A-1
reviewed by MB		

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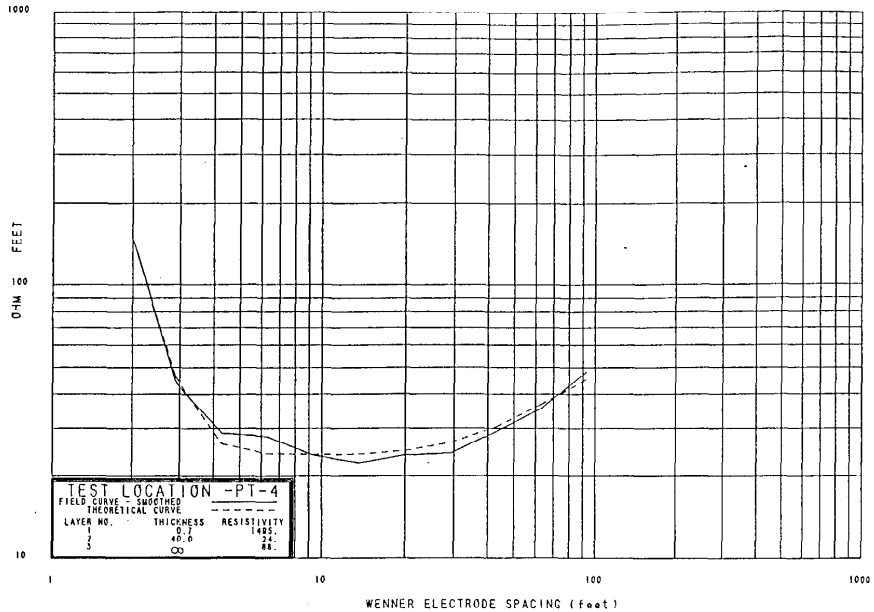
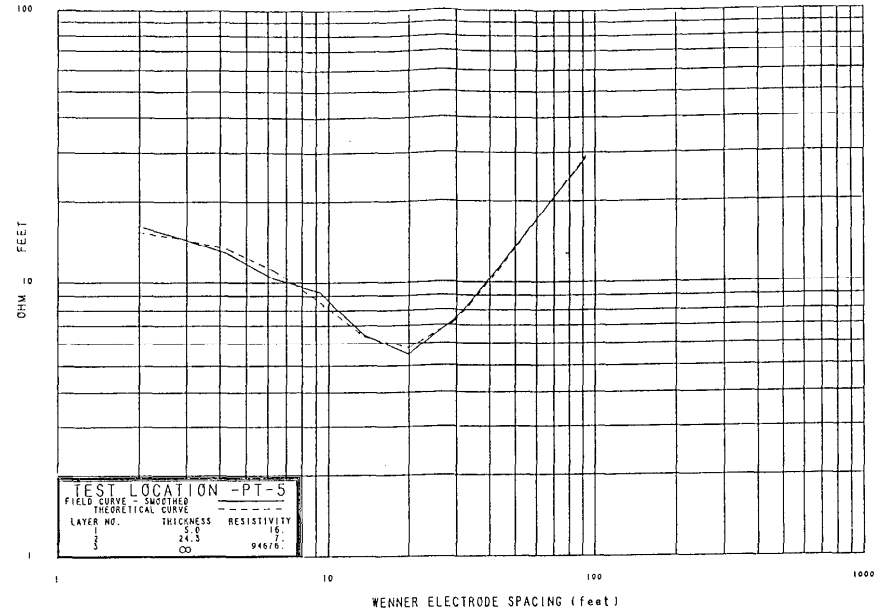
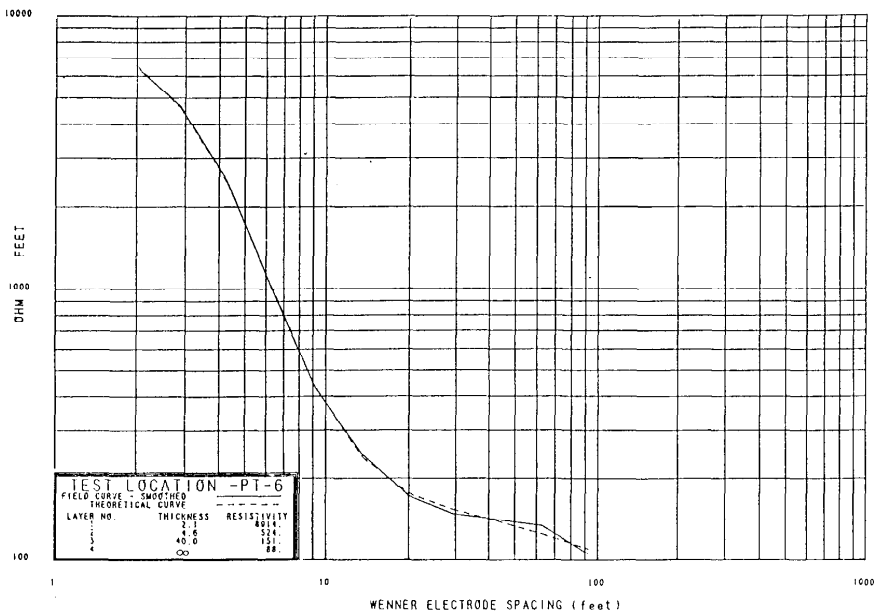
ATTACHMENT A
GEOPHYSICAL DATA







prepared by PG checked by MB reviewed by MB	GEOPHYSICAL INVESTIGATION CAMP ALLEN LANDFILL - AREAS A AND B NORFOLK, VIRGINIA prepared for BAKER ENVIRONMENTAL, INC.	**Area A** **Resistivity Soundings** **PT-4, PT-5, and PT-6** Weston Geophysical — Fig. **A-2**

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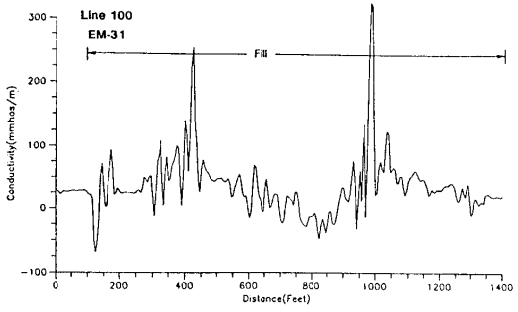

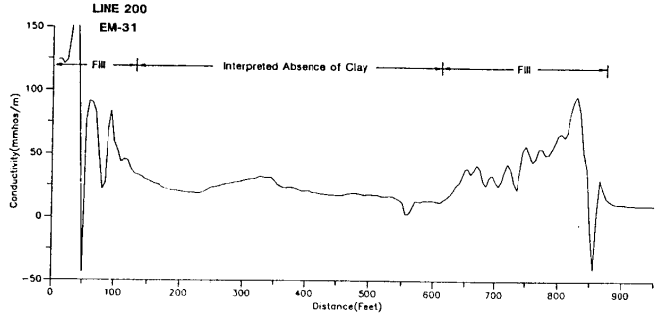

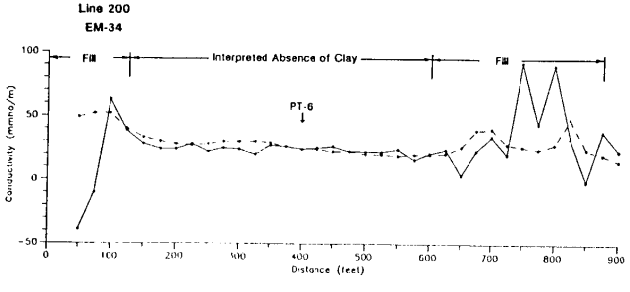

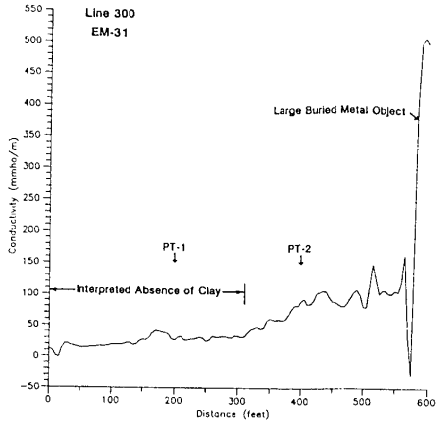

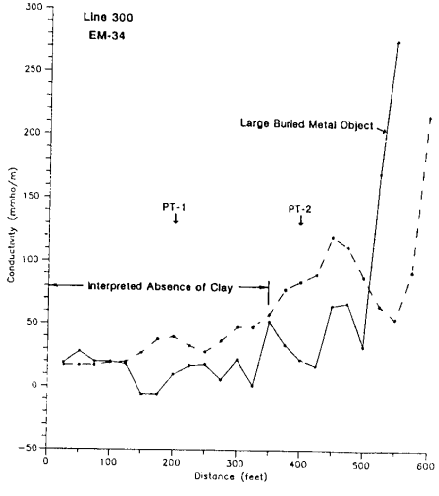

EXPLANATION

- - - - Horizontal Dipole Mode

——— Vertical Dipole Mode

prepared by DMD checked by MB reviewed by MB	GEOPHYSICAL INVESTIGATION CAMP ALLEN LANDFILL - AREAS A AND B NORFOLK, VIRGINIA prepared for BAKER ENVIRONMENTAL, INC.	**Area A** **EM Profiles** Weston Geophysical — Fig. **A-3**

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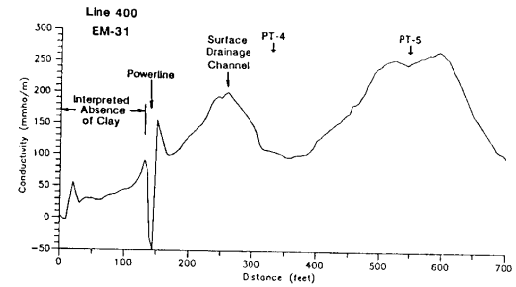

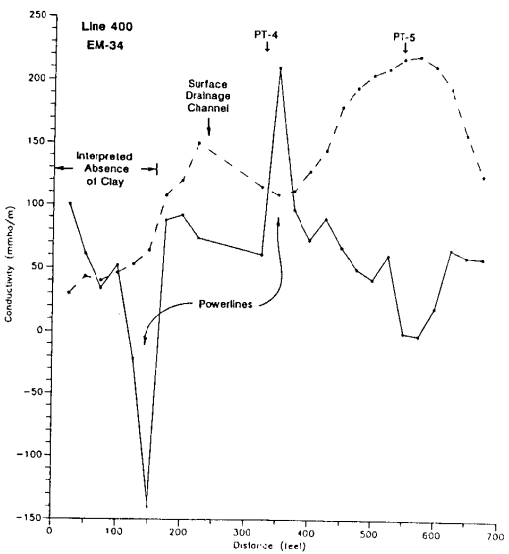

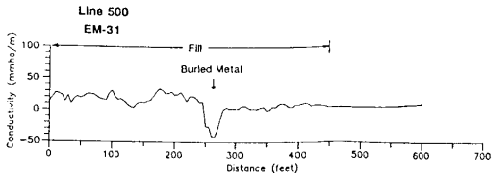

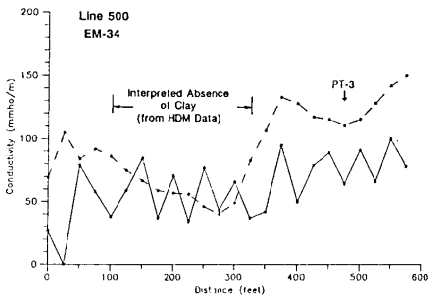

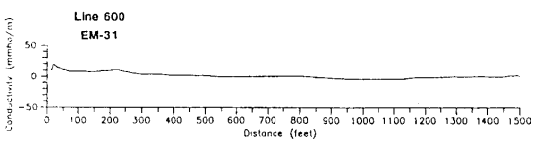

EXPLANATION

— — — Horizontal Dipole Mode

——— Vertical Dipole Mode

prepared by	GEOPHYSICAL INVESTIGATION CAMP ALLEN LANDFILL - AREAS A AND B NORFOLK, VIRGINIA prepared for BAKER ENVIRONMENTAL, INC.	Area A EM Profiles
checked by MB		Weston Geophysical — Fig. A-4
reviewed by MB		

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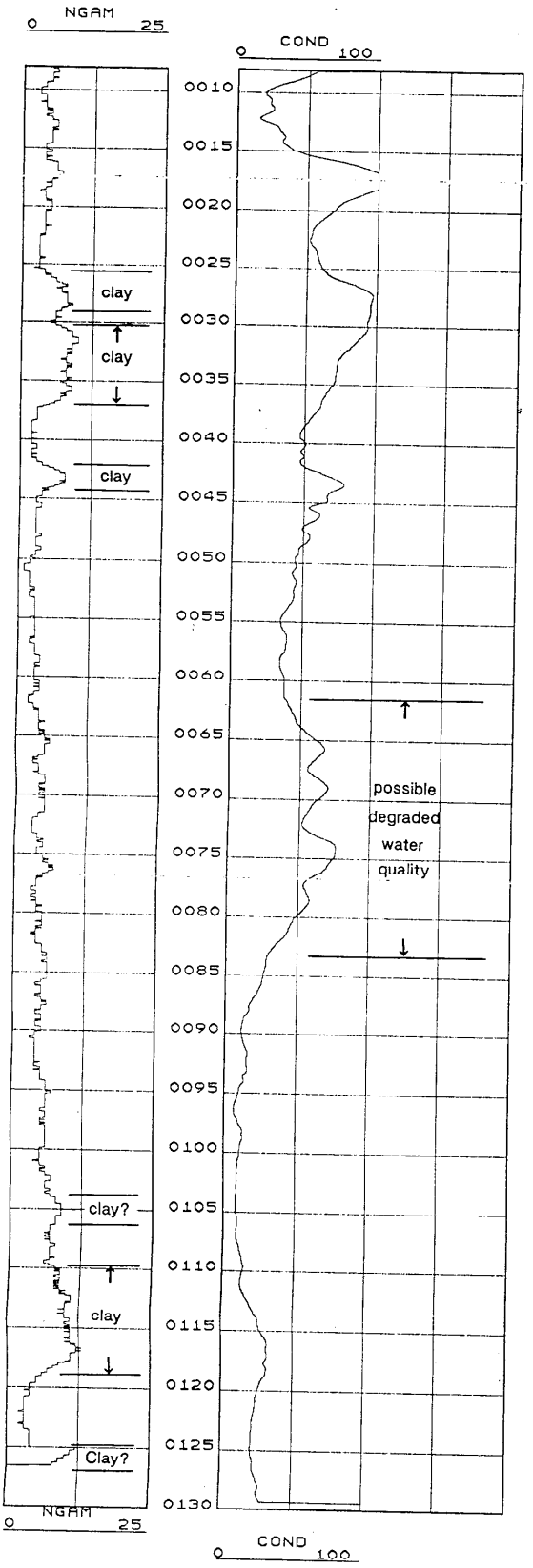
A-MW1C



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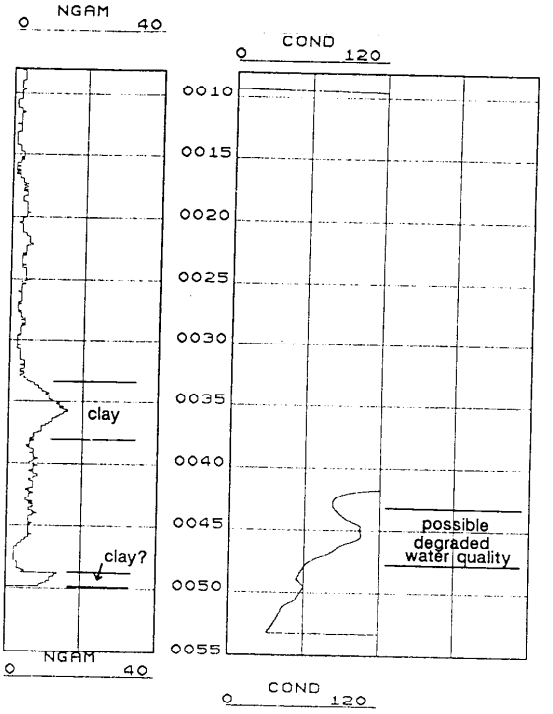

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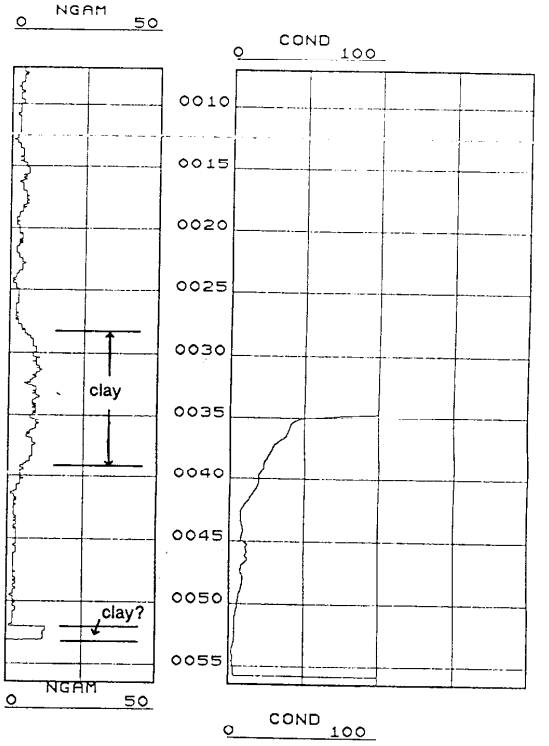
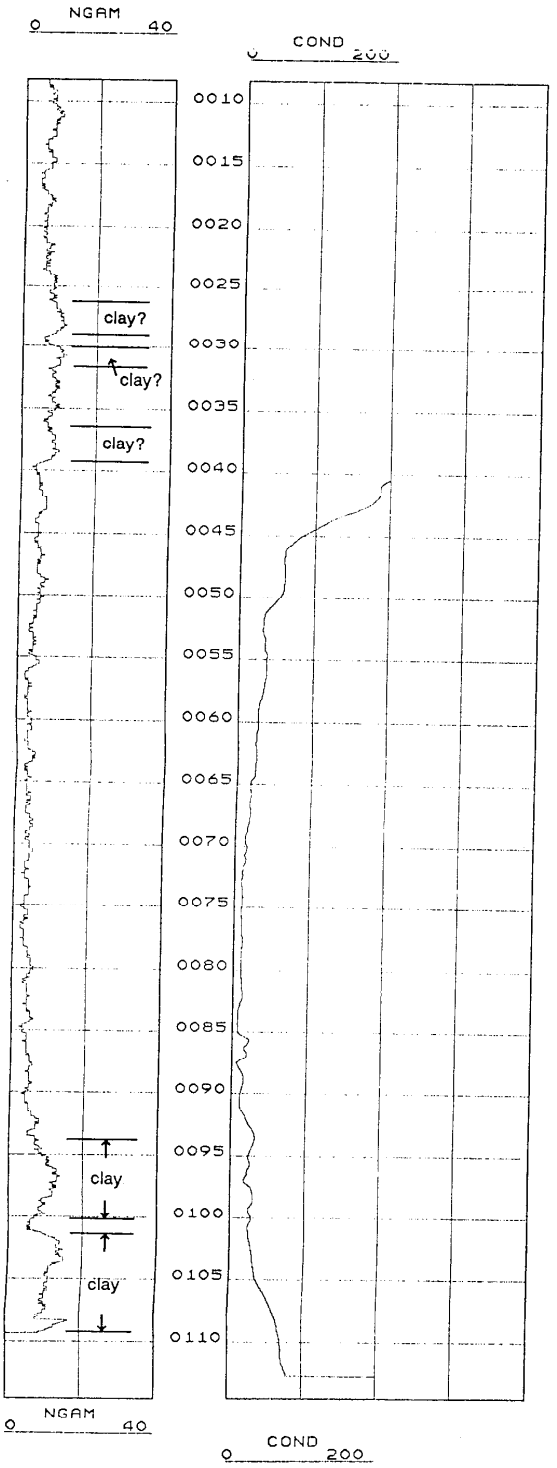
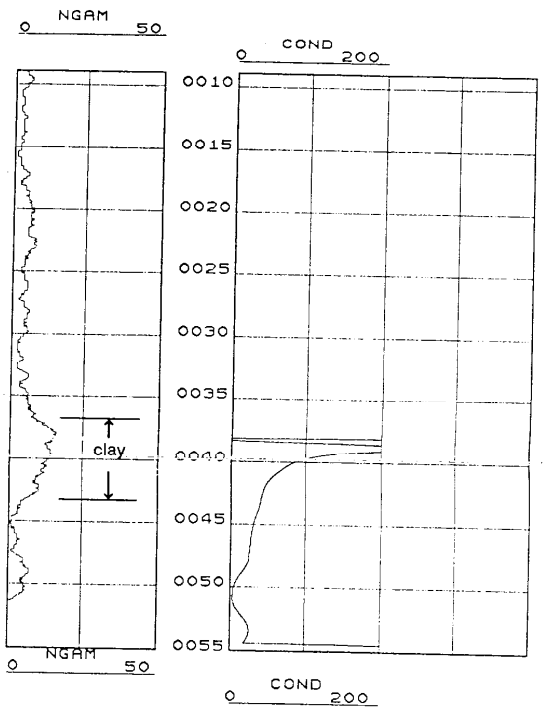


prepared by M.J.N checked by MB reviewed by MB	GEOPHYSICAL INVESTIGATION CAMP ALLEN LANDFILL - AREAS A AND B NORFOLK, VIRGINIA prepared for BAKER ENVIRONMENTAL, INC.	Area A Borehole Geophysical Logs Weston Geophysical — Fig. A-5

A-MW9C



A-MW11B



prepared by M.J.N.	GEOPHYSICAL INVESTIGATION CAMP ALLEN LANDFILL - AREAS A AND B NORFOLK, VIRGINIA prepared for BAKER ENVIRONMENTAL, INC.	**Area A** **Borehole Geophysical Logs**
checked by MB		Weston Geophysical — Fig. **A-6**
reviewed by MB		

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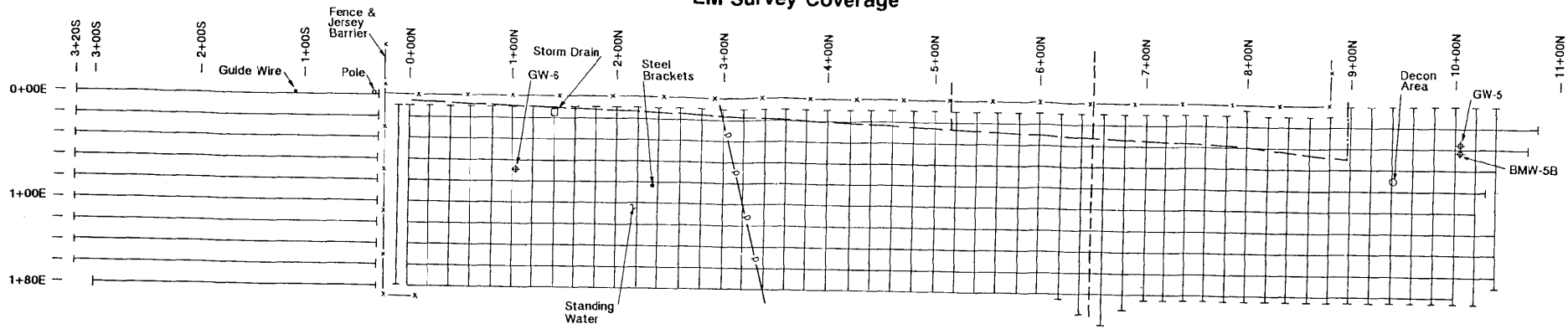
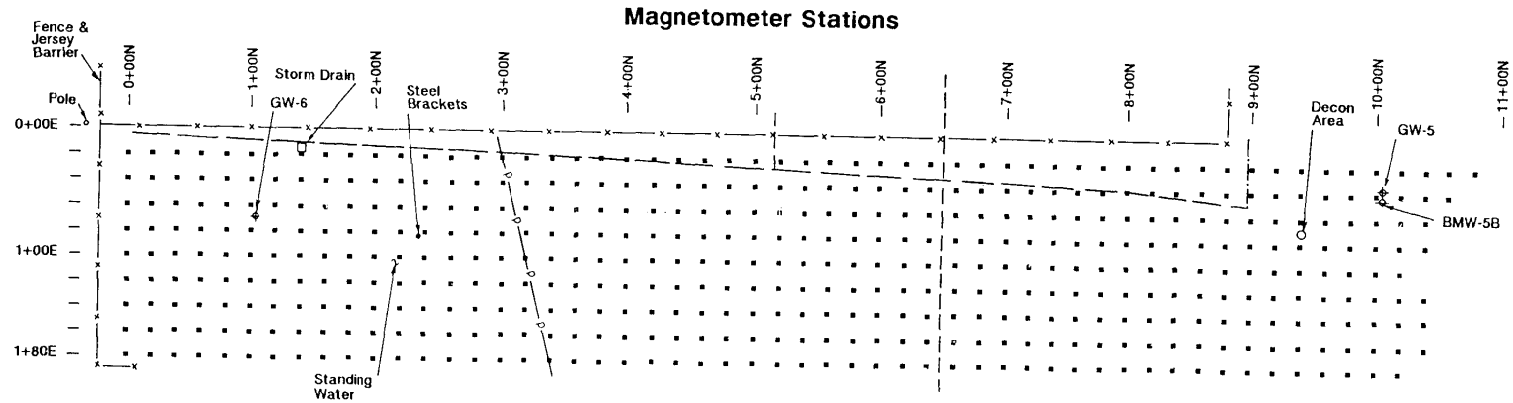
EM Survey Coverage



Magnetometer Stations



EXPLANATION

- EM-31 Survey Line
- Magnetometer Survey Point
- Overhead Powerline
- Buried Powerline
- Chainlink Fence
- Buried Utility Marked on Ground

Grid North

0 100 200

Scale - Feet

prepared by J.B.	GEOPHYSICAL INVESTIGATION CAMP ALLEN LANDFILL - AREAS A AND B NORFOLK, VIRGINIA prepared for BAKER ENVIRONMENTAL, INC.	Area B Geophysical Coverage
checked by MJS		Weston Geophysical — Fig. A-7
reviewed by MJS		

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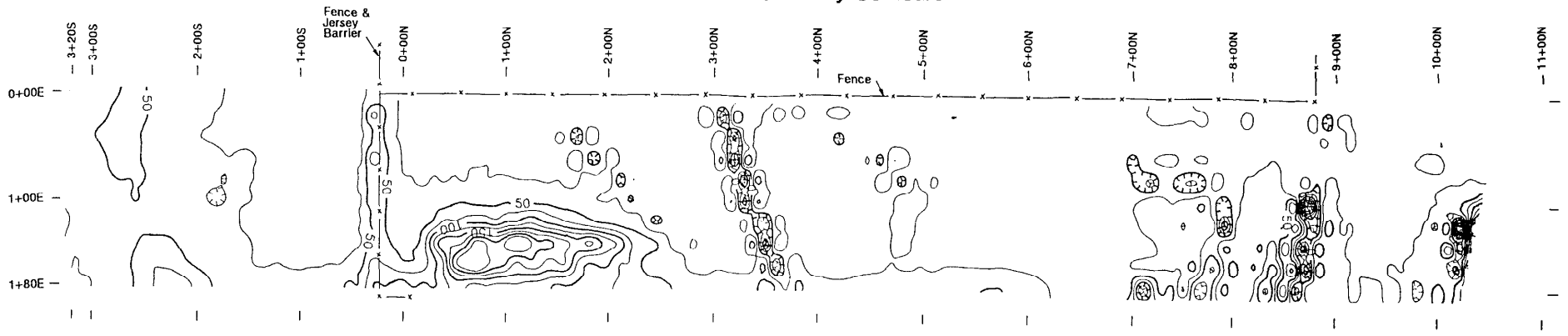
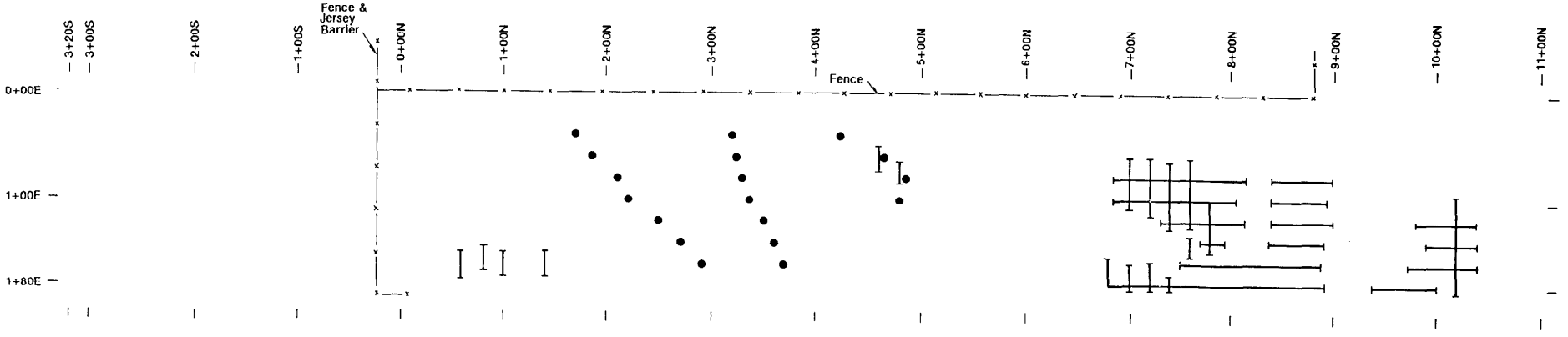
EM Conductivity Contours



Interpreted EM Results



EXPLANATION

50 EM Terrain Conductivity Contour
Contour Interval: 25 millimhos/meter

FM In-Phase Data Indicative of Metal Objects

Interpreted Pipe or Conduit

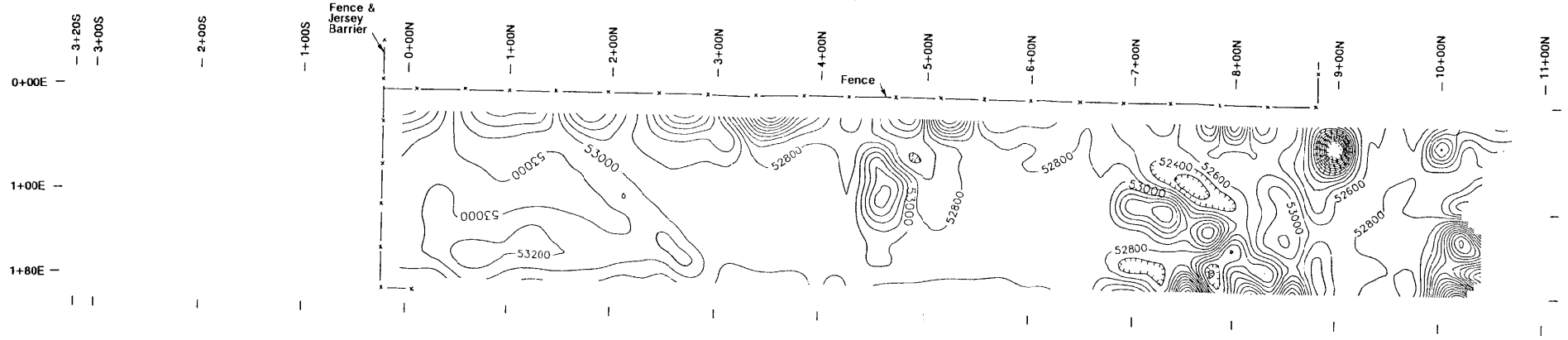
Grid North

0 100 200
Scale - Feet

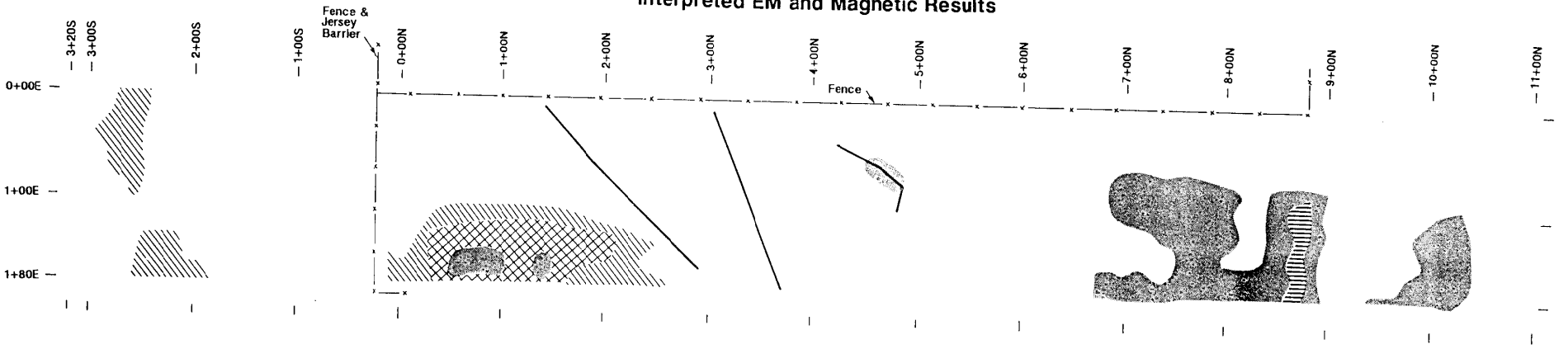
prepared by PG, M.J.N checked by MB reviewed by MB	GEOPHYSICAL INVESTIGATION CAMP ALLEN LANDFILL - AREAS A AND B NORFOLK, VIRGINIA prepared for BAKER ENVIRONMENTAL, INC.	Area B EM-31 Conductivity and In-Phase Contour Maps Weston Geophysical — Fig. A-8

6/92

Magnetic Intensity Contours



Interpreted EM and Magnetic Results



EXPLANATION

- 53000 — Magnetic Contour, Contour Interval: 200 Gammas
- Area of High-Conductivity Fill, Generally Non-Metallic.
- Area of Moderately Elevated Conductivity, Possible Fill
- Area of Buried Metal Objects
- Possible Trench
- Buried Pipe or Conduit

Grid North

0 100 200

Scale - Feet

prepared by PG, M.J.N checked by MB reviewed by MB	GEOPHYSICAL INVESTIGATION CAMP ALLEN LANDFILL - AREAS A AND B NORFOLK, VIRGINIA prepared for BAKER ENVIRONMENTAL, INC.	Area B Magnetic Contour Map, and Interpreted EM and Magnetic Results Weston Geophysical — Fig. A-9

APPENDIX F

APPENDIX F
TEST BORING AND WELL CONSTRUCTION LOGS

MALCOLM PIRNIE, INC.

BORING LOGS/WELL CONSTRUCTION DETAILS (1983-1987)

Herbert and Associates, Ltd.
TESTING • ENGINEERING • INSPECTING
POST OFFICE BOX 64758 • VIRGINIA BEACH, VA. 23464 • PHONE (804) 420-2797

LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (BRIG) LOCATION Norfolk, Virginia

BORING NO. B-1W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/14/83 DATE COMPLETED 11/14/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 7' AFTER ___ HRS. ___

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ___

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0			
	1-5		
2	1-8	Dark brown silt with gravel	S-1
	8-5		
4	4-3	Brown silt with traces of clay	S-2
	5-4		
6	3-3	Brown silt with traces of clay	S-3
	3-3		
8	4-3	Light brown silty sand - Wet	S-4
	2-2		
	2-5	Light brown silty sand - Wet	S-5
	3-4		
12	5-4	Light brown silty sand - Wet	S-6
	5-5		
14	6-5	Light brown silty sand - Wet	S-7
	5-9		
16	10-10	Light brown silty sand - Wet	S-8
	6-6		
18	4-5	Light brown silty sand - Wet	S-9
	7-6		
20	8-8	Light brown silty sand - Wet	S-10
	5-8		
22	9-11	Light brown silty sand - Wet	S-11
	9-9		
24	11-19	Light brown silty sand - Wet	S-12
26		Bottom of boring 24.0'	
		Screen 24' - 4'	
28			
		Stand Pipe 4' - 0'	
30			
		Stick-up 3'	
32			
		Sand 25' - 3'	
34			
		Bentonite 3' - 2'	
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall.

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-2 TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/83 DATE COMPLETED 11/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 6' AFTER ____ HRS. --

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0	2-8 18-22	Fill material - tan silty sand with gravels of concrete & slag - Medium to fine grain sand	S-1
2	5-5 7-11	Light brown sandy silt with some clay properties	S-2
4	4-5 9-10	Light brown sandy silt	S-3
6	2-4 5-7	Light brown silty sand - Wet - Medium to fine grain	S-4
8	3-4 5-5	Light brown sand with silt - Saturated - Medium to fine grain	S-5
10	1-1 3-4	Light brown sand with silt - Saturated - Medium to fine grain	S-6
12	7-5 8-7	Light brown sand with silt - Saturated - Medium to fine grain	S-7
14	7-7 8-9	Light brown sand with silt - Saturated - Medium to fine grain	S-8
16	5-8 11-11	Light brown sand with silt - Saturated - Medium to fine grain	S-9
18	7-13 10-19	Light brown silty sand, pebble in matrix - Wet	S-10
20	13-14 15-16	Light brown to light gray sand with silt - Medium to fine grain - Wet	S-11
22	12-12 14-18	Light gray to light brown sand with silt, pebbles in matrix - Saturated	S-12
24		Bottom of boring 24.0'	
26			
28		Below surface 7'2" Stick up 2'10"	
30			
32			
34			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall.

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Virginia

BORING NO. B-3 TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/83 DATE COMPLETED 11/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 7' AFTER ____ HRS.

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0			
	7-8		
2	5-5	Light brown sandy silt - Moist	S-1
	3-4		
4	5-5	Light brown silt with sand - Moist	S-2
	4-5		
6	4-5	Light brown silty sand - Moist	S-3
	2-2		
8	4-3	Light brown sand with silt - Wet - Medium to fine grain	S-4
	2-4		
	5-5	Light brown sand with silt - Saturated - Medium to fine grain	S-5
	4-4		
12	4-5	Light brown sand with silt - Saturated - Medium to fine grain	S-6
	7-7		
14	6-8	Light brown silty sand - Wet - Medium to fine grain	S-7
	5-5		
16	9-10	Light brown silty sand - Saturated - Medium to fine grain	S-8
	12-12		
18	10-12	Light brown silty sand - Saturated - Medium to fine grain	S-9
	10-10		
20	11-12	Light brown silty sand - Saturated - Medium to fine grain	S-10
	10-12	Mottled gray & light brown sand with silt - Wet -	
22	13-25	Medium to fine grain	S-11
	10-12	Mottled gray and light brown sand with silt - Wet	
24	8-10	Medium to fine grain	S-12
26		Bottom of boring 24.0'	
28		Below surface 7'0" Stick up 3'0"	
30			
32			
34			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (BRIG) LOCATION Norfolk, Virginia

BORING NO. B-4W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/83 DATE COMPLETED 11/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 9' AFTER ____ HRS. ____

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0			
2	5-7 11-15	Dark brown fill, sand silt with pebbles and concrete	S-1
4	25-8 11-13	Dark brown fill, sand silt with pebbles and concrete	S-2
6	23-12 11-8	Dark brown fill, sand silt with pebbles and concrete	S-3
8	5-4 4-5 5-7	Olive gray silty clay with organics, Moist	S-4
10	12-15	Mottled brown to gray silty sand with pebbles, Wet	S-5
12	10-8 7-7	Gray silty sand, medium to fine grain - Wet	S-6
14	4-7 8-18	Gray silty sand, medium to fine grain - Wet	S-7
16	--14	Mottled gray & brown silty sand, medium to fine grain - Wet	S-8
18	12-12 12-12	Light brown silty sand, fine grained - Wet	S-9
20	8-8 13-17	Light brown silty sand, fine grained - Wet	S-10
22	30-30 35-32	Light brown & yellow brown silty sand, fine grain - Wet	S-11
24	12-14 20-24	Light brown & yellow brown silty sand, fine grain - Wet with pebbles in matrix	S-12
26		Bottom of boring 24.0'	
28		Screen 24'2" - 2'2" Stand Pipe 2'2" - 0 Stick-up 2'0"	
30		Sand 25' - 3' Bentonite 3' - 2'	
32			
34			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall.

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (BRIG) LOCATION Norfolk, Va.

BORING NO. B5W TYPE DRILL Acker Th CLIENT Malcolm Pirnie

DATE STARTED 11/83 DATE COMPLETED 11/83 DRILLER P.Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 20' AFTER ___ HRS.

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ___

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0			
	6-100	Dark brown fill sandy silt with pebbles and concrete	S-1
2	49-157		
	6-10	Dark brown fill sandy silt with pebbles and concrete	S-2
4	14-8		
	10-23	Dark brown fill sandy silt with pebbles and concrete	S-3
6	70-5		
	85-40	Dark brown sill sand silt with pebbles and concrete	S-4
8	61-20		
	94-100/0"	No Sample	
	1-1	Olive gray silty clay, moist with trace of organics & sand	S-6
12	1-0		
	1-1	Olive gray silty clay, moist with trace of organics & sand	S-7
14	1-1		
	2-2	Olive gray silty clay, moist with trace of organics & sand	S-8
16	2-1		
	2-1	Olive gray silty clay, moist with trace of organics, sand & pebbles	S-9
18	1-1		
	2-1	Olive gray silty clay, moist with trace of organics, sand & pebbles	S-10
20	2-1		
	2-1	Olive gray silty clay with trace of organics, sand and pebbles - Wet	S-11
22	2-1		
	1-1	Olive gray silty clay with trace of organics, sand and pebbles - Wet	S-12
24	1-1		
	2-2	Olive gray silty clay with trace of organics, sand and pebbles - Wet	S-13
26	2-1		
28		Bottom of boring 26.0'	
30		Screen 22'7" - 2'7" Stand Pipe 2'7" - 0	
32		Stick-up +2'5" Sand 25' - 3'	
34		Bentonite 3' - 2'	
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall.

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-6 TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/8/83 DATE COMPLETED 11/8/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 10' AFTER ___ HRS. ___

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ___

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0			
	7-11	Brown and black sandy silt	S-1
2	8-7		
	4-5	Black silt - Damp	S-2
4	5-5		
	3-1	Dark gray silty clay - Moist	S-3
6	1-1		
	1-2	Dark gray silty clay - Moist	S-4
8	2-1		
	WOH - PUSH	Dark gray silty clay - Moist	S-5
10	PUSH		
	Wt. of Rod	Dark gray silty clay - Wet	S-6
12	PUSH	Dark gray silty clay with organics - Wet	S-7
14	2-2		
	2-4	Alternating olive green & dark gray silty sands - Moist	S-8
16	4-3		
	1-3	Mottled light brown & gray silty sand - Moist - fine grain	S-9
18	1-4		
	10-12	Mottled light brown & gray silty sand - Saturated - Medium to fine grain	S-10
20	10-9		
	10-10	Light brown silty sand - Saturated - medium to fine grain	S-11
22	12-20		
	24-30	Light brown & gray silty sand - Saturated - Medium to fine grain	S-12
24	23-18		
26		Bottom of boring 24.0'	
28			
30		Below surface 7'2" Stick up 2'10"	
32			
34			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (BRIG) LOCATION Norfolk, Virginia

BORING NO. B7W TYPE DRILL Acker Th CLIENT Malcolm Pirnie

DATE STARTED 11/8/83 DATE COMPLETED 11/8/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 7' AFTER ____ HRS. ____

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0			
2	3-3 7-30	Brown sandy silt with concrete & metal fragments	S-1
4	13-13 52-65	Brown sandy silt with concrete & metal fragments	S-2
6	11-4 7-15	Brown sandy silt with concrete hash	S-3
8	6-4 6-11	Brown sandy silt with pebbles & concrete, Wet	S-4
	4-7 9-9	Gray sand with silt, medium to fine grain, Wet	S-5
12	5-6 7-5	Gray sand with silt, medium to fine grain, Wet	S-6
14	3-4 3-5	Light brown silty sand, medium to fine grain, Saturated	S-7
16	12-13 15-19	Light brown silty sand, medium to fine grain, Saturated	S-8
18	5-5 6-5	Light brown silty sand, medium to fine grain, Saturated	S-9
20	5-6 9-15	Light brown silty sand, medium to fine grain, Saturated	S-10
22	6-7 8-7	Mottled light brown & light gray silty sand, Medium to fine grain - Saturated	S-11
24	16-25 30-35	Mottled light brown & light gray silty sand, Medium to fine grain - Saturated	S-12
26		Bottom of boring 24.0'	
28		Screen 23'8" - 3'8" Stand Pipe 3'8" - 0	
30		Stick-up 3'4" Sand 25' - 3'	
32		Bentonite 3' - 2'	
34			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall.

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Virginia

BORING NO. B-8 TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/12/83 DATE COMPLETED 11/12/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 8' AFTER ____ HRS. ____

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0			
2	8-20 56-14	Brown sandy silt with organics, glass & pebbles	S-1
4	1-6 4-3	No sample	S-2
6	3-3 3-2	No sample	S-3
8	4-4 4-5	Brown sandy silt with organics and gravel - Moist	S-4
10	3-4 5-5	Light brown silty sand - Wet	S-5
12	4-3 4-3	Light brown silty sand - Wet	S-6
14	5-5 5-6	Light brown silty sand - Wet	S-7
16	5-7 8-10	Light brown silty sand - Wet	S-8
18	6-6 9-12	Light brown sandy silt - Wet	S-9
20	11-8 9-9	Light brown sandy silt - wet	S-10
22	11-12 11-9	Light brown silty sand - Wet	S-11
24	9-11 9-11	Light brown silty sand - Wet	S-12
26		Bottom of boring 24.0'	
28		Below surface 6'9"	
30		Stick up 3'3"	
32			
34			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDIFLL (Brig) LOCATION Norfolk, Va.

BORING NO. B-9W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/11/83 DATE COMPLETED 11/11/83 DRILLER P.Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 10' AFTER ____ HRS.

TYPE SAMPLER SS LENGTH -- DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE
0			
	4-19		
2	16-12	Brown silt with gravel & organics	S-1
	6-9		
4	9-16	Dark brown silt with glass and organics	S-2
	22-41	No Sample	
6	8-4		S-3
	1-1		
8	2-3	Light brown and dark brown sandy silt - Moist	S-4
	5-4		
	3-3	Light brown and light gray silty sand - Moist	S-5
	5-5		
12	4-4	Light gray silty sand - Wet	S-6
	6-6		
14	5-5	Gray silty sand - Wet	S-7
	6-6		
16	5-8	Light gray silty sand - Wet	S-8
	5-4		
18	4-5	Light brown and gray silty sand - Wet	s-9
	8-7		
20	6-7	Light brown and gray silty sand - Wet	S-10
	4-5		
22	5-7	Light brown and gray silty sand - Wet	S-11
	6-12		
24	15-14	Light brown and gray silty sand - Wet	S-12
26		Bottom of boring 24.0'	
28		Screen 22'7" - 2'7" Stand pipe 2'7" - 0 Stick up 2'5"	
30		Sand 23' - 3'	
32		Bentonite 3' - 2'	
34			
38			
40			

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-10 TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/11/83 DATE COMPLETED 11/11/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 10' AFTER ____ HRS

TYPE SAMPLER SS LENGTH 30" DIA. 2" OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0			
	3-6		
2	18-27	Dark brown & dark gray silt with organics, pebbles & glass	S-1
	15-11		
4	15-21	Dark gray sandy silt with concrete hash	S-2
	9-5		
6	4-2		S-3
	1-1		
8	1-1	Olive gray silty clay with sand lenses	S-4
	1-1		
10	1-2	Olive gray silty clay with sand lenses and gravel	S-5
	9-7		
12	6-6	Gray silty sand - Wet	S-6
	5-5		
14	4-5	Light brown and gray silty sand - Wet	S-7
	6-5		
16	5-5	Light brown and gray silty sand - Wet	S-8
	4-4		
18	4-3	Light brown and gray silty sand - Wet	S-9
	5-3		
20	2-5	Light brown silty sand - Wet	S-10
	11-13		
22	17-11	Light brown silty sand - Wet	S-11
	5-7		
24	6-10	Light brown silty sand - Wet	S-12
26		Bottom of boring 24.0'	
28		Below surface 7'6"	
30		Stick up 2'6"	
32			
34			
36			
38			
40			

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-11W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/11/83 DATE COMPLETED 11/11/83 DRILLER P.Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 7' AFTER ___ HRS. ___

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ___

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0			
2	2-3 4-5	Brown silt with organics and pebbles	S-1
4	3-1 0-1	Rope fiber	S-2
6	2-3 8-27	Black silt with slag, gravels	S-3
8	7-9 3-3	Dark brown silt - Wet - with concrete hash	S-4
10	3-3 3-3	Brown & olive gray sandy silt (with a bolt)	S-5
12	2-1 1-3	Dark brown silt - Wet - with gravel & coarse sand	S-6
14	5-5 6-6	Light gray silty sand - Saturated	S-7
16	4-5 6-6	Gray silty sand - Saturated	S-8
18	5-7 7-7	Gray to light brown silty sand - Saturated	S-9
20	4-4 3-2	Gray to light brown silty sand - Saturated	S-10
22	2-4 8-9	Light brown sandy silt - Wet	S-11
24	6-8 8-8	Light brown sandy silt - Wet	S-12
26		Bottom of boring 24.0'	
28		Screen 22'4" - 2'4" Stand pipe 2'4" - 0	
30		Stick up 2'8" Sand 23' - 3'	
32		Bentonite 3' - 2'	
34			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall.

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (BRIG) LOCATION Norfolk, Va.

BORING NO. B-12 TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/83 DATE COMPLETED 11/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 7' AFTER ___ HRS. ___

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ___

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0			
	2-14		
2	46-7	Dark brown & dark gray silt with plastic, glass & organics	S-1
	2-8		
4	1-4	No sample	S-2
	1-2		
6	4-5	No Sample	S-3
8		No Sample	S-4
	1-10		
10	73-40	Dark brown silt with gravels, sand & glass	S-5
	1-2		
12	3-3	Dark brown & dark gray silt with concrete	S-6
	3-2		
14	3-4	Dark gray & olive green silt - Wet - organic layer	S-7
	4-3		
16	4-3	Olive gray silt grading to olive green sandy silt - Wet	S-8
	2-2		
18	2-3	Olive gray & dark gray silt - wet	S-9
	4-6		
20	7-9	Olive gray & dark gray silt - Wet (piece of wire)	S-10
	11-9		
22	11-13	Light brown silty sand - Wet	S-11
	12-13		
24	15-16	Light brown silty sand - Wet	S-12
26		Bottom of boring 24.0'	
28		Below surface 7'0" Stick up 3'0"	
30			
32			
34			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall.

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-13W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/10/83 DATE COMPLETED 10/10/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 8' AFTER ___ HRS. ___

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ___

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0			
	7-14		
2	15-12	Dark brown silt with glass, wood and gravels	S-1
	10-14		
4	17-23	Dark brown silt with glass, wood and gravel	S-2
	30-89		
6	68-80	Dark brown silt with glass, wood, gravel and metal	S-3
	50-94		
8	86-32	Dark brown silt with glass, wood, gravel and metal	S-4
	-9		
	8-7	Dark brown silt with glass, wood and gravels - Wet	S-5
	8-6		
12	5-4	no sample	S-6
	2-2		
14	1-1	Dark gray to gray silty clay - Moist	S-7
	PUSH		
16	P-2	Dark gray to gray silty clay with organics - moist	S-8
	P-2		
18	2-2	Gray silty clay with organics - Moist	S-9
	2-3		
20	5-8	Gray silty sand - Wet	S-10
	13-4		
22	5-5	Gray alternating silty sand and silty clay - Moist	S-11
	7-12		
24	11-14	Gray alternating silty sand and silty clay - Moist	S-12
26		Bottom of boring 24.0'	
28		Screen 24'3" - 4'3" Standpipe 4'3" - 0 Stick up 2'9" Sand 25' - 3' Bentonite 3' - 2'	
30			
32			
34			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall.

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-14 TYPE DRILL Acker Th CLIENT Malcolm Pirnie

DATE STARTED 11/10/83 DATE COMPLETED 11/10/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 8' AFTER ___ HRS. ___

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ___

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0			
2	3-6 2-2	Black & dark brown silt with organics & glass	S-1
4	2-2 2-2	Black silt with metal fragment	S-2
6	1-2 1-1	Black silt with organics, wet	S-3
8	1-1 2-3	Olive gray clayey silt with organics & shell hash, Damp	S-4
10	4-3 2-1	Olive gray clayey silt with dense layers of shell hash, wet	S-5
12	1-1 1-1	Dark brown sandy silt with organics, saturated	S-6
14	1-1 0-1	Dark brown sandy silt with organics, glass & pebbles, Wet	S-7
16	1-1 2-4	Dark brown sandy silt with organics, glass & pebbles, Wet	S-8
18	9-12 12-7	Light gray sand with silt - wet	S-9
20	5-5 5-5	Light gray sand with silt - wet	S-10
22	5-8 7-7	Light brown silty sand - Wet	S-11
24	5-4 5-9	Light brown silty sand - Wet	S-12
26		Bottom of boring 24.0'	
28		Below surface 6'10" Stick up 3'2"	
30			
32			
34			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall.

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-15W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/9/83 DATE COMPLETED 11/9/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 10' AFTER ____ HRS. ____

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0			
	8-16	Brown silt with gravel, concrete, sand & organics	S-1
2	24-37		
	19-7	Brown silt with gravel, concrete, sand & organics	S-2
4	8-9		
	5-5	Gray & brown sandy silt - Moist	S-3
6	5-5		
	1-2		S-4
8	2-1	Brown silt with gravels	
	1-1	Gray silt with organics - Moist	S-5
10	1-1		
12	PUSH	Gray silt with organics - Moist	S-6
	2-1	Gray silt with organics - Moist	S-7
14	2-2		
	2-3	Gray silt with organics - Moist	S-8
16	2-3		
	3-2	Gray silt with organics - Moist	S-9
18	3-2		
	8-16	Light gray silty sand - Wet - fine grain	S-10
20	24-38		
	25-26	Light gray silty sand - Saturated - fine grain	S-11
22	21-20		
	14-16	Light brown silty sand - Saturated - fine grain	S-12
24	16-14		
26		Bottom of boring 24.0'	
28		Screen 24'3" - 4'3"	
30		Standpipe 4'3" - 0 Stick up 2'9"	
32		Sand 25' - 3' Bentonite 3' - 2'	
34			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall.

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (BRIG) LOCATION Norfolk, Va.

BORING NO. B-16W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/9/83 DATE COMPLETED 11/9/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 7' AFTER ____ HRS. ____

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0			
	4-6	Dark brown silt with gravels, concrete & organics	S-1
2	2-7		
	4-4	Dark gray silt with organics & shells - Moist	S-2
4	12-15		
	5-2	Dark brown silt - moist	S-3
6	1-1		
	1-0	Dark brown silt - Wet	S-4
8	1-0		
	1-0	Dark brown silt - Wet	S-5
10	1-0		
	1-1		S-6
12	1-6	Gray silty sand - Wet - Medium to fine grain	
	10-12	Gray to light gray silty sand - Wet - Medium to fine grain	S-7
14	12-10		
	8-7	Gray to light gray silty sand - Wet - Medium to fine grain	S-8
16	5-5		
	6-9	Gray to light brown silty sand - Wet - Medium to fine grain	S-9
18	10-9		
	5-8	Light brown silty sand, fine grain - Wet	S-10
20	9-10		
	10-10	Light brown & gray silty sand, fine grain - Wet	S-11
22	6-7		
	2-3	Mottled light brown, gray & dark brown silty clay - Wet	S-12
24	3-4		
26		Bottom of boring 24.0'	
28		Screen 24'4" - 4'4" Stand pipe 4'4" - 0 Stick up 2'8" Sand 25' - 3' Bentonite 3' - 2'	
30			
32			
34			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall.

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-17W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/9/83 DATE COMPLETED 11/9/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 8' AFTER ____ HRS ____

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0			
	4-12	Dark brown fill material, sandy silt - Concrete, pebbles & metal	S-1
2	8-20		
	12-14	No sample	S-2
4	14-14		
		Concrete	S-3
6			
	6-12		S-4
8	2-2	Olive green sandy silt with metal & pebbles - Moist	
	1-2	Olive green sandy silt - Wet	S-5
10	2-1		
	1-1	Olive gray silty clay with organics & sand	S-6
12	1-1		
	1-2	Piece of slag blocked spoon opening	S-7
14	1-1		
	4-4	Olive gray silty clay - Moist	S-8
16	3-3		
	3-2	Olive gray silty clay with organics & sand - Moist	S-9
18	3-2		
	4-3	Dark gray silt with sand & organics - Moist	S-10
20	2-2		
	3-3		S-11
22	7-3	Dark gray sandy silt - Moist	
	5-3	Mottled dark gray, light brown & gray sandy silt	S-12
24	3-6		
26		Bottom of boring 24.0'	
28		Screen 23'8" - 3'8" Standpipe 3'8" - 0 Stick up 3'4" Sand 24' - 3' Bentonite 3' - 2'	
30			
32			
34			
36			
38			
40			

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-18 TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/9/83 DATE COMPLETED 11/9/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 8' AFTER ___ HRS. ___

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ___

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0			
2	7-100 15-20	Dark brown silt with organics, glass, pebbles & cement	S-1
4	8-9 4-5	Dark brown silt with pebbles - Dry	S-2
6	4-6 5-7	Dark brown clayey silt with sand - Damp	S-3
8	3-5 6-4	Light brown silty sand - Moist	S-4
10	7-5 6-4	Brown silty sand - Wet - fine grain	S-5
12	3-5 4-5	Light brown silty sand - Wet - fine grain	S-6
14	6-6 5-5	Light gray silty sand - Wet - fine grain	S-7
16	2-3 5-6	Light brown silty sand - Wet - fine grain	S-8
18	5-5 6-6	Light brown silty sand - Wet - fine grain	S-9
20	2-3 5-5	Light brown silty sand - Wet - fine grain	S-10
22	8-8 8-6	Light brown silty sand - Wet - fine grain	S-11
24	8-2 4-8	Light brown silty sand - Wet - fine grain	S-12
26		Bottom of boring 24.0'	
28			
30		Below surface 7'6" Stick up 2'6"	
32			
34			
36			
38			
40			

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-19 TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/9/83 DATE COMPLETED 11/9/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 10' AFTER ____ HRS. ____

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0			
2	12-20 18-28	Dark gray fill material, sandy silt with concrete, Medium to fine grain sand	S-1
4	11-5 5-5	Dark gray sandy silt, fine grain - Damp	S-2
6	3-2 3-2	Dark gray silt with trace sands - Damp	S-3
8	3-2 4-3	Dark gray silt with trace sands - Damp	S-4
10	2-1 0-1	Alternating layer of dark gray silt and yellow-green silty sand	S-5
12	PUSH	Dark gray silt with sand - Wet	S-6
14	PUSH	Olive gray clayey silt - Wet	S-7
16	PUSH	Olive gray clayey silt - Wet	S-8
18	PUSH	Olive gray clayey silt - Wet	S-9
20	PUSH	Olive gray clayey silt with organics - Wet	S-10
22	PUSH 1-3	Gray sandy silt with pebbles - Wet	S-11
24	3-2 2-1	Gray sandy silt with pebbles - Wet	S-12
26	2-2 2-2	Gray silty sand - Wet - Medium to fine grain	S-13
28		Bottom of boring 26.0'	
30			
32		Below surface 7'3" Stick up 2'9"	
34			
36			
38			
40			

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (Brig) LOCATION Norfolk, Va.

BORING NO. B-20W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/14/83 DATE COMPLETED 11/14/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 5' AFTER ____ HRS. ____

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO.
0			
2	2-7 9-9	Dark gray silt with organics	S-1
4	8-5 4-5	Tan & dark gray silt	S-2
6	4-3 2-3	Dark gray silt - Wet	S-3
8	1-0 1-0	Dark gray silt - Wet	S-4
10	1-1 1-0	Dark gray clayey silt - Wet	S-5
12	PUSH	Dark gray silty clay	S-6
14	PUSH	Dark gray silty clay	S-7
16	PUSH	Dark gray silty clay with organics	S-8
18	PUSH	Dark gray silty clay	S-9
20	PUSH	Dark gray silty clay	S-10
22	PUSH	Dark gray silty clay	S-11
24	PUSH	Dark gray silty clay	S-12
26	PUSH	Dark gray silty clay	S-13
28		Bottom of boring 26.0'	
30		Screen 22'2" - 2'2" Standpipe 2'2" - 0 Stick up 2'10"	
32		Sand 23' - 3' Bentonite 3' - 2'	
34			
36			
38			
40			

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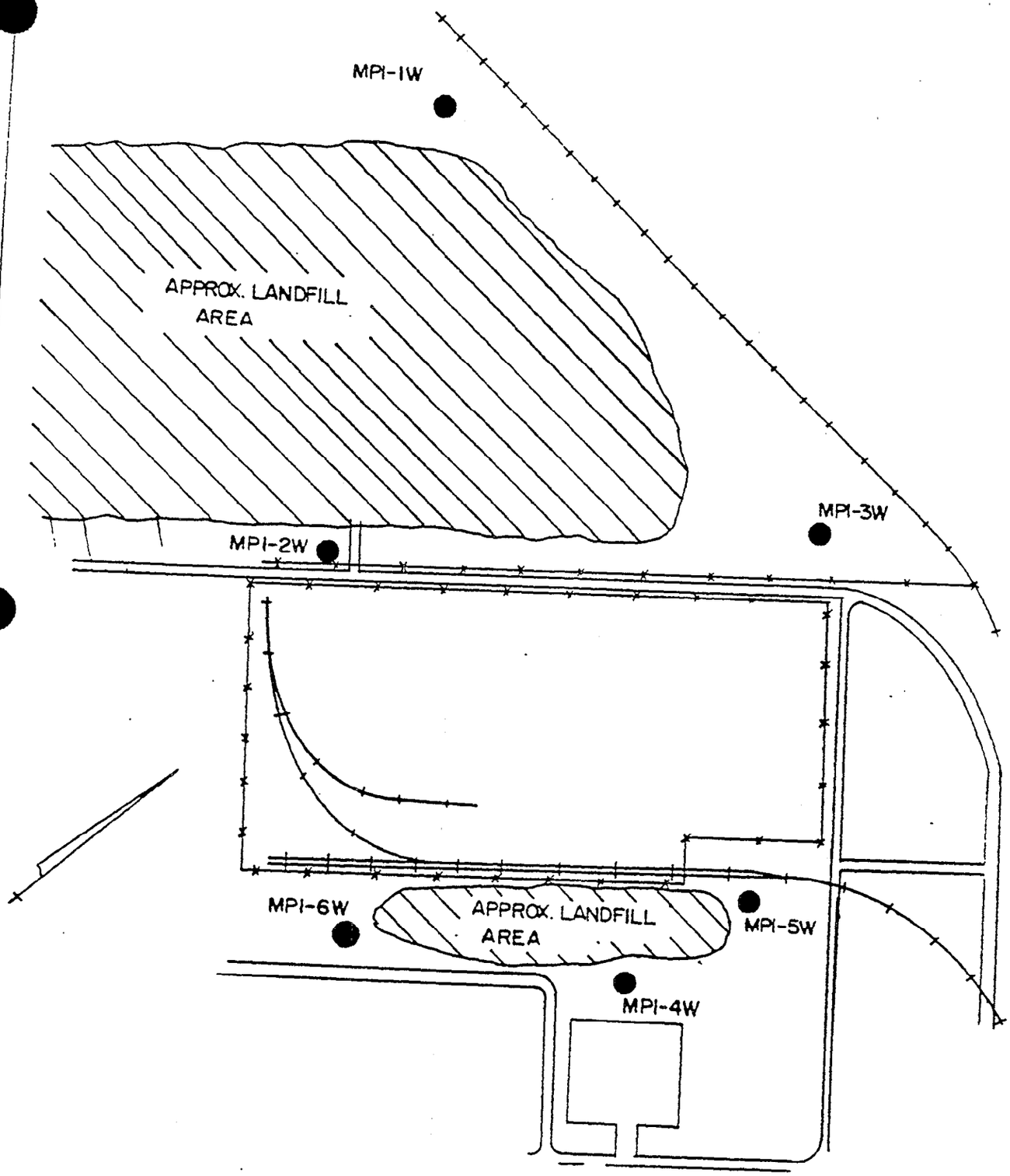

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VIRGINIA BEACH, VA

CAMP ALLEN LANDFILL AREA
-BORING LOCATIONS-

JOB: 83-3454

DECEMBER 29, 1983

Herbert and Associates, Ltd.
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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN (NACIP) LOCATION Norfolk, Va.

BORING NO. MPI - 1W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/10/83 DATE COMPLETED 11/10/83 DRILLER P.Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 7' AFTER ____ HRS. ____

TYPE SAMPLER AA LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0			
2	2-11 28-23 32-30	Dark brown silt with shell hash, organics & gravel	S-1
4	25-16	Brown silty sand, Damp	S-2
6	10-8 8-4	Brown silty sand, Damp	S-3
8	H-H H-1	Brown sand, silt - wet	S-4
	5-4 14-15	Light gray silty sand, saturated	S-5
12	14-15 16-16	Light gray silty sand, saturated	S-6
14	8-9 10-10	Light brown silty sand, wet	S-7
16	4-6 4-2	Mottled light brown silt with gray clay, moist	S-8
18	3-3 4-5	Mottled light brown silt with alternating gray and sandy clay - moist	S-9
20	6-8 9-10	Mottled light brown silt with alternating gray and sandy clay - moist	S-10
22	8-10 11-11	Light brown silty sand - wet	S-11
24	13-13 16-16	Light brown silty sand - wet	S-12
26		Bottom of boring 24.0'	
28		Screen 24'4" - 4'4" Stand pipe 4'4" - 0" Stick up 2'8"	
30		Sand 25' - 3' Bentonite 3' - 1'7"	
32			
34			
38			
40			

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (NACIP) LOCATION Norfolk, Va.

BORING NO. MPI-2 W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/14/83 DATE COMPLETED 11/14/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 7' AFTER ___ HRS. ___

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ___

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0			
	4-30		
2	21-13	Brown silt with organics, brick & concrete hash	S-1
	6-10		
4	10-8	Brown silt with gray shell hash	S-2
	7-5		
6	2-2	Red shell hash - silty	S-3
	2-1		
8	2-2	Gray shell hash, wet, silty	S-4
	3-0		
10	1-2	Gray shell hash, wet, silty	S-5
	7-8		
12	9-9	Olive gray silty sand	S-6
	5-6		
14	8-7	Olive gray silty sand - wet	S-7
	7-6		
16	7-7	Gray & light brown silty sand - wet	S-8
	2-2		
18	4-6	Light brown silty sand - wet	S-9
	8-7		
20	8-9	Light brown silty sand - wet	S-10
	7-7		
22	7-5	Light brown and gray silty sand - wet	S-11
	7-9		
24	13-16	Light gray silty sand - wet	S-12
26		Bottom of boring 24.0'	
28		Screen 24'2" - 4'2" Standpipe 4'2" - 0' Stick up 2'10"	
30		Sand 24'6" - 3'	
32		Bentonite 3' - 2'5"	
34			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall.

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (NACIP) LOCATION Norfolk, Va.

BORING NO. MPI-3W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/14/83 DATE COMPLETED 11/14/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 9' AFTER ___ HRS. ___

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ___

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0			
	3-6	Dark gray silt with organics and concrete	S-1
2	15-11		
	10-11	Brown silt with glass, concrete hash & sand	S-2
4	10-7		
	7-4	Brown silt with glass, concrete hash, sand & organics	S-3
6	3-2		
	2-0	Brown silt with glass	S-4
8	0-1		
	3-3	Glass	S-5
	4-6		
	7-4		
12	6-4	Light brown silty sand - wet	S-6
	6-6	Light brown silty sand - wet	S-7
14	6-6		
	3-1	Light brown silty sand - wet	S-8
16	1-1		
	6-4		
18	8-9	Gray sandy silt - wet	S-9
	5-5	Gray sandy silt - wet	S-10
20	9-11		
	22-23	Gray silty sand, wet with gravel	S-11
22	25-34		
	4-13	Gray silty sand - wet	S-12
24	24-36		
26		Bottom of boring 24.0'	
28		Screen 24'4" - 4'4" Standpipe 4'4" - 0' Stick up 2'8" Sand 25' - 3' Bentonite 3' - 2'	
30			
32			
34			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED. utilizing a 140 pound hammer with a 30 inch fall.

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (NACIP) LOCATION Norfolk, Virginia

BORING NO. MP-I-4W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/12/83 DATE COMPLETED 11/12/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 4.0' AFTER ____ HRS. ____

TYPE SAMPLER SS LENGTH 30" DIA. 2" OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0			
2	3-4 6-5	Brown fine sand and silt	S-1
4	2-3 5-4	Brown fine sand and silt	S-2
6	2-3 3-8	Brown sand with little silt *Red fluid leaking out of spoon	S-3
8	2-2 2-2	Grading to gray sand	S-4
10	3-3 3-3	Gray sand	S-5
12	4-4 4-5	Gray sand	S-6
14	4-4 4-4	Gray sand	S-7
16	2-3 5-2	Gray sand	S-8
18	5-4 4-4	Gray sand	S-9
20	8-9 7-8	Gray sand	S-10
22	7-9 8-7	Gray sand	S-11
24	11-11 15-14	Gray sand	S-12
26		*NOTE: Red fluid - looks like hydraulic fluid, went to respirators	
28		Screen 24'6" - 4'6" Stand Pipe 4'6" - 0 Stick-up 2'6" Sand 3' Bentonite 3' - 2'	
30			
32			
34			
36		Bottom of boring 24.0'	
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall

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LOG OF BORING

FILE NO. 83-3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (NACIP) LOCATION Norfolk, Va.

BORING NO. MPI-5W TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/12/83 DATE COMPLETED 11/12/83 DRILLER P.Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 6.0' AFTER ____ HRS. ____

TYPE SAMPLER SS LENGTH -- DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0			
	3-3		
2	4-4	Brown silt with organics	S-1
	4-4		
4	4-5	Brown & dark gray sandy silt	S-2
	5-4	Black sandy silt, saturated	
6	1-1		S-3
	1-0		
8	1-1	Olive gray silty clay and peat, Moist	S-4
	0-2		
	0-1	Brown sandy silt, wet	S-5
	H-H		
12	2-2	Light gray sandy silt, staurated	S-6
	1-3		
14	1-2	Light gray silty sand, saturated	S-7
	3-5		
16	5-6	Light gray silty sand, saturated	S-8
	3-4		
18	4-6	Light brown silty sand, saturated	S-9
	5-9		
20	9-9	Light brown silty sand, saturated	S-10
	4-5		
22	4-4	Light brown silty sand, saturated	S-11
	7-9		
24	11-12	Light brown silty sand, saturated	S-12
26		Bottom of boring 24.0'	
28		Screen 24'6" - 4'6" Stand Pipe 4'6" - 0 Stick-up 2'6" Sand 25' - 3' Bentonite 3' - 2'	
30			
32			
34			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall.

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LOG OF BORING

FILE NO. 83- 3545

PROJECT IDENTIFICATION CAMP ALLEN LANDFILL (NACIP) LOCATION Norfolk, Va.

BORING NO. ~~MPI-6W~~ 6W-6 TYPE DRILL Acker TH CLIENT Malcolm Pirnie

DATE STARTED 11/12/83 DATE COMPLETED 11/12/83 DRILLER P. Herbert

CASING LENGTH -- DIA. -- WATER ELEV: IMMEDIATE 4.0' AFTER ____ HRS. ____

TYPE SAMPLER SS LENGTH 30" DIA. 2"OD SURF. ELEV. ____

DEPTH	STD. PEN. (N)*	SAMPLE DESCRIPTION	SAMPLE NO
0			
	2-5	Dark gray silt with sand and organics	S-1
2	7-7		
	10-9	Light brown silty sand	
4	10-2		S-2
	5-5	Brown sandy silt	
6	7-7	Brown sandy silt, wet	S-3
	2-2		S-4
8	7-4	Brown and gray silty sand - Wet	
	4-3	Brown and gray silty sand - Wet	S-5
10	1-1		
	4-4	Light brown silty sand, Wet	S-6
12	5-6		
	7-7	Light brown silty sand, Wet	S-7
14	7-8		
	4-4	Light brown silty sand, Wet	S-8
16	6-5		
	6-6	Light brown silty sand, Wet	S-9
18	7-8		
	6-6	Light brown silty sand, Wet	S-10
20	6-5		
	11-12	Light brown silty sand, Wet	S-11
22	13-13		
	7-5	Light brown silty sand, Wet	S-12
24	4-2		
		Bottom of boring 24.0'	
26		Screen 23'11" - 3'11"	
		Stand Pipe 3'11" - 0	
28		Stick-up 3'1"	
		Sand 24' - 3'	
30		Bentonite 3' - 2'	
32			
34			
36			
38			
40			

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED, utilizing a 140 pound hammer with a 30 inch fall.

CH$_2$M HILL

TEST BORING LOGS & WELL CONSTRUCTION DETAILS (1991)

========= ========= CH2M HILL =========	PROJECT NUMBER:HRO30868.A0.02	BORING NO.: A-MW-4	SHEET: 1 of 3
	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:12.46 DRILLING CONTRACTOR: Hardin-Huber, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-60
WATER LEVEL AND DATE: 4.78 4/18/91 START: 1/28/91 FINISH: 2/8/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	RECOVERY	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
	0	S-1	15"	3-3-2 (5)	SILTY SAND-Moderate Brown (5YR 4/4), Moist, Organics		HNU/Explo.
	2.0						0/0
	3.0	S-2	16"	3-2-2 (4)	Same as Above		
5	5.0						0/0
	8.0	S-3	18"	3-2-2 (5)	SAND-Moderate Yellow (10YR 5/6), Unconsolidated, Coarse		
10	10.0						0/0
	13.0	S-4	12"	3-3-4 (7)	SAND-Light Brown (5YR 5/6), Little Shell		
15	15.0						0/0
	18.0	S-5	21"	5-4-4 (9)	Same as Above		
20	20.0						0/0

=========	PROJECT NUMBER:HRQ30868	BORING NO.: A-MW-4	SHEET: 2 of 3
========= CH2M HILL =========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:12.46 DRILLING CONTRACTOR: Hardin-Huber, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-60
WATER LEVEL AND DATE: 4.78 4/18/91 START: 1/28/91 FINISH: 2/8/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
20	20.0						HNU/Explo.
	23.0	S-6	19"	7-5-6 (11)	SAND-Moderate Yellow Brown (10YR 4/2), Vary Coarse, Wet, Unconsolidated		0/0
25	25.0						
	28.0	S-7	15"	1-2-3 (5)	SAND-Medium Light Gray (N6), Fine, Unconsolidated		0/0
30	30.0						
35	35.0	S-8	2"	5-5-6-5 (11)	SAND WITH SILT-Yellowish Gray (5Y 8/1), Unconsolidated, Wet		0/0
	37.0	S-9	3"	4-4-5-8 (9)	CLAY-Yellowish Gray (5Y 8/1), Moist, Lean, Stiff		0/0, Clay @ 37.0'
	39.0	S-10	7"	0	Same as Above		0/0
40							

=========	PROJECT NUMBERHR030868	BORING NO.: A-MW-4	SHEET: 3 of 3
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:12.46 DRILLING CONTRACTOR: Hardin-Huber, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-60
WATER LEVEL AND DATE: 4.78 4/18/91 START: 1/28/91 FINISH: 2/8/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
40							HNU/Explo.
	41.0						0/0
	43.0	S-11	12"	3-3-4-7 (7)	SANDY CLAY-Greenish Black (5GY 2/1), Moist, Fine		
45	45.0						0/0
	48.0	S-12	6"	10-19-19-21 (38)	SILTY SAND WITH SHELL FRAGMENTS-Grayish Green (5GY 5/2), Vary Fine, Glauconitic		YORKTOWN @ 48.0'
50	50.0						0/0
							*This replacement well was installed because of a breach in the screen of the origional well.
	53.0	S-13	12"	36-39-34-34 (73)	Same as Above		
55	55.0						*A-MW-4A Screen: 10.0-20.0' Sand: 7.0-20.0' Bentonite: 5.0-7.0' Grout: 0.0-5.0'
							A-MW-4B Screen: 47.0-57.0' Sand: 42.0-57.0' Bentonite: 40.0-42.0' Grout: 0.0-40.0'
							6" Casing to 40.0'
60							Bottom of Borehole 60.0'

=========	PROJECT NUMBER:HR030868	BORING NO.: A-MW-5	SHEET: 1 of 2
========= CH2M HILL =========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:5.53 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 1.95 4/18/91 START: 1/23/91 FINISH: 1/23/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
	0	S-1	6"	2-2-3 (5)	CLAY-Grayish Brown (5YR 2/2), Stiff		HNU/Explo.
--	2.0						0/0
--	3.0	S-2	12"	1-12-1 (13)	CLAY-Grayish Black (N2), Stiff, Moist		
5 --	5.0						0/0 Water At 5.5'
--	8.0	S-3	14"	1-1-WOH (1)	Same as Above		
10 --	10.0						0/0
--	13.0	S-4	23"	1-5-WOH (5)	Same as Above		
15 --	15.0						0/0
--	18.0	S-5	24"	1-8-WOH (8)	Same as Above		
20 --	20.0						0/0

=========	PROJECT NUMBER:HR030868	BORING NO.: A-MW-5	SHEET: 2 of 2
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:5.53 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 1.95 4/18/91 START: 1/23/91 FINISH: 1/23/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
20	20.0						HNU/Explo.
	23.0	S-6	24"	1-1-WOH	CLAY-Dark Gray (N3), Stiff, Moist, Much Stiffer		0/0, Clay @ 23.0'
25	25.0						Bottom of Borehole 25.0'
							A-MW-5 Screen: 10.0-25.0' Sand: 8.0-25.0' Bentonite: 6.0-8.0' Grout: 0.0-6.0'
30							
35							
40							

=========	PROJECT NUMBER:HR030868	BORING NO.: A-MW-6	SHEET: 1 of 3
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:10.67 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.63 4/18/91 START: 1/23/91 FINISH: 1/25/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
	0	S-1	10"	1-3-2 (5)	SILTY CLAY WITH SAND- Brown (5YR 3/4),Coarse to Moderate		HNU/Explo.
	2.0						0/0
	3.0	S-2	18"	2-2-2 (4)	Same as Above		
5	5.0						
	8.0	S-3	0"	WOH	No Recovery		0/0
10	10.0						Water at 10.0'
	13.0	S-4	2"	1-1-1 (2)	SAND-Black (5YR 4/4)		0/0
15	15.0						
	18.0	S-5	12"	2-3-5 (8)	SAND-Gray (N5), Coarse		0/0
20	20.0						

=========	PROJECT NUMBER:HR030868	BORING NO.: A-MW-6	SHEET: 2 of 3
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:10.67 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.63 4/18/91 START: 1/23/91 FINISH: 1/25/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
20	20.0						HNU/Explo.
--							--
--							--
--	23.0	S-6	15"	5-5-7 (12)	SAND-Gray (N5)		0/0
--							--
25 --	25.0						--
--							--
							Clay @ 26.5'
--							--
--	28.0	S-7	20"	3-3-3 (6)	CLAY-Dark Yellowish Orange (10YR 6/6), Some Fine Sand		0/0
--							--
30 --	30.0						--
--							--
--							--
--	33.0	S-8	19"	2-3-4 (7)	Same as Above		0/0
--							--
35 --	35.0						--
--							--
--							--
--	38.0	S-9	13"	5-5-WOH (5)	SILTY SAND-Grayish (10Y 4/2)		0/0 Lost Mud
--							--
40 --	40.0						--

=========	PROJECT NUMBERHR030868	BORING NO.: A-MW-6	SHEET: 3 of 3
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:10.67 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.63 4/18/91 START: 1/23/91 FINISH: 1/25/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
40							
							HUN/Explo.
	43.0	S-10	15"	11-7-10 (17)	SAND-Grayish (10YR 4/2)		0/0
45	45.0						
	48.0	S-11	15"	9-14-13 (27)	SILTY SAND WITH SHELLS-Grayish Green, Fine, Wet, Glaconitic, YORKTOWN		0/0 YORKTOWN CONTACT @ 48.0'
50	50.0						
	53.0	S-12	19"	14-19-14 (33)	Same as Above		0/0
							A-MW-6A
							Screen: 10.0-20.0'
55	55.0						Sand: 8.0-20.0'
							Bentonite 6.0-8.0'
							Grout: 0.0-6.0'
							A-MW-6B
					Same as Above		Screen: 50.0-60.0'
	58.0	S-13	18"	16-15-15 (30)			Sand: 48.0-60.0'
							Bentonite: 46.0-48.0'
							Grout: 0.0-46.0'
							6" Casing 30.0'
60	60.0						Bottom of Borehole 60.0'

&kOG

========= ========= CH2M HILL =========	PROJECT NUMBER:HR030868	BORING NO.: A-MW-7	SHEET: 1 of 2

SOIL BORING LOG

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:6.06 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 2.39 4/18/91 START: 1/30/91 FINISH: 1/31/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
	0	S-1	18"	1-2-3 (5)	SAND-Moderate Brown (5YR 4/4), Coarse, Moist		HNU/Explo.
	2.0						0.0
	3.0	S-2	16"	1-3-3 (6)	Same as Above		
5	5.0						0/0, Water at 5.0'
	8.0	S-3	20"	3-3-6 (9)	SAND WITH GRAVEL-Dark Yellowish Orange (5Y 6/1), Coarse, Wet		
10	10.0						0/0
	13.0	S-4	15"	7-9-8 (17)	Same as Above		
15	15.0						0/0
	18.0	S-5	17"	8-9-12 (21)	Same as Above		
20	20.0						0/0

=========	PROJECT NUMBERHR030868	BORING NO.: A-MW-7	SHEET: 2 of 2
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:6.06 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 2.39 4/18/91 START: 1/30/91 FINISH: 1/31/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
20	20.0						HNU/Explo.
							Clay Contact at 21.5'
	23.0	S-6	24"	1-2-3 (5)	CLAY-Light Olive Gray (5Y 6/1), Stiff, Moist		
25	25.0						O/O
							A-MW-7
							Screen: 10.0-20.0'
							Sand: 8.0-20.0'
							Bentonite: 6.0-8.0'
							Grout: 0.0-6.0'
							Bottom of Borehole 25.0'
30							
35							
40							

=========	PROJECT NUMBER:HR030868.A0.02	BORING NO.: A-MW-8	SHEET: 1 of 2
========= CH2M HILL =========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:8.32 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 2.57 4/18/91 START: 1/25/91 FINISH: 1/25/91 LOGGER: J. Ford

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
	0	S-1	14"	3-4-5-4 (9)	SILTY SAND-Grayish Black (N2), Organics, Shell Fragments, Fine Sand		HNU/Explo.
	2.0						0/0
	3.0	S-2	16"	2-2-2-2 (4)	SILTY SAND-Medium Gray (N5), M-C Sand, Unconsolidated, Wet, Well Sorted		
							Water at 5.0'
5	5.0						1ppm/0
	8.0	S-3	22"	2-1-2-4 (3)	Same as S-2		
10	10.0						2ppm/0
	13.0	S-4	14"	12-12-10-9 (22)	SANDS-Medium Gray (N5), M-C, Unconsolidated, Wet, Well Sorted		
15	15.0						0/0
	18.0	S-5	13"	4-3-4-3 (7)	Same as S-4 more organics		
20	20.0						4ppm/5% L.E.L.

=========	PROJECT NUMBER:HR030868.A0.02	BORING NO.: A-MW-8	SHEET: 2 of 2
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:8.32 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 2.57 4/18/91 START: 1/25/91 FINISH: 1/25/91 LOGGER: J. Ford

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
20	20.0						
	23.0	S-6	17"	4-2-1-1 (3)	SANDS-Medium Gray (N3), M-C, Unconsolidated, Wet, Well Sorted		
25	25.0						
							Clay Contact at 27.5'
	28.0	S-7	15"	1-2-1-1 (3)	CLAY-Dark Gray (N3), Organics, Stiff		A-MW-8 Screen: 13.0-23.0' Sand: 11.0-23.0' Bentonite: 9.0-11.0' Grout: 0.0-9.0'
30	30.0						
							Bottom of Borehole 30.0'
35							
40							

=========	PROJECT NUMBERHR030868.A0.02	BORING NO.: A-MW-9	SHEET: 1 of 3
========= CH2M HILL =========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:7.74 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.38 4/18/91 START: 1/24/91 FINISH: 1/30/91 LOGGER: J. Ford

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
	0	S-1	18"	3-2-3-2 (5)	SILTY SAND-Light Olive Brown (5YR 5/6), some organics, dry		HNU/Explo.
	2.0						1ppm/0
	3.0	S-2	0"	2-1-1-1 (2)	No Return		
5	5.0						0/0
							Water @ 7.0'
	8.0	S-3	12"	0	UNCONSOLIDATED SAND-Medium Light Gray (N6), M-C, Well Sorted, Wet		
10	10.0						3ppm/0
	13.0	S-4	8"	2-3-2-2 (5)	Same as S-3		5ppm/0
15	15.0						
							2ppm/0
	18.0	S-5	22"	2-3-4-2 (7)	SAND WITH SILT AND CLAY-Light Olive Gray (5YR 5/2), semi-consolidated, > % fines		3ppm/0
20	20.0						

=========	PROJECT NUMBER:HRO30868.A0.02	BORING NO.: A-MW-9	SHEET: 2 of 3
========= CH2M HILL =========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:7.74 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.38 4/18/91 START: 1/24/91 FINISH: 1/30/91 LOGGER: J. Ford

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
20	20.0						
	23.0	S-6	24"	2-3-3-3 (6)	CLAY-Dark Gray (N3), Clean, Plastic		Clay @ 23.0'
25	25.0						
							6" Casing to 26.0'
							Shelby Tube TAKEN @ 27.0', (S-1)
	29.0	S-7	0	0	Same as S-6		
30							
	31.0						
	33.0	S-8	12"	8-9-8 (17)	SILTY SANDY CLAY-Grayish Olive (10Y 4/2)		
35	35.0						
	38.0	S-9	10"	4-9-10 (19)	Same as S-8		
40	40.0						

=========	PROJECT NUMBER:HR030868.A0.02	BORING NO.: A-MW-9	SHEET: 3 of 3
========= CH2M HILL =========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:7.74 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.38 4/18/91 START: 1/24/91 FINISH: 2/13/91 LOGGER: S. Repko

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
40							
	43.0	S-10	14"	14-13-9 (2)	Same as S-8, except larger shall fragments		
45	45.0						
	48.0	S-11	13"	11-17-23 (40)	Top 11" Same as S-10, bottom 2" SILTY SAND-Grayish Green (10YR 5/2), Fine, Glaconitic, YORKTOWN FORMATION		YORKTOWN @ 48.0'
50	50.0						
	53.0	S-12	14"	11-18-25 (43)	Same as S-11		A-MW-9A Screen:12.0-22.0' Sand:10.0-22.0' Bentonite: 8.0-10.0' Grout: 0.0-8.0'
55	55.0						6" Surface Casing to 26'
	58.0	S-13	12"	12-19-26 (45)	Same as S-12		A-MW-9B Screen: 50.0-60.0' Sand: 47.0-60.0' Bentonite: 45.0-47.0' Grout: 0.0-47.0'
60	60.0						Bottom of Borehole 60.0'

=========	PROJECT NUMBER:HR030868	BORING NO.: A-MW-10	SHEET: 2 of 4
========= CH2M HILL =========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:6.76 DRILLING CONTRACTOR: Fishburne Drilling, Inc.
DRILLING METHOD AND EQUIPMENT: CME 7 with HSA
WATER LEVEL AND DATE: 3.16 4/18/91 START: 6/19/91 FINISH: 6/21/91 LOGGER: J. Ford

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
20							HNU/Explo.
--	21.0	S-1	1.0	1-2-3-3 (5)	SILTY SAND-Light Brown (5YR 6/4), Clean, Well Sorted, Well Rounded, Wet, Medium to Fine, Unconsolidated		0/0
--							
--							
--	24.0						
25 --							
--	26.0	S-2	1.0	1-1-3-4 (4)	Same as Above except M - VC		0/0
--							
--							
--	29.0						
30 --							
--	31.0	S-3	0.8	3-4-6-4 (10)	SILTY SAND-Dark Gray (N3), Fine Sand, Wet Unconsolidated		0/0
--							
--							
--	34.0						
35 --							
--	36.0	S-4	1.3	10-5-7-1 (12)	SILTY SAND WITH SHELL FRAGMENTS-90% shells, Dark Brown, Wet, Semi-consolidated		0/0
--							
--							
--	39.0						
40 --							

=========	PROJECT NUMBERHR030868	BORING NO.: A-MW-10	SHEET: 3 of 4
========= CH2M HILL =========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:6.76 DRILLING CONTRACTOR: Fishburne Drilling, Inc.
DRILLING METHOD AND EQUIPMENT: CME 7 with HSA
WATER LEVEL AND DATE: 3.16 4/18/91 START: 6/19/91 FINISH: 6/21/91 LOGGER: J. Ford

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
40							HNU/Explo.
--	41.0	S-5	0.7	10-12-15-12 (27)	Same as S-4		0/0
--							
--							
--	44.0	S-6	0.4	10-8-13-17 (21)	Same as S-4		0/0
45 --							
--	46.0						
--							
--							
--	49.0	S-7	0.6	14-9-16-22 (25)	SILTY CLAY WITH FINE SAND- Medium Green Gray, Wet, Consolidated, YORKTOWN		0/0, YORKTOWN @ 51.0'
50 --							
--	51.0						
--							
--	53.0	S-8	1.4	3-2-2-1 (4)	Same as S-7		
--							
							0/0
55 --	55.0						
--							
--							
--	58.0	S-9	1.5	20-20-18-19 (38)	Same as S-7		
--							
60 --	60.0						

=========	PROJECT NUMBER:HR030868	BORING NO.: A-MW-10	SHEET: 4 OF 4
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:6.76 DRILLING CONTRACTOR: Fishburne Drilling, Inc.
DRILLING METHOD AND EQUIPMENT: CME 7 with HSA
WATER LEVEL AND DATE: 3.16 4/18/91 START: 6/19/91 FINISH: 6/21/91 LOGGER: J. Ford

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	RECOVERY	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
							HNU/Explo.
63.0							
65.0	65.0	S-10	1.0	16-18-22-19 (40)	Same as Above		0/0
							A-MW-10A Screen: 10.0-20.0' Sand: 8.0-20.0' Bentonite: 6.0-8.0' Grout: 0.0-6.0'
							A-MW-10B Screen: 55.0-65.0' Sand: 53.0-65.0' Bentonite: 51.0-53.0' Grout: 0.0-51.0'
							Bottom of Borehole 65.0'

=========	PROJECT NUMBER:HR030868	BORING NO.: A-MW-11	SHEET: 1 of 3
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:12.91 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.74 4/18/91 START: 1/28/91 FINISH: 2/14/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
	0	S-1	10"	13-17-14 (31)	GRAVEL-Dusky Yellowish Brown (10YR 3/4)		HNu/Explo.
	2.0						0/0
	3.0	S-2	11"	8-3-3 (11)	SAND- (10Y 2/2)		
5	5.0						0/0
	8.0	S-3	15"	2-1-2 (3)	SANDY CLAY-Moderate Brown (5YR 3/4)		
10	10.0						0/0, Water @ 10.0'
	13.0	S-4	15"	2-4-2 (6)	Same as Above		
15	15.0						0/0
	18.0	S-5	18"	3-2-2 (5)	SAND-Pale Yellowish Brown (10YR 6/2), Vary Fine		
							0/0
20	20.0						

=========	PROJECT NUMBER:HRO30868	BORING NO.: A-MW-11	SHEET: 2 of 3
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:12.91 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.74 4/18/91 START: 1/28/91 FINISH: 1/14/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
20	20.0						HNU/Explo.
23.0		S-6	19"	2-2-3 (5)	SAND-Dark Yellowish Orange (10YR 6/6), Unconsolidated		
25	25.0						0/0
28.0		S-7	18"	15-17-21 (38)	Same as Above		
30	30.0						0/0
35							Clay @ 35.0' 0/0, Shelby Tube Taken @ 35.0', (S-2)
38.0		S-8	24"	2-2-3-7 (5)	CLAY-Dark Gray, Lean, Peat and Wood Chips, Soft, Moist		0/0
40	40.0						

=========	PROJECT NUMBER:HRO30868	BORING NO.: A-MW-11	SHEET: 3 of 3
========= CH2M HILL =========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:12.91 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.74 4/18/91 START: 1/28/91 FINISH: 2/14/91 LOGGER: S. Repko

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
40							HNU/Explo.
	43.0	S-10	20"	7-10-15-20 (25)	CLAY-Dark Gray, Lean, Moist, Hard		0/0
45	45.0						
	48.0	S-11	24"	4-5-4-5 (9)	Same as Above		0/0
50	50.0						
							YORKTOWN @ 51.5'
	53.0	S-12	19"	15-24-28-34 (52)	Top 6" Same as Above. Bottom 18" SILTY SAND WITH SHELL FRAGMENTS- Light Gray-Green, Fine, Glaconitic, YORKTOWN		0/0 A-MW-11A Screen: 15.0-25.0' Sand: 13.0-15.0' Bentonite: 11.0-13.0' Grout: 0.0-11.0'
55	55.0						
							A-MW-11B Screen: 54.0-64.0' Sand: 42.0-64.0' Bentonite: 36.5-42.0 Grout: 0.0-36.5'
	58.0	S-13	24"	14-15-20-12 (35)	Same as Above		
							6" Casing to 37.9'
60	60.0						Bottom of borehole @ 64.0'

=========	PROJECT NUMBER: HR030868	BORING NO.: A-MW-12	SHEET: 1 of 1
========= CH2M HILL =========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION: Camp Allen Landfill
ELEVATION: 10.96 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.17 4/18/91 START: 1/26/91 FINISH: 1/26/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	RECOVERY	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
	0	S-1	8"	5-7-6-8 (13)	CLAY-Brown-Red (5YR 4/4), Silty, Some Fine Sand		HNU/Explo.
	2.0						0/0
	3.0	S-2	12"	4-7-2-2 (9)	SAND-Gray (N5), Coarse, Wet		
5	5.0						0/0 Water at 5.5'
	8.0	S-3	14"	2-3-2-2 (5)	Same as Above		
10	10.0						0/0
	13.0	S-4	24"	3-2-2-1 (4)	Same as Above		
15	15.0	S-5	24"	1-1-1-1 (2)	CLAY-Olive Black (5Y 2/1), Moist, Stiff		0/0, Clay @ 15.0'
	17.0						0/0 A-MW-12
	18.0	S-6	24"	2-3-2-5 (5)	Same as Above		Screen: 10.0-20.0' Sand: 8.0-20.0' Bentonite: 6.0-8.0' Grout: 0.0-6.0'
20	20.0						Bottom of Borehole @ 20.0'

CH2M HILL

PROJECT NUMBER: HR030868 | BORING NO.: A-MW-1B | SHEET: 1 of 3

SOIL BORING LOG

PROJECT: Norfolk Naval Base | LOCATION: Camp Allen Landfill

ELEVATION: 11.43 | DRILLING CONTRACTOR: Froehling & Robertson, Inc.

DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA

WATER LEVEL AND DATE: 3.15 4/18/91 | START: 2/13/91 | FINISH: 2/15/91 | LOGGER: S.Repko

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
	0	S-1	18"	5-12-21-20 (33)	SILT WITH FINE SAND-Medium Brown Gray, Organics, Shells		HNU/Explo.
	2.0						0/0
	3.0	S-2	23"	6-5-4-5 (9)	ORGANIC SILT-Medium Brown-Gray, Small Pebbles		
5	5.0						
							0/0
	8.0	S-3	21"	6-7-7-7 (14)	SAND WITH SILT-Medium Brown-Gray, Medium, Well Sorted, Wet		
10	10.0						
							0/0
	13.0	S-4	20"	3-2-4-4 (6)	CLAY-Medium Gray (N5), Lean, Rust Bands		
15	15.0						
							0/0
							Shelby Tube Taken @ 18.0' (S-3)
20	20.0						

=========	PROJECT NUMBER:HR030868	BORING NO.: A-MW-1B	SHEET: 2 of 3
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:11.43 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.15 4/18/91 START: 2/13/91 FINISH: 2/15/91 LOGGER: S. Repko

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
20							
	21.0	S-6	14"	3-3-2-1 (5)			
	23.0	S-7	8"	13-14-6-6 (20)	SAND-Moderate Yellowish Brown (10YR 4/2), Medium to Fine		
25	25.0	S-8	20"	3-3-5-6 (8)	CLAY-Gray (N4), Lean, Stiff, Rust Zones		Clay @ 25.0'
	27.0						Shelby Tube taken @ 27.0' (S-4)
30	30.0	S-9	20"	4-3-4-4 (7)	Same as Above		
	32.0						
	33.0	S-10	24"	3-6-11-2 (17)	Same as Above		
35	35.0						
	38.0	S-11	24"	6-5-24-21 (29)	Same as Above		
40	40.0						

========= ========= CH2M HILL =========	PROJECT NUMBER:HR030868	BORING NO.: A-MW-1B	SHEET: 3 of 3

SOIL BORING LOG

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:11.43 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.15 4/18/91 START: 2/13/91 FINISH: 2/15/91 LOGGER: S. Repko

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
40							HNU/Explo.
	43.0	S-13	18"	9-11-13 -10 (24)	CLAY-Ligh Gray-Green, Moist, Tight, Iron Concintrations, YORKTOWN at 44.0', Glauconitic		YORKTOWN @ 44.0'
45	45.0						0/0
	48.0	S-14	18"	21-23-25 -28 (48)	SILTY SAND WITH SHELL FRAGMENTS-Light Green-Gray, Wet, >% Shell Fragments, Glauconitic		
50	50.0						0/0
	53.0	S-15	12"	17-20-11 -15 (31)	Same as Above		
							0/0
55	55.0						
							A-MW-1B Screen: 43.5-53.5' Sand: 35.9-53.5' Bentonite: 33.0-35.9' Grout: 0.0-33.0'
							6" Casing to 27.0'
60							Bottom of Borehole 55.0'

========= ========= CH2M HILL =========	PROJECT NUMBER:HR030868	BORING NO.: B-MW-1	SHEET: 1 of 2
	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:7.84 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 4.04 4/18/91 START: 1/26/91 FINISH: 1/26/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
--	0	S-1	17"	3-8-9-9 (17)	SAND-Grayish (5G 7/11),Fine to Coarse, Not Well Sorted, Moist		HNU/Explo.
--	2.0						0/0
--	3.0	S-2	18"	8-5-3-3 (8)	SAND-Brown (10YR 6/2), Vary Coarse, Wet		
5 --	5.0						0/0
--							
--							Water at 7.0'
--	8.0	S-3	8"	4-4-5-5 (9)	Same as Above		
10 --	10.0						0/0
--	13.0	S-4	25"	2-1-1-3 (2)	SAND WITH GRAVEL-Yelowish Brown (10YR 6/6), Wet		
15 --	15.0						0/0
--	18.0	S-5	21"	2-3-4-5 (7)	Same as Above		
20 --	20.0						0/0

=========	PROJECT NUMBER:HR030868	BORING NO.: B-MW-1	SHEET: 2 of 2
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:7.84 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 4.04 4/18/91 START: 1/26/91 FINISH: 1/26/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
20	20.0						HNU/Explo.
--							--
--							--
--	23.0	S-6	23"	5-5-7-6 (12)	SAND-Yellowish Brown-Orange (10YR 6/6), Coarse, Wet		--
--							--
25 --	25.0						0/0 --
--							--
--							--
--	28.0	S-7	24"	5-5-7-12 (12)	Same as Above		--
--							--
30 --	30.0						0/0 --
--							--
--							B-MW-1
--							Screen: 12.0-22.0' --
--							Sand: 10.0-22.0'
--							Bentonite: 8.0-10.0' --
--							Grout: 0.0-8.0'
--							--
35 --							Bottom of Borehole 30.0' --
--							--
--							--
--							--
--							--
40 --							--

=========	PROJECT NUMBER:HR030868	BORING NO.: B-MW-2	SHEET: 1 of 3
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:9.72 DRILLING CONTRACTOR: Hardin-Huber, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-60
WATER LEVEL AND DATE: 3.85 4/18/91 START: 1/28/91 FINISH: 2/15/91 LOGGER: J. Ford

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
	0	S-1	0"	5-10-9-4 (19)	No Recovery		HNU/Explo. 0/0
	2.0						
	3.0	S-2	18"	3-3-3-5 (6)	SAND-Light Olive Gray (5YR 5/2), Wet, Unconsolidated, Coarse		2ppm/0
5	5.0						Water Level @ 5.0'
	8.0	S-3	16"	5-4-6-5 (10)	Same as S-2		0/0
10	10.0						
	13.0	S-4	24"	5-6-5-5 (11)	SAND-Moderate Yellowish Brown (10YR 5/4), Unconsolidated, Wet, >% Fines, Fine to Coarse		1ppm/0
15	15.0						
	18.0	S-5	0"	4-4-3-2 (7)	No Recovery		0/0
20	20.0						

=========	PROJECT NUMBER:HR030868.A0.02	BORING NO.: B-MW-2	SHEET: 2 of 3
========= CH2M HILL =========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:9.72 DRILLING CONTRACTOR: Hardin-Huber, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-60
WATER LEVEL AND DATE: 3.85 4/18/91 START: 1/28/91 FINISH: 2/15/91 LOGGER: J. Ford

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
20	20.0						HNU/Explo. 0/0
	23.0	S-6	21"	2-2-3-2 (5)	CLAY-Olive Gray (5YR 3/2), Plastic, Wet, Weathering Features		1ppm/0, Clay @ 23.0'
25	25.0						
	28.0	S-7	20"	8-8-8-7 (16)	CLAY-Light Gray, Some fine sand, Weathering Features, Round Black Pebbles		0/0
30	30.0						
	33.0	S-8	12"	5-7-5-7 (12)	Same as Above		0/0
35	35.0						
	38.0	S-9	19"	3-3-4-0 (7)	FINE SAND WITH SILT-Dark Greenish Gray, M-C Sand, Some Washed Shell Fragments		0/0
40	40.0						

=========	PROJECT NUMBERHR030868.A0.02	BORING NO.: B-MW-2	SHEET: 3 of 3
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:9.72 DRILLING CONTRACTOR: Hardin-Huber, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-60
WATER LEVEL AND DATE: 3.85 4/18/91 START: 1/28/91 FINISH: 2/15/91 LOGGER: S. Repko

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	RECOVERY	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
40							HNU/Explo. 0/0
							YORKTOWN FORMATION @ 41.5'
	43.0	S-10	15"	5-12-17-21 (29)	FINE SAND WITH SHELL FRAGMENTS-Medium Greenish Gray, Moist, Tight, Glauconitic		0/0
45	45.0						
	48.0	S-11	15"	15-20-26-28 (46)	Same as Above		0/0 * This replacement well was installed because of possible grout contamination in the origional well.
50	50.0						
	53.0	S-12	18"	13-18-18-10 (36)	Same as Above		0/0 B-MW-2A Screen: 10.0-20.0' Sand: 8.0-20.0' TD
55	55.0						Bentonite: 6.0-8.0' Grout: 0.0-6.0' *B-MW-2B 6" Casing to 30.0' Screen: 51.0-61.0' Sand: 47.0-61.0' Bentonite: 44.8-47.0' Grout: 0.0-44.8'
60							Bottom of Borehole 55.0'

=========	PROJECT NUMBER:HR030868.A0.02	BORING NO.: B-MW-3	SHEET: 1 of 3
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:7.79 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.16 4/18/91 START: 1/29/91 FINISH: 2/14/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
	0	S-1	4"	12-15-15 -12 (30)	SILTY SAND-Dark Gray (N3), Fill, Concrete, Steel, Shells, ect.		HNU/Explo.
	2.0						
	3.0	S-2	8"	5-3-4-6 (7)	SAND-Olive Gray (5Y 3/2), Unconsolidated, Wet, Medium to Coarse Sand		0/0
5	5.0						Water Level @ 4.8'
	8.0	S-3	14"	3-3-4-6 (7)	SAND-Light Olive Gray (5Y 5/2), Unconsolidated, Wet, Medium to Coarse Sand		1ppm/0
10	10.0						
	13.0	S-4	16"	1-3-2-3 (5)	Same as Above except Light Brown (5YR 5/6)		0/0
15	15.0						
	18.0	S-5	12"	6-7-8-9 (15)	Same as Above except Fine Sand		0/0
20	20.0						

=========	PROJECT NUMBER:HR030868	BORING NO.: B-MW-3	SHEET: 2 of 3
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:7.79 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.16 4/18/91 START: 1/29/91 FINISH: 2/14/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
20	20.0						HNU/Explo.
--							--
--							--
--	23.0	S-6	14"	3-2-6-7 (8)	SAND-Light Brown (5YR 6/4), Clean, Well Sorted, Well Rounded, Wet, Medium		0/0 --
--							--
25 --	25.0						--
--							--
--							--
--	28.0	S-7	22"	3-3-4-7 (7)	Same as Above		0/0 --
--							--
30 --	30.0						--
--							--
--							--
--	33.0	S-8	13"	2-2-5 (7)	SILTY SAND-Dark Gray (N3), Fine Sand, Wet		0/0 --
--							--
35 --	35.0						--
--							--
--							--
--	38.0	S-9	14"	3-3-6 (9)	Same as Above		0/0 --
--							--
40 --	40.0						--

=========	PROJECT NUMBER:HR030868	BORING NO.: B-MW-3	SHEET: 3 of 3
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:7.79 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.16 4/18/91 START: 1/29/91 FINISH: 2/14/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
40							HNU/Explo.
	43.0	S-10	15"	3-3-5 (8)	SILTY SAND-Black (N1)		0/0
45	45.0						
							YORKTOWN at 46.5'
	48.0	S-11	20"	10-3-10 (10)	SILTY SAND WITH SHELLS-Grayish Green (10YR 5/2), Wet, Numerous Shell Fragments, Glauconitic		0/0
50	50.0						
	53.0	S-12	21"	9-14-20 (34)	Same as Above		0/0
							B-MW-3A Screen: 10.0-20.0' Sand: 8.0-20.0' Bentonite: 6.0-8.0' Grout: 0.0-6.0'
55	55.0						
							B-MW-3B Screen: 50.0-60.0' Sand: 48.0-60.0' Bentonite: 46.0-48.0' Grout: 0.0-46.0'
	58.0	S-13	20"	10-16-23 (39)	Same as Above		
60	60.0						Bottom of Borehole 60.0'

========= ========= CH2M HILL =========	PROJECT NUMBER:HR030868	BORING NO.: B-MW-5B	SHEET: 1 of 3

SOIL BORING LOG

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:12.13 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.85 4/18/91 START: 2/11/91 FINISH: 2/13/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
	0	S-1	17"	3-5-5-7 (10)	SAND-Moderate Brown (5YR 4/4), Fine to Medium		HNU/Explo.
	2.0						0/0
	3.0	S-2	24"	1-4-0-1 (4)	SAND-Greenish Gray (5GY 2/1), Fine		
							Water at 4.0'
5	5.0						0/0
	8.0	S-3	24"	3-5-WOH-WOH (5)	SAND-Medium Dark Gray (N4), Course-Medium		
10	10.0						0/0
	13.0	S-4	9"	5-6-5-5 (11)	Same as Above		
15	15.0						0/0
	18.0	S-5	14"	3-4-4-5 (8)	Same as Above		
20	20.0						0/0

=========	PROJECT NUMBER:HR030868	BORING NO.: B-MW-5B	SHEET: 2 of 3
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:12.13 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.85 4/18/91 START: 2/11/91 FINISH: 2/13/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	RECOVERY	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
20	20.0						HNU/Explo.
	23.0	S-6	16"	4-4-5-5 (9)	SAND-Medium Gray (N5), Course, Wet		0/0
25	25.0						
	28.0	S-7	19"	3-5-6-7 (11)	CLAY-Medium Dark Gray (N4), Moist, Stiff		0/0, Clay @ 28.0'
30	30.0						
	33.0	S-8	24"	3-3-3-3 (6)	Same as Above except for some vary fine sand		0/0
35	35.0						
	38.0	S-9	20"	2-3-4-5 (7)	SAND-Dark Yellowish Brown (10YR 6/6), Fins, Wet		0/0
40	40.0						

========= ========= CH2M HILL =========	PROJECT NUMBER:HR030868	BORING NO.: B-MW-5B	SHEET: 3 of 3

SOIL BORING LOG

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:12.13 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.85 4/18/91 START: 2/11/91 FINISH: 2/13/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
40							HNU/Explo.
	43.0	S-10	.5"	9-4-5-6 (9)	No Recovery		0/0
45	45.0						
							YORKTOWM @ 46.5'
	48.0	S-11	7"	4-3-3-3 (6)	SILTY SAND WITH SHELL FRAGMENTS-Grayish Green (10YR 5/2), Fine, Wet, Glaconitic, YORKTOWN		0/0
50	50.0						
	53.0	S-12	14"	12-14-17-14 (31)	Same as Above		0/0
55	55.0						B-MW-5B Screen: 50.0-60.0' Sand: 48.0-60.0' Bentonite: 43.0-48.0' Grout: 0.0-43.0' 6" Casing at 30.0'
	58.0	S-13	19"	16-25-26 (51)	Same as Above		0/0
60	60.0						Bottom of Borehole 60.0'

========= ========= CH2M HILL =========	PROJECT NUMBER:HR030868	BORING NO.: B-MW-7	SHEET: 1 of 2

SOIL BORING LOG

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:11.29 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 4.19 4/18/91 START: 1/29/91 FINISH: 1/29/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
	0	S-1	8"	11-9-11 (20)	SAND-Dusky Brown (5YR 2/2), Coarse, Moist		HNU/Explo.
	2.0						0/0
	3.0	S-2	18"	6-6-4 (10)	SAND-Medium Dark Gray (N4), Fine		
5	5.0						0/0
							Water at 7.0'
	8.0	S-3	13"	1-1-WOH (1)	SILTY SAND-Moderate Brown (5YR 3/4), Fine to Medium		
10	10.0						0/0
	13.0	S-4	21"	2-2-2 (4)	SAND-Medium Gray (N5), Coarse, Wet, Unconsolidated		
15	15.0						0/0
	18.0	S-5	7"	4-6-6 (12)	Same as Above		
20	20.0						0/0

=========	PROJECT NUMBER:HR030868	BORING NO.: B-MW-7	SHEET: 2 of 2
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:11.29 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 4.19 4/18/91 START: 1/29/91 FINISH: 1/29/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
20	20.0						HNU/Explo.
	23.0	S-6	15"	5-3-4 (7)	SAND-Medium Light Gray (N6), Coarse, Wet, Unconsolidated		0/0
25	25.0						
							Clay at Contact 26.5'
	28.0	S-7	22"	4-4-2 (6)	CLAY-Medium Gray (N5), Stiff, Moist		0/0
30	30.0						B-MW-7 Screen: 12.0-22.0' Sand: 10.0-22.0' Bentonite: 8.0-10.0' Grout: 0.0-8.0'
							Bottom of Borehole 30.0'
35							
40							

========= ========= CH2M HILL =========	PROJECT NUMBER:HR030868	BORING NO.: B-MW-8	SHEET: 1 of 2

SOIL BORING LOG

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:12.78 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 4.41 4/18/91 START: 1/28/91 FINISH: 1/28/91 LOGGER: J. Ford

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
	0	S-1	16"	9-15-8-6 (23)	SILTY SAND-Light Brown (5YR 5/6), Moisty, Semiplastic, Consolidated, Fine to Medium		HNU/Explo.
	2.0						0/0
	3.0	S-2	18"	7-4-3-3 (7)	SAND-Pale Brown (5YR 5/2), Wet, Unconsolidated, Coarse		Water at 3.0'
5	5.0						0/0
	8.0	S-3	15"	3-3-4-7 (7)	SAND-Medium Gray (N5), Wet, Unconsolidated, Coarse		
10	10.0						1ppm/0
	13.0	S-4	6"	5-4-5-7 (9)	SAND-Light Brown (5YR 6/4), Wet, Semiconsolidated, Fine to Medium		
15	15.0						0/0
	18.0	S-5	7"	3-3-3-1 (6)	SAND-Medium Dark Gray (N4), Wet, Semiconsolidated, Vary Fine Sand		
20	20.0						1ppm/0

=========	PROJECT NUMBER:HR030868	BORING NO.: B-MW-8	SHEET: 2 of 2
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:12.78 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 4.41 4/18/91 START: 1/28/91 FINISH: 1/28/91 LOGGER: J. Ford

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	RECOVERY	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
20	20.0						HNU/Explo.
							Clay @ 21.5'
	23.0	S-6	11"	1-1-1-1 (2)	CLAY WITH SAND-Grayish Black (N2), Moist, Consolidated, Vary Fine Sand		
25	25.0						0/0
							B-MW-8
							Screen: 10.0-20.0'
							Sand: 7.0-20.0'
							Bentonite: 5.0-7.0'
							Grout: 0.0-5.0'
30							
35							
40							

========= ========= CH2M HILL =========	PROJECT NUMBER:HR030868.A0.02	BORING NO.: B-MW-9	SHEET: 1 of 2

SOIL BORING LOG

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:10.96 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 4.37 4/18/91 START: 1/30/91 FINISH: 1/30/91 LOGGER: J. Ford

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
	0	S-1	24"	3-4-5-5 (9)	SILTY SAND-Moderate Brown (5YR 4/4),Top 3" organic SILT		HNU/Explo.
	2.0						
	3.0	S-2	24"	5-5-5-5 (10)	SAND-Moderate Brown (5YR 4/4), Wet, Fine to Medium Sand		0/0 Water @ 3.0'
5	5.0						
	8.0	S-3	24"	4-3-3-5 (6)	Same as Above		0/0
10	10.0						
	13.0	S-4	18"	4-3-6-3 (9)	Same as Above		0/0
15	15.0						
	18.0	S-5	22"	3-4-5-5 (9)	VARY SILTY SAND-Light Olive Gray (5Y 5/2), Wet, Fine Sand, Semi-consolidated		0/0
20	20.0						

=========	PROJECT NUMBER:HR030868	BORING NO.: B-MW-9	SHEET: 2 of 2
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:10.96 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 4.37 4/18/91 START: 1/30/91 FINISH: 1/30/91 LOGGER: J. Ford

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	RECOVERY	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
20	20.0						HNU/Explo.
	23.0	S-6	13"	15-11-8-4 (19)	SILTY SAND-Medium Gray (N5), Vary Coarse Sand to Small Gravel, Unconsolidated		0/0
25	25.0						
							Clay @ 26.5'
	28.0	S-7	24"	4-4-4-4 (8)	CLAY-Olive Gray (5Y 3/2), some Organic Material		0/0
30	30.0						B-MW-9 Screen: 17.0-27.0' Sand: 13.0-27.0' Bentonite: 12.0-14.0' Grout: 0.0-12.0'
							Bottom of Borehole 30.0'
35							
40							

========= ========= CH2M HILL =========	PROJECT NUMBER:HR030868	BORING NO.: B-MW-10	SHEET: 1 of 2
	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:8.16 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 4.18 4/18/91 START: 1/30/91 FINISH: 1/31/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
	0	S-1	18"	2-5-9 (14)	SAND-Moderate Brown (5YR 4/4), Coarse, Moist		HNU/Explo.
	2.0						
	3.0	S-2	16"	2-2-4 (6)	Same as Above		0/0
5	5.0						Water at 5.0'
	8.0	S-3	17"	2-1-2 (3)	Same as Above		0/0
10	10.0						
	13.0	S-4	20"	1-2-1 (3)	Same as Above		0/0
15	15.0						
	18.0	S-5	23"	3-4-5 (9)	Same as Above		0/0
20	20.0						

=========	PROJECT NUMBER:HR030868	BORING NO.: B-MW-10	SHEET: 2 of 2
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:8.16 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 4.18 4/18/91 START: 1/30/91 FINISH: 1/31/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
20	20.0						HNU/Explo.
	23.0	S-6	11"	3-6-5 (11)	SAND-Dark Yellowish-Orange (10YR 6/6), Coarse, Wet		0/0
25	25.0						
							Clay Contact at 26.5'
	28.0	S-7	16"	4-5-6 (11)	CLAY-Dark Gray (N4), Stiff, Moist		0/0
30	30.0						B-MW-10 Screen: 13.0-23.0' Sand: 11.0-23.0' Bentonite: 9.0-11.0' Grout: 0.0-9.0'
							Bottom of Borehole 30.0'
35							
40							

=========	PROJECT NUMBER:HR030868	BORING NO.: B-MW-11	SHEET: 1 of 2
=========			
CH2M HILL			
=========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:8.10 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.72 4/18/91 START: 1/30/91 FINISH: 1/30/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
	0	S-1	15"	2-7-13-16 (20)	SAND-Olive Gray (5Y 4/1), Coarse, Moist, Unconsolidated		HNU/Explo.
	2.0						0/0
	3.0	S-2	12"	2-2-2-3 (4)	SAND-Light Brown (5YR 4/4), Coarse, Wet, Unconsolidated		
5	5.0						Water at 5.0'
	8.0	S-3	19"	6-5-4-4 (9)	Same as Above		0/0
10	10.0						
	13.0	S-4	24"	3-3-4-5 (7)	SAND-Dark Yellowish Orange (10YR 6/6), Coarse, Wet, Unconsolidated		0/0
15	15.0						
	18.0	S-5	23"	5-9-9-9 (18)	Same as Above		0/0
20	20.0						

=========	PROJECT NUMBER:HRO30868	BORING NO.: B-MW-11	SHEET: 2 of 2
========= CH2M HILL =========	SOIL BORING LOG		

PROJECT: Norfolk Naval Base LOCATION:Camp Allen Landfill
ELEVATION:8.10 DRILLING CONTRACTOR: Froehling & Robertson, Inc.
DRILLING METHOD AND EQUIPMENT: Mobile B-57 with HSA
WATER LEVEL AND DATE: 3.72 4/18/91 START: 1/30/91 FINISH: 1/30/91 LOGGER: D. Snyder

DEPTH BELOW SURFACE	DEPTH INTERVAL	TYPE AND NUMBER	REC	STD. PEN. TEST 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TEST AND INSTRUMENTATION
20	20.0						HNU/Explo.
23.0		S-6	24"	5-3-2-2 (5)	CLAY-Olive Black (N3), Stiff, Moist		0/0
							Clay Contact at 23.5'
25	25.0						B-MW-11
							Screen: 10.0-20.0'
							Sand: 8.0-20.0'
							Bentonite: 6.0-8.0'
							Grout: 0.0-6.0'
							Bottom of Borehole 25.0'
30							
35							
40							

BAKER ENVIRONMENTAL, INC.
SOURCE CHARACTERIZATION TEST BORING RECORDS
AREAS A & B (1992)

TEST BORING LOG LEGEND

SOIL DESCRIPTION

GRAIN SIZE IDENTIFICATION

NAME	SIZE LIMITS
Boulder	12" OR MORE
Cobbles	3" - 12"
Coarse Gravel	3/4" - 3"
Fine Gravel	4.76 mm (#4) - 3/4"
Coarse Sand	2 mm (#10) - 4.76 mm (#4)
Medium Sand	0.42 mm (#40) - 2 mm (#10)
Fine Sand	0.074 mm (#200)-0.42 mm (#40)
Silt	0.002 mm-0.074 mm (#200)
Clay	Less than 0.002 mm

RELATIVE DENSITY

NONCOHESIVE SOIL

TERM	SPT (Blows/ft)
Very Loose	Below 4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	OVER 50

COHESIVE SOILS

TERM	SPT (Blows/ft)
Very Soft	BELOW 2
Soft	2-4
Medium Stiff	4-8
Stiff	8-15
Very Stiff	15-30
Hard	OVER 30

MOISTURE	DESCRIPTIVE TERMS	
Dry	Trace	0-10%
Damp	Little	10-20%
Moist	Some	20-35%
Wet	And	35-50%

ROCK DESCRIPTIONS

HARDNESS

Very Soft -	Easily gouged by knife, easily scratched by fingernail, easily broken by hand
Soft -	Gouged by knife, scratched by fingernail, difficult to break by hand, powders with hammer
Medium Hard -	Easily scratched by knife, easily broken with hammer
Hard -	Difficult to scratch, breaks with hammer
Very Hard -	Difficult to break, rings when struck

WEATHERING

Decomposed -	Soft to Very soft, bedding and fractures indistinct, no cementation.
Highly Weathered -	Very soft to soft, with medium hard relict rock fragments; little to moderate cementation. Vugs, openings in bedding and fractures (may be filled).
Weathered -	Soft to medium hard. Good cementation, bedding and fractures are pronounced. Uniformly stained.
Slightly Weathered -	Medium hard. Fractures pronounced, non-uniform staining, bedding distinct.
Fresh -	Medium hard to hard. No staining. Fractures may be present. Bedding may or may not be indistinct.

BEDDING AND FRACTURES:

SPACING	BEDDING	FRACTURES
	Indistinct	
LESS THAN 1/2" (1 cm)	Laminated	Fissile
1/2" to 1" (1cm-3cm)	Very Thin	Very Close
1" TO 4" (3cm-10cm)	Thin	Close
4" TO 1' (10cm-30cm)	Moderate	Moderate
1' TO 3' (30 cm-1m)	Thick	Wide
3' TO 10' (1m-3m)	Massive	Very Wide

CONTACTS:

_____ = DEFINITE

_____ _____ = INDEFINITE

. . . . . = GRADATIONAL

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash (Roller Bit)
C = Core
P = Piston
N = No Sample Taken

ABBREVIATIONS

HS	=	Hollow Stem
NP	=	Non Plastic
-PL	=	Below the Plastic Limit
PL	=	At the Plastic Limit
+PL	=	Above the Plastic Limit
+LL	=	Above the Liquid Limit
SPT	=	Standard Penetration Test
RQD	=	Rock Quality Designation

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: SBA-01
COORDINATES: EAST: 2641531.39 NORTH: 224062.33
ELEVATION: SURFACE: 12.74 TOP OF STEEL CASING: -NA-

RIG: Mobile B-60	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	4 1/4" ID	--	5/27/92	18.0	Partly Cloudy, 70°F	5.0	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30" ±	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 0.5 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1 – 2.0	SS-1	1.5 / 75%	3 5 8 7		7.0	SILT and sand fine grained ; dark grey; medium dense; damp	
3 – 4.0	SS-2	1.5 / 75%	2 2 2 2		30.0	silty SAND fine grained; dark grey; loose; moist	
5 – 6.0	SS-3	2.0 / 100%	2 W O H		20.0	silty SAND fine grained; dark grey; very loose; wet (environmental sample)	▼
7 – 8.0	SS-4	2.0 / 100%	W O H		5.0	SILT; dark grey; very soft; wet	
9 – 10.0	SS-5	2.0 / 100%	W O H		5.0		

Match to Sheet 2

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBA-01 SHEET 1 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: SBA-01

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
11 – 12.0	SS-6	2.0 100%	W O H		BG	SILT; dark grey; very soft; wet	
13 – 14.0	SS-7	2.0 100%	W O H		BG	SILT; w/plant material throughout; dark grey; very soft; wet	
15 – 16.0	SS-8	2.0 100%	W O H		BG	SILT; w/plant material throughout; dark grey; very soft	
17 – 18.0	SS-9	2.0 100%	W O H		BG	SILT; w/some sand; dark grey; very soft; wet	
18						TD @ 18.0'	
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBA-01 SHEET 2 OF 2

TEST BORING RECORD

Baker
Baker Environmental, Inc.

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: SBA-02
COORDINATES: EAST: 2641532.42 NORTH: 224159.66
ELEVATION: SURFACE: 13.11 TOP OF STEEL CASING: -NA-

RIG: Mobile B-60	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	4 1/4" ID	--	5/27/92	16.0	Partly Cloudy, 70°F	5.0	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 0.5 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1 – 2.0	SS-1	1.5	5 9 6 6		BG	**SILT**, trace broken glass; dark grey; stiff; damp	
3 – 4.0	SS-2	1.5	2 2 3 2		20.0	**SILT**; w/some fine grained sand, trace cinders; dark grey; medium stiff; moist	
5 – 6.0	SS-3	1.5	2 1 1 2		5.0	**SILT**, w/some fine sand; dark grey; soft; wet (environmental sample)	▼
7 – 8.0	SS-4	1.5	1/12" 1/12"		25.0	**SILT**, w/some fine sand; dark grey; very soft; wet	
9 – 10.0	SS-5	1.0	1 W O H		14.0	Alternating **SILT** and fine grained **SAND** seams; dark grey; very soft	

Match to Sheet 2

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBA-02 SHEET 1 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: SBA-02

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
11 – 12.0	SS-6	2.0 100%	W O H		5.0	SILT; dark grey; very soft; wet	
13 – 14.0	SS-7	2.0 100%	W O H		BG	SILT; dark grey; very soft; wet	
15 – 16.0	SS-8	2.0 100%	W O H		BG	SILT, w/plant matter throughout; dark grey; very soft; wet	
16						TD @ 16.0'	
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBA-02 SHEET 2 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: SBA-03
COORDINATES: EAST: 2641467.11 NORTH: 224157.51
ELEVATION: SURFACE: 13.24 TOP OF STEEL CASING: -NA-

RIG: Mobile B-60	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	4 1/4" ID	--	5/28/92	16.0	Partly Cloudy, 70°F	6.0	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30" ±	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 0.5 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1 – 2.0	SS-1	1.0 50%	1 7 5 5		BG	silty SAND fine grained; grey; medium dense; damp	
3 – 4.0	SS-2	2.0 100%	3 3 2 2		3.0	silty SAND; fine grained grey; loose; moist	
5 – 6.0	SS-3	2.0 100%	1 1 2 1		BG	silty SAND fine grained; grey; very loose; moist to wet	▼
7 – 8.0	SS-4	2.0 100%	W O H		7.0	silty SAND fine grained; dark grey; very loose; wet (environmental sample)	
9 – 10.0	SS-5	NR	W O H		--	No Recovery	

Match to Sheet 2

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBA-03 SHEET 1 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: SBA-03

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
11 – 12.0	SS-6	2.0 100%	W O A		7.0	SILT; grey to dark grey; very soft; wet	
13 – 14.0	SS-7	2.0 100%	W O H		8.0	SILT; dark grey; very soft; wet	
15 – 16.0	SS-8	2.0 100%	W O H		BG	SILT; w/plant material throughout; dark grey; very soft; wet	
						TD @ 16.0'	

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBA-03 SHEET 2 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: SBA-04
COORDINATES: EAST: 2641408.93 NORTH: 224141.66
ELEVATION: SURFACE: 12.64 TOP OF STEEL CASING: -NA-

RIG: Mobile B-60	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	4 1/4" ID	--	5/28/92	18.0'	Partly Cloudy, 70°F	5.0	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 0.5 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1 – 2.0	SS-1	0.5 / 25%	1 1 2 2		BG	silty SAND; fine grained, dark grey; very loose; damp	
3 – 4.0	SS-2	1.5 / 75%	5 5 6 5		BG	silty SAND; fine grained dark grey; medium dense; damp	
5 – 6.0	SS-3	2.0 / 100%	2 1 1 1		4.0	silty SAND; fine grained, dark grey; very loose; wet	▼
7 – 8.0	SS-4	0.5 / 25%	W O R		BG	silty SAND; fine grained dark grey; very loose; wet	
9 – 10.0	SS-5	0.5 / 25%	1/12" 1/12"		BG	silty SAND; fine grained dark grey; very loose; wet	

Match to Sheet 2

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBA-04 SHEET 1 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: SBA-04

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
11 – 12.0	SS-6	0.5 25%	WOH		BG	silty SAND; fine grained, dark grey; very loose; wet	
13 – 14.0	SS-7	2.0 100%	WOH		BG	SILT; dark grey; very soft; wet	
15 – 16.0	SS-8	2.0 100%	WOH		BG	SILT; dark grey; very soft; wet	
17 – 18.0	SS-9	2.0 100%	WOH		BG	SILT; w/plant material throughout, dark grey; very soft; wet	
19						TD @ 18.0'	
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBA-04 SHEET 2 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: SBA-05
COORDINATES: EAST: 2641416.47 NORTH: 224096.30
ELEVATION: SURFACE: 13.24 TOP OF STEEL CASING: NA

RIG: Mobile B-60	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	4 1/4" ID	--	5/28/92	18.0	Partly Cloudy, 70°F	5.5	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 0.5 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1 – 2.0	SS-1	0.5 / 25%	2 4 4 2		BG	**silty SAND**, trace broken glass; grey; loose; damp	
3 – 4.0	SS-2	1.5 / 75%	3 7 4 4		0.4	**silty SAND** fine grained; grey; medium dense; moist	
5 – 6.0	SS-3	2.0 / 100%	3 4 2 1		BG	**silty SAND** fine grained; grey; loose; wet	▼
7 – 8.0	SS-4	0.5 / 25%	1/12" 1/12"		BG	**SILT**; grey; very soft; wet (environmental sample)	
9 – 10.0	SS-5	0.2 / 10%	W O H		BG	**SILT**; grey; very soft; wet	
10						Match to Sheet 2	

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBA-05 SHEET 1 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: SBA-05

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
11 – 12.0	SS-6	2.0 100%	WOH		BG	SILT; w/1" seam of grey sand and crushed shells @ 11.0' grey; very soft; wet	
12 – 14.0	SS-7	2.0 100%	WOH		BG	SILT; alternating layers dark grey; very soft; wet	
14 – 16.0	SS-8	2.0 100%	WOH		BG	SILT; alternating layers dark grey; very soft; wet	
16 – 18.0	SS-9	1.0 50%	WOH		BG	silty SAND fine grained; w/plant material throughout; dark grey; very loose; wet	
18						TD @ 18.0'	
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBA-05 SHEET 2 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: SBA-06
COORDINATES: EAST: 2641476.24 NORTH: 220463.22
ELEVATION: SURFACE: 13.09 TOP OF STEEL CASING: NA

RIG: Mobile B-60	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	4 1/4" ID	--	5/28/92	14.0	Partly Cloudy, 70°F	5.0	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 0.5 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1 – 2.0	SS-1	1.0 50%	2 4 8 6		5.0	silty SAND fine grained little gravel; dark grey; medium dense; damp	
3 – 4.0	SS-2	2.0 100%	3 3 2 3		BG	silty SAND fine grained; dark grey; loose; damp	
5 – 6.0	SS-3	1.0 50%	2 2 2 2		BG	silty SAND fine grained; dark grey; loose; moist to wet	▼
7 – 8.0	SS-4	1.5 75%	1 1 1/12"		4.0	SILT; dark grey; very soft; wet (environmental sample)	
9 – 10.0	SS-5	2.0 100%	W O H		BG	SILT; dark grey; very soft; wet	

Match to Sheet 2

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBA-06 SHEET 1 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: SBA-06

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
11 – 12.0	SS-6	2.0 100%	WOH		BG	SILT; alternating layers dark grey; very soft; wet	
12 – 14.0	SS-7	2.0 100%	WOH		BG	SILT; w/plant material throughout dark; grey; very soft; wet	
14						TD @ 14.0'	
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBA-06 SHEET 2 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: SBA-07
COORDINATES: EAST: 2641572.36 NORTH: 224101.29
ELEVATION: SURFACE: 13.30 TOP OF STEEL CASING: NA

RIG: Mobile B-60	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	4 1/4" ID	--	5/28/92	16.0	Partly Cloudy, 70°F	6.0	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 0.5 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)		Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1	2.0	SS-1	1.5 / 75%	5 11 8 5		BG	SILT; grey; very stiff; damp; pulled up copper wire @ 2.0', moved rig ahead 5'	
3	4.0	SS-2	2.0 / 100%	8 9 5 6		6.0	SILT; trace charcoal, grey; stiff; damp	
5	6.0	SS-3	2.0 / 100%	1 1 1 1		5.0	silty SAND fine grained, trace charcoal; grey; very loose; moist	▼
7	8.0	SS-4	0.5 / 25%	1/12" 1/12"		2.0	silty SAND fine grained, trace charcoal; grey; very loose; wet	
9	10.0	SS-5	2.0 / 100%	1/12" 1/12"		17.0	SILT; w/fine grained sand; dark grey; very soft; wet (environmental sample & duplicate)	

Match to Sheet 2

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBA-07 SHEET 1 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: SBA-07

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
11 – 12.0	SS-6	2.0 100%	W O H		3.0	SILT; grey; very soft; wet	
13 – 14.0	SS-7	2.0 100%	W O H		3.0	SILT; light and dark grey; very soft; wet	
15 – 16.0	SS-8	2.0 100%	W O H		BG	SILT; w/plant material light and dark grey; very soft; wet	
16						TD @ 16.0'	

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBA-07 SHEET 2 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: SBA-08
COORDINATES: EAST: 2641566.36 NORTH: 224137.03
ELEVATION: SURFACE: 13.40 TOP OF STEEL CASING: NA

RIG: Mobile B-60	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	4 1/4" ID	--	5/28/92	16.0	Partly Cloudy, 70°F	5.0	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 0.5 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1 – 2 (2.0)	SS-1	1.5 / 75%	6 9 8 5		3.0	silty SAND fine grained, trace cinders; dark grey; medium dense; damp	
3 – 4 (4.0)	SS-2	2.0 / 100%	3 3 3 3		1.0	silty SAND fine grained, grey; loose; moist	
5 – 6 (6.0)	SS-3	2.0 / 100%	1 1 1 1		17.0	SILT; grey; very soft; wet, (environmental sample)	▼
7 – 8 (8.0)	SS-4	2.0 / 100%	W O H		BG	silty SAND fine grained, grey; very loose; wet	
9 – 10 (10.0)	SS-5	2.0 / 100%	W O H		BG	SILT; light and dark grey; very soft; wet; some thin seams of sand and crushed shells	

Match to Sheet 2

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBA-08 SHEET 1 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: SBA-08

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
11 – 12.0	SS-6	2.0 100%	W O H		BG	SILT; light to dark grey; very soft; wet	
12 – 14.0	SS-7	2.0 100%	W O H		BG	SILT; w/plant material @ 13'; light to dark grey; very soft; wet	
14 – 16.0	SS-8	2.0 100%	W O H		BG	SILT; w/plant material throughout; light to dark grey; very soft; wet	
16						TD @ 16.0'	
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBA-08 SHEET 2 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: SBB-01
COORDINATES: EAST: 2643363.54 NORTH: 224003.49
ELEVATION: SURFACE: 9.23 TOP OF STEEL CASING: -NA-

RIG: Mobile B-61	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	4-1/4" ID	--	5/19/92	10.0	65°	5.0	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 0.4 ppm No reading on spoons above background.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1 – 2.0	SS-1	1.6 / 80%	2 4 3 5		BG	**SAND**, very fine grained and **silt**; dark grey; loose; damp	
3 – 4.0	SS-2	1.0 / 50%	2 2 4 4		BG	**SAND**, very fine grained and **silt**; dark grey; loose; damp	
5 – 6.0	SS-3	1.5 / 75%	1 1 2 3		BG	**SAND**, very fine grained and **silt**; dark grey; very loose; wet. (environmental sample)	▼
7 – 8.0	SS-4	2.0 / 100%	3 2 2 2		BG	**SAND**, very fine grained and **silt**; dark grey; loose; moist to wet	
9 – 10.0	SS-5	1.5 / 75%	1 2 2 2		BG	**SAND**, very fine grained and **silt**; dark grey; loose; wet	
						TD @ 10.0'	

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBB-01 SHEET 1 OF 1

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: SBB-02
COORDINATES: EAST: 2643312.69 NORTH: 224107.98
ELEVATION: SURFACE: 11 (estimated) TOP OF STEEL CASING: -NA-

RIG: Mobile B-61	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	3-7/8" ID	--	5/19/92	8.0	rain 65°	5.0	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 0.4 ppm. No readings on spoons above background.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1 – 2 (2.0)	SS-1	1.5 / 75%	3 3 5 4		BG	SAND, coarse to fine grained with trace silt; light brown; loose; damp	
3 – 4 (4.0)	SS-2	1.0 / 50%	7 8 18 10		BG	silty SAND; light grey; medium dense; damp	
5 – 6 (6.0)	SS-3	1.5 / 75%	1 1 2 3		BG	silty SAND; light brown; very loose; wet. Environmental sample	▼
7 – 8 (8.0)	SS-4	2.0 / 100%	1 2 4 3		BG	silty SAND; light brown; very loose; wet	
9 – 10						TD @ 8.0'	

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBB-02 SHEET 1 OF 1

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: SBB-03
COORDINATES: EAST: 2643519.06 NORTH: 224230.19
ELEVATION: SURFACE: 8.43 TOP OF STEEL CASING: -NA-

RIG: Mobile B-61	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	4 1/4" ID	--	5/19/92	8.0	rain 65°	5.0	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 0.4 ppm. No readings on split spoons above background.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1 – 2 (2.0)	SS-1	1.0 / 50%	3 2 2 4		BG	silty SAND; light brown; loose; damp	
3 – 4 (4.0)	SS-2	1.0 / 50%	4 2 4 3		BG	silty SAND; light brown; loose; damp	
5 – 6 (6.0)	SS-3	NR	3 2 4 3		BG	No Recovery piece of stone in shoe	▼
7 – 8 (8.0)	SS-4	2.0 / 100%	2 2 3 3		BG	silty SAND; light brown; loose; wet. (environmental sample)	
9 – 10						TD @ 8.0'	

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBB-03 SHEET 1 OF 1

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: SBB-04
COORDINATES: EAST: 2643412.51 NORTH: 224213.14
ELEVATION: SURFACE: 9 (estimated) TOP OF STEEL CASING: -NA-

RIG: Mobile B-61									
	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	4-1/4" ID	--	5/19/92	10.0	rain 65°	5.0	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 0.4 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1 – 2.0	SS-1	1.5 / 75%	1 2 4 5		BG	silty SAND; brown; loose; damp.	
3 – 4.0	SS-2	1.5 / 75%	2 2 3 2		BG	silty SAND; brown; loose; moist to wet.	
5 – 6.0	SS-3	1.0 / 50%	1 1 2 1		10.0	silty SAND; grey; very loose; wet.	▼
7 – 8.0	SS-4	1.5 / 75%	1 1 2 1		100+	silty SAND; dark grey; very loose; wet.	
9 – 10.0	SS-5	2.0 / 100%	1 2 4 5		4.0	silty SAND; dark grey; very loose; wet.	
						TD @ 10.0'	

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBB-04 SHEET 1 OF 1

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: SBB-05
COORDINATES: EAST: 2643551.73 NORTH: 224362.18
ELEVATION: SURFACE: 10 (estimated) TOP OF STEEL CASING: -NA-

RIG: Mobile B-61									
	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	4-1/4" ID	--	5/19/92	10.0	rain 65°	7.0	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 0.4 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1 – 2.0	SS-1	1.8 / 90%	2 2 2 2		BG	silty SAND; brown; loose; damp.	
3 – 4.0	SS-2	2.0 / 100%	1 1 2 2		BG	silty SAND; brown; very loose; damp.	
5 – 6.0	SS-3	1.0 / 50%	1 2 1 1		1.5	SILT, w/sand and some clay; grey; very loose; moist, some organic pieces.	
7 – 8.0	SS-4	1.5 / 75%	1 1 1 1		1.5	silty SAND; grey; very loose; wet, darker grey at bottom of spoon. (environmental sample)	▼
9 – 10.0	SS-5	1.0 / 50%	1 1 1 1		1.5	silty SAND; grey; very loose; wet.	
10						TD @ 10.0'	

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBB-05 SHEET 1 OF 1

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: SBB-06
COORDINATES: EAST: 2643755.40 NORTH: 224480.00
ELEVATION: SURFACE: 9.22 TOP OF STEEL CASING: -NA-

RIG: Mobile B-61	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	4-1/4" ID	--	5/18/92	10.0	partly sunny 80°	6.5	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 2.0 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1 – 2.0	SS-1	1.0 50%	2 2 3 4		BG	silty SAND; brown; loose; damp.	
3 – 4.0	SS-2	1.5 75%	2 3 4 6		3.8	silty SAND; brown and grey; loose; moist.	
5 – 6.0	SS-3	1.6 80%	2 1 2 2		10.0	silty SAND, grey; very loose; moist. (Environmental sample.)	
7 – 8.0	SS-4	1.5 75%	2 2 1 1		2.2	SAND, w/little silt; grey; very loose; wet	▼
9 – 10.0	SS-5	2.0 100%	1 2 2 2		BG	SAND, w/little silt; grey; very loose; wet.	
						TD @ 10.0'	

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBB-06 SHEET 1 OF 1

TEST BORING RECORD

Baker
Baker Environmental, Inc.

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: SBB-07
COORDINATES: EAST: 2643732.78 NORTH: 224561.35
ELEVATION: SURFACE: 10.32 TOP OF STEEL CASING: -NA-

RIG: Mobile B-61	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	4-1/4" ID	--	5/18/92	10.0	sunny 80°	9.5	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 2.0 ppm

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1 – 2.0	SS-1	1.5 / 75%	1 1 3 3		8.0	silty SAND; dark brown; loose; dry to damp.	
3 – 4.0	SS-2	1.5 / 75%	3 3 3 3		10.0	silty SAND; fine grained; grey; loose; moist. (Environmental sample.)	
5 – 6.0	SS-3	1.5 / 75%	2 4 3 3		7.0	silty SAND, grey; very loose; moist.	
7 – 8.0	SS-4	2.0 / 100%	2 1 2 1		BG	silty SAND, w/some clay; grey and brown; very loose; moist.	
9 – 10.0	SS-5	1.0 / 50%	2 2 1 2		BG	silty SAND; grey; very loose; wet.	▼
						TD @ 10.0'	

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBB-07 SHEET 1 OF 1

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: SBB-08
COORDINATES: EAST: 2643815.03 NORTH: 224620.04
ELEVATION: SURFACE: 9.61 TOP OF STEEL CASING: -NA-

RIG: Mobile B-61	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	4-1/4" ID	--	5/18/92	10.0	overcast 72°	8.0	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 2.0 ppm

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1 – 2 (2.0)	SS-1	1.2 / 60%	2 3 5 5		4.5	silty SAND; dark brown; loose; damp.	
3 – 4 (4.0)	SS-2	0.8 / 40%	5 7 11 8		4.5	silty SAND, w/traces of cardboard, metal; dark brown; medium dense; moist.	
5 – 6 (6.0)	SS-3	0.5 / 25%	2 6 4 6		7.0	silty SAND; dark grey; medium dense; moist	
7 – 8 (8.0)	SS-4	2.0 / 100%	4 3 3 4		BG	silty SAND; dark grey; loose; moist.	▼
9 – 10 (10.0)	SS-5	2.0 / 100%	3 2 1 2		BG	SAND, fine to coarse grained; grey; very loose; wet.	
						End of Boring @ 10.0'	

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBB-08 SHEET 1 OF 1

TEST BORING RECORD

Baker
Baker Environmental, Inc.

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: SBB-09
COORDINATES: EAST: 2643924.84 NORTH: 224749.28
ELEVATION: SURFACE: 10.34 TOP OF STEEL CASING: -NA-

RIG: Mobile B-61	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	4-1/4" ID	--	5/18/92	10.0	overcast 75°	7.8	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 2.0 ppm. No readings on spoons above background.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1 – 2 (2.0)	SS-1	0.3 / 15%	4 3 3 3		BG	silty SAND; brown; loose; dry	
3 – 4 (4.0)	SS-2	0.3 / 15%	3 2 5 4		BG	SAND, fine to coarse grained, trace silt; brown; loose; dry	
5 – 6 (6.0)	SS-3	1.5 / 75%	2 1 2 2		BG	silty SAND, very fine grained w/trace clay, steel pieces; grey; very loose; moist	
7 – 8 (8.0)	SS-4	2.0 / 100%	2 2 2 2		BG	silty SAND, some clay; grey; loose; wet.	▼
9 – 10 (10.0)	SS-5	2.0 / 100%	5 2 2 3		BG	silty SAND; grey; loose; wet	
						TD @ 10.0'	

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBB-09 SHEET 1 OF 1

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: SBB-10
COORDINATES: EAST: 2643720.99 NORTH: 224678.22
ELEVATION: SURFACE: 10.69 TOP OF STEEL CASING: -NA-

RIG: Mobile B-61	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	4-1/4" ID	--	5/18/92	10.0	sun 80°	5.0	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 2.0 ppm. No readings on spoons above background.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1 – 2.0	SS-1	1.0 50%	2 3 5 3		BG	SAND, fine grained w/little silt; light brown; loose; damp	
3 – 4.0	SS-2	1.0 50%	2 3 4 1		BG	SAND, fine grained w/little silt; light brown; loose; moist	
5 – 6.0	SS-3	0.3 15%	W O R		BG	silty SAND; grey; very loose; wet	▼
7 – 8.0	SS-4	NR	4 10 7 3		BG	No Recovery	
9 – 10.0	SS-5	2.0 100%	2 1 1 1		BG	silty SAND, w/little clay; brownish grey; very loose; wet.	
10						TD @ 10.0'	

DRILLING CO.: Hardin and Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: SBB-10 SHEET 1 OF 1

BAKER ENVIRONMENTAL, INC.

AREA A GEOLOGIC TEST BORING RECORDS (1992)

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: TBA-1
COORDINATES: EAST: 2642797.53 NORTH: 224763.11
ELEVATION: SURFACE: 13.23 TOP OF STEEL CASING: -NA-

RIG: Mobile B-80	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	3 1/4" ID	--	5/29/92	29.0			
LENGTH	2.0'	--	5'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu background reading is 0.5 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1							
2						Hard Drilling may be fill	
3							
4					BG	Advance Augers to 25'	
5	AN						
6							
7							
8							
9							
10						Match to Sheet 2	

DRILLING CO.: Hardin & Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: TBA-1 SHEET 1 OF 2

TEST BORING RECORD

Baker
Baker Environmental, Inc.

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: TBA-1

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
11							
12							
13							
14							
15						Native soil material	
16					BG		
17	AN						
18							
19							
20							
21							
22							
23							
24							
25	25.0						
26	SS-1 27.0	1.4 75%	3 1 1 1		BG	SAND; fine to coarse grained, w/some silt and some clay; light orange brown; very loose; wet	
27						CLAY; light green; soft; moist	
28	SS-2 29.0	2.0 100%	3 3 3 3		BG	CLAY; w/trace silt and trace sand, light orange brown; medium stiff; moist	
29							
30						TD @ 29.0'	

DRILLING CO.: Hardin & Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: TBA-1 SHEET 2 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: TBA-2
COORDINATES: EAST: 2642450.48 NORTH: 224294.35
ELEVATION: SURFACE: 12.31 TOP OF STEEL CASING: -NA-

RIG: Mobile B-80	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	3 1/4" ID	--	5/28/92	30.0			
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu background reading is 0.5 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1							
2						Fill material (bricks) in with drill cuttings	
3							
4					BG	Advance Augers to 20'	
5							
6	AN						
7							
8							
9							
10						Match to Sheet 2	

DRILLING CO.: Hardin & Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: TBA-2 SHEET 1 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: TBA-2

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
11, 12, 13, 14, 15, 16, 17, 18, 19, 20.0	AN				BG	Advance Augers to 20'	
						Drill cuttings @ 15' are native soil	
20.0–22.0	SS-1	1.0 / 50%	3 2 12 23		BG	**CLAY** w/some silt and trace sand fine to coarse grained. Clay ≈ 6" thick; light brown; medium dense; wet	
22.0–24.0	SS-2	1.0 / 50%	1 12 27 29		BG	**SAND**; fine to coarse grained, w/trace silt and trace clay; light brown; very dense; wet	
24.0–26.0	SS-3	1.0 / 50%	4 9 11 20		BG	**SAND**; fine to coarse grained; light orangeish brown; medium dense; wet	
26.0–28.0	SS-4	1.0 / 50%	4 10 10 10		BG	**SAND**; fine to coarse grained; with some gravel (subrounded, fine to coarse grained); light brown; medium dense; wet	
28.0–30.0	SS-5	1.0 / 50%	2 2 2 4		BG	**SAND**; fine to coarse grained; with little gravel (subrounded, fine to coarse grained); light green; loose; wet	
						CLAY w/some silt and trace sand fine to coarse grained; light brown; soft; moist to wet TD @ 30.0'	

DRILLING CO.: Hardin & Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: TBA-2 SHEET 2 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: TBA-3
COORDINATES: EAST: 2642275.69 NORTH: 223773.69
ELEVATION: SURFACE: 12.95 TOP OF STEEL CASING: -NA-

RIG: Mobile B-80	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	3 1/4" ID	--	5/28/92	37.0			
LENGTH	2.0'	--	5'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu background reading is 0.5 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1						Advance Augers to 25'	
2						Fill material (pipe, bricks) extends to approx. 15' ↓	
3							
4					BG		
5	AN						
6							
7							
8							
9							
10						Match to Sheet 2	

DRILLING CO.: Hardin & Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: TBA-3 SHEET 1 OF 3

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: TBA-3

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
11							
12							
13						Advance Augers to 25'	
14							
15							
16	AN				BG	Native soil	
17							
18							
19							
20							
21							
22							
23							
24							
25	25.0						
26	SS-1	1.0	5 7 10 12			SAND fine to coarse grained w/trace silt and trace clay;light orange brown; medium dense; wet	
27	27.0	50%					
28	SS-2	1.5	7 7 12 10			SAND fine to coarse grained w/some silt and trace clay;light orange brown to light grey; medium dense; wet	
29	29.0	75%					
30	SS-3	1.0 50%	6 15 17 17			CLAY w/some silt and some sand fine grained;light grey; very stiff; wet SAND fine to medium grained, w/trace silt; light grey; dense; wet	M[redacted] to Sh[redacted]3

DRILLING CO.: Hardin & Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: TBA-3 SHEET 2 OF 3

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: TBA-3

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
31.0							
31–33.0	SS-4	1.5 / 75%	7 16 18 20		BG	**SILT** w/sand fine grained and some clay; light grey; dense; wet	
33–35.0	SS-5	2.0 / 100%	2 4 6 7		BG	**SILT** w/sand fine grained and some clay; light orange brown to light grey; medium dense; wet	
35–37.0	SS-6	2.0 / 100%	2 10 10 10		BG	**SAND** fine grained, w/some silt and trace clay; light grey to light brown; medium dense; wet	
37						TD @ 37.0'	

DRILLING CO.: Hardin & Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: TBA-3 SHEET 3 OF 3

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084
COORDINATES: EAST: 2642297.95
ELEVATION: SURFACE: 13.07

BORING NO.: TBA-4
NORTH: 223397.99
TOP OF STEEL CASING: -NA-

RIG: Mobile B-80	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	3 1/4" ID	--	5/27/92	33.0			
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 0.5 ppm.

SAMPLE TYPE
S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1						Advance Augers to 15'	
2						Drill cuttings appear to be native soil	
3							
4							
5	AN						
6							
7							
8							
9							
10						Match to Sheet 2	

DRILLING CO.: Hardin & Huber
DRILLER: Steve Uhlrich

BAKER REP.: Donald C. Shields
BORING NO.: TBA-4

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: TBA-4

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
11, 12, 13, 14, 15.0	AN					Advance Augers to 15'	
15, 16, 17.0	SS-1	2.0 100%	5 4 5 1		BG	SAND fine to coarse grained , w/some silt and some clay; light brown to light grey; loose; wet	
17, 18, 19.0	SS-2	2.0 100%	3 3 5 4		BG	SAND fine to coarse grained w/trace silt and trace clay;light brown to light grey; loose; wet	
19, 20, 21.0	SS-3	1.0 50%	2 3 3 2		BG	SAND fine to coarse grained w/trace silt and trace clay;light brown to light grey; loose; wet	
21, 22, 23.0	SS-4	2.0 100%	1 2 3 3		BG	SAND fine to coarse grained w/trace silt and trace clay;light brown to light grey; loose; wet	
23, 24, 25.0	SS-5	2.0 100%	4 2 6 2		BG	SAND fine to coarse grained w/trace gravel, (subrounded-fine) and trace silt and trace clay; light brown; loose; wet	
25, 26, 27.0	SS-6	0.5 25%	2 2 3 4		BG	SAND fine to coarse grained w/little silt and little clay;light brown; loose; wet	
27, 28, 27.0	SS-7	1.0 50%	6 7 30 22		BG	SILT and CLAY w/sand fine to coarse grained ;light brown to light grey; very dense; wet	
29, 30, 29.0	SS-8	1.5 75%	1 1 1 2		BG	CLAY and SILT, w/trace sand fine grained light grey; soft; moist to wet	M[illegible] to S[illegible]3

DRILLING CO.: Hardin & Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: TBA-4 SHEET 2 OF 3

TEST BORING RECORD

Baker
Baker Environmental, Inc.

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: TBA-4

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
31.0							
31						CLAY and SILT, w/trace sand fine grained; light grey; medium stiff; wet	
32	SS-9	2.0 100%	3 4 3 4		BG		
33.0							
33						TD @ 33.0'	
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							

DRILLING CO.: Hardin & Huber
DRILLER: Steve Uhlrich
BAKER REP.: Donald C. Shields
BORING NO.: TBA-4
SHEET 3 OF 3

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: TBA-5
COORDINATES: EAST: 2641856.95 NORTH: 223681.80
ELEVATION: SURFACE: 13.66 TOP OF STEEL CASING: -NA-

RIG: Mobile B-80	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	3 1/4" ID	--	5/28/92	36.0			
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 0.5 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1						Advance Augers to 25'	
2						↓	
3						Fill material in drill cuttings	
4						↓	
5	AN						
6							
7							
8							
9							
10						Match to Sheet 2	

DRILLING CO.: Hardin & Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: TBA-5 SHEET 1 OF 3

TEST BORING RECORD

Baker
Baker Environmental, Inc.

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: TBA-5

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
11							
12							
13						Advance Augers to 25'	
14							
15						Fill material in drill cuttings	
16	AN						
17							
18							
19							
20							
21						Native soil material	
22							
23							
24							
25							
26	SS-1	2.0	18 11 11 12		BG	SAND fine to coarse grained w/trace gravel (subround-fine); trace silt and trace clay; light brown to light orange brown; medium dense; wet	
27	27.0	100%					
28	SS-2	1.75	10 12 22 27		BG	SAND fine to coarse grained w/trace silt and trace clay;light brown; dense; wet	
29	29.0	88%					
30	SS-3	1.0 50%	11 14 11 14		BG	SAND fine to coarse grained, w/trace gravel,(subround-fine), and trace silt and trace clay; light grey; medium dense; wet	M[illegible] to Sh[illegible] 3

DRILLING CO.: Hardin & Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: TBA-5 SHEET 2 OF 3

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: TBA-5

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
31 32.0	AN	NR			--	No Recovery Note- Drillers drill through the 31-32' internal	
33 34.0	SS-4	1.5 75%	2 3 3 4		BG	CLAY, w/little silt and trace sand very fine grained ; light grey; medium stiff; moist	
35 36.0	SS-5	1.5 75%	2 3 3 4		BG	CLAY, w/little silt and trace sand fine grained; light grey; medium stiff; moist	
36						TD @ 36.0'	
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							

DRILLING CO.: Hardin & Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: TBA-5 SHEET 3 OF 3

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: TBA-6
COORDINATES: EAST: 2642109.43 NORTH: 224994.74
ELEVATION: SURFACE: 16.52 TOP OF STEEL CASING: -NA-

RIG: Mobile B-80	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	3 1/4" ID	--	5/29/92	35.0			
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 0.5 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1						Advance Augers to 25'	
2							
3						Hard drilling @ 3'	
4						- fill material returns w/cuttings	
5						↓	
6	AN						
7							
8							
9							
10						Match to Sheet 2	

DRILLING CO.: Hardin & Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: TBA-6 SHEET 1 OF 3

TEST BORING RECORD

Baker
Baker Environmental, Inc.

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: TBA-6

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	Lab. Moist %	Visual Description	Elevation
11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24	AN					fill ↓ / Native soil ↓	
25.0							
26	SS-1	2.0 / 100%	2 1 3 5		BG	**SILT** and **SAND** fine grained; light grey to light reddish brown; very loose;wet	
27.0						**CLAY**; light grey to light brown; medium stiff; moist	
28	SS-2	1.5 / 75%	5 5 5 4		BG	**SAND** fine to coarse grained w/silt and little clay; light grey to light orangish brown; loose;wet	
29.0						**SAND** fine to medium grained w/silt and little clay; light grey to light orangish brown; loose;wet	
30	SS-3	1.5 / 75%	2 2 3 10		BG	**CLAY**; w/some silt; light grey; stiff; moist	M[illegible] to Sh[illegible]3

DRILLING CO.: Hardin & Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: TBA-6 SHEET 2 OF 3

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: TBA-6

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	Lab. Moist %	Visual Description	Elevation
31							
32	SS-4	2.0	2 1 3 6		BG	SAND fine to coarse grained, w/trace silt, and clay (2" layer w/wood frags); light brown; medium dense; wet	
33	33.0	100%					
34	SS-5	1.75	6 6 5 3		BG	SILT, w/some clay and some sand fine to medium grained; light grey w/light orangish brown streaks; loose; wet	
35	35.0	88%				CLAY - (bottom 2 inches)	
36						TD @ 35.0'	
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							

DRILLING CO.: Hardin & Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: TBA-6 SHEET 3 OF 3

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: TBA-7
COORDINATES: EAST: 2641694.24 NORTH: 224561.72
ELEVATION: SURFACE: 10.77 TOP OF STEEL CASING: -NA-

RIG: Mobile B-61	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	3 7/8" ID	--	05/29/92	30.0	Overcast, 65°F	5.0	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: OVA reading in parts per million (ppm). Background is 1.0 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description	Elevation
1	A/N				30.0	**TOPOSIL**; brown; (from cuttings)	
2						**SILT** and **SAND**, refuse, metal; shiny black; creates sheen when placed in water	
3							
4							
5							▼
6	A/N					**silty SAND**; light and dark grey; (from cuttings)	
7							
8							
9							
10						Match to Sheet 2	

DRILLING CO.: Hardin & Huber BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: TBA-7 SHEET 1 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: TBA-7

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description	Elevation
11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24.0	A/N				BG	silty SAND, light grey; (from cuttings)	
24.0–26.0	SS-1	1.5 / 75%	10 8 20 11		BG	silty SAND w/fine to coarse grained sand and trace gravel in layers; white to light grey; medium dense; wet	
26.0–28.0	SS-2	1.0 / 50%	4 10 10 10		BG	clayey SAND, w/some silt; light grey to orange; medium dense; moist	
28.0–30.0	SS-3	1.0 / 50%	2 2 2 4		BG	TD @ 30.0'	

DRILLING CO.: Hardin & Huber
DRILLER: T. Mize
BAKER REP.: B. Steffes
BORING NO.: TBA-7
SHEET 2 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: TBA-8
COORDINATES: EAST: 2641761.88 NORTH: 225057.80
ELEVATION: SURFACE: 10.71 TOP OF STEEL CASING: -NA-

RIG: Mobile B-61	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	3 7/8" ID	--	5/29/92	34.0	Overcast, 65°F	5.0	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background .5 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1							
2							
3	A/N					silty SAND; brown; (from auger cuttings)	
4							
5							▼
6							
7							
8							
9							
10						Match to Sheet 2	

DRILLING CO.: Hardin & Huber BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: TBA-8 SHEET 1 OF 3

TEST BORING RECORD

Baker

Baker Environmental, Inc.

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: TBA-8

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
11							
12	A/N						
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24 — 24.0							
25	SS-1	1.5 / 75%	4 8 10 11		BG	silty SAND fine grained; grey to white; medium dense; wet	
26 — 26.0							
27	SS-2	2.0 / 100%	7 8 11 12		BG	silty SAND fine to medium grained; grey to white; medium dense; wet	
28 — 28.0							
29	SS-3	2.0 / 100%	10 11 13 12		BG	silty SAND fine to medium grained; grey to white; medium dense; wet	M[illegible] to Sh[illegible]3
30 — 30.0							

DRILLING CO.: Hardin & Huber BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: TBA-8 SHEET 2 OF 3

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: TBA-8

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
31	SS-4	2.0 / 100%	6 8 9 10		BG	silty SAND fine to medium grained; grey to white; w/some thin orange laminations; medium dense; wet	
32.0							
33	SS-5	1.0 / 50%	11 12 10 10		BG	SAND fine to medium grained, w/trace silt; grey to white; w/some thin orange laminations; medium dense; wet,	
34.0							
34						TD @ 34.0'	
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							

DRILLING CO.: Hardin & Huber BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: TBA-8 SHEET 3 OF 3

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: TBA-9
COORDINATES: EAST: 2642731.01 NORTH: 005300.56
ELEVATION: SURFACE: 12.50 TOP OF STEEL CASING: -NA

RIG: Mobile B-80	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	3 1/4" ID	--	5/29/92	30.0			
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 0.5 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1						Advance Augers to 20'	
2						Fill material (?) hard drilling	
3							
4							
5							
6	AN						
7						Appears to be native soil material	
8							
9							
10						Match to Sheet 2	

DRILLING CO.: Hardin & Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: TBA-9 SHEET 1 OF 2

TEST BORING RECORD

Baker

Baker Environmental, Inc.

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: TBA-9

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
11, 12, 13, 14, 15, 16, 17, 18, 19, 20.0	AN					Advance Augers to 20'	
20, 21, 22.0	SS-1	2.0 100%	2 4 4 7		BG	CLAY, w/trace silt and trace sand fine grained; light grey; stiff; moist to wet	
22, 23, 24.0	SS-2	2.0 100%	1 3 8 9		BG	CLAY and silt; light grey; soft; moist to wet SILT and sand fine grained; light grey to light orange brown; medium dense; wet	
24, 25, 26.0	SS-3	1.0 50%	8 10 12 12		BG	CLAY; light grey, w/light orange brown streaks; very stiff; damp SAND very fine to fine grained w/silt; light grey to light orange brown; medium dense; wet	
26, 27, 28.0	SS-4	1.5 75%	5 4 7 9		BG	CLAY w/little silt; light orange brown; stiff; damp SAND fine grained w/silt and some clay; light grey; medium dense; wet	
28, 29, 30.0	SS-5	1.0 50%	10 5 4 5		BG	SAND fine grained w/some silt and trace clay; light brown to light grey; medium dense; wet TD @ 30.0'	

DRILLING CO.: Hardin & Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: TBA-9 SHEET 2 OF 2

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: TBA-10
COORDINATES: EAST: 2642280.27 NORTH: 224922.19
ELEVATION: SURFACE: 17.6912.50 TOP OF STEEL CASING: -NA-

RIG: Mobile B-80	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	3 1/4" ID	--	5/29/92	35.0			
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HSA	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: HNu Background 0.5 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1						Advance Augers to 25'	
2							
3						Hard drilling @ 3'	
4						- fill material (metal fragments) in drill cuttings	
5	AN					↓	
6							
7							
8							
9							
10						Match to Sheet 2	

DRILLING CO.: Hardin & Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: TBA-10 SHEET 1 OF 3

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: TBA-10

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
11						fill	
12							
13							
14							
15	AN						
16						Native soil	
17							
18							
19							
20							
21							
22							
23							
24							
25							
26	SS-1	2.0 100%	3 3 4 3		BG	SAND fine to coarse grained w/little silt and trace clay; light grey; loose;wet	
27	27.0						
28	SS-2	2.0 100%	7 8 11 12		BG	SAND fine to coarse grained w/little silt and trace clay; light grey; loose;wet	
29	29.0						
30	SS-3	2.0 100%	10 11 13 12		BG	SAND fine to coarse grained w/some silt and trace clay; light grey to light brown; loose;wet	M[illegible] to Sh[illegible] 3

DRILLING CO.: Hardin & Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: TBA-10 SHEET 2 OF 3

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: TBA-10

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
31.0							
31–33.0	SS-4	1.0 50%	2 1 3 6		BG	SILT and clay; light grey; loose; wet	
33.0–35.0	SS-5		6 6 5 3		BG	SAND and silt, w/little clay; light brown; loose; wet	
35						TD @ 35.0'	

DRILLING CO.: Hardin & Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: TBA-10 SHEET 3 OF 3

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: TBA-11
COORDINATES: EAST: 2642182.09 NORTH: 224903.90
ELEVATION: SURFACE: 16.57 TOP OF STEEL CASING: -NA-

RIG: ATV	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	--	3 7/8" ID	--	6/16/92	33.0	Sunny Warm, 70°F	10.0	
LENGTH	2.0'	--	5.0'	--					
TYPE	SS	--	HS	--					
HAMMER WT.	140#	--	--	--					
FALL	30"	--	--	--					
STICK UP	--	--	--	--					

REMARKS: Straight auger through fill material end of fill 15' depth. PID/FID Background 0.3 to 1.8 ppm

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1	A/N					**SAND** and **SILT**, landfill debris consisting of foil, wire, rags, burnt material, paper, metal cans, plastic; black and brown; damp to moist	
2							
3							
4							
5							
6						**SAND** and **SILT**, landfill debris consisting of foil, wire, rags, burnt material, paper, metal cans, plastic; brown; damp to moist	
7							
8							
9							
10						Match to Sheet 2	▼

DRILLING CO.: Hardin - Huber, Inc. BAKER REP.: Jeri L. Trageser
DRILLER: Mark Fletcher BORING NO.: TBA-11 SHEET 1 OF 3

TEST BORING RECORD

Baker
Baker Environmental, Inc.

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: TBA-11

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description	Elevation
11, 12, 13, 14, 15	A/N				100	**SAND** and landfill debris consisting of foil, wire, rags, burnt material, paper, metal cans, plastic	
16, 17 (17.0)	SS-1	2.0 / 100%	1 1 2 2		20	**CLAY**; dark grey to black; oily sheen soft; moist to wet	
18, 19 (19.0)	SS-2	N.R. / 0%	7 7 5 10		BG	No Recovery	
20, 21 (21.0)	SS-3	0.8 / 40%	4 4 4 4		BG	**SAND** and **CLAY**, fine to medium grained sand; brownish grey; medium stiff; moist to wet	
22, 23 (23.0)	SS-4	1.7 / 85%	2 4 11 14		BG	**SAND**, fine to medium to coarse grained, w/trace clay; grey; medium dense; wet	
24, 25 (25.0)	SS-5	2.0 / 100%	1 WOH 2 2		BG	**SAND**, medium to coarse grained; light grey; very loose; wet	
26, 27 (27.0)	SS-6	1.0 / 50%	2 2 4 7		BG	**SAND**, medium to coarse grained w/small clay seam; light grey; loose; wet	
28, 29 (29.0)	SS-7	2.0 / 100%	7 5 11 11		BG	**SAND** coarse grained, w/trace organics (rootlets); light grey; medium dense; wet	
30 (31.0)	SS-8	2.0 / 100%	7 7 12 11		BG	**SAND** medium to coarse grained, large gravel middle of sample; light grey; medium dense; wet	M[illegible] to S[illegible] 3

DRILLING CO.: Hardin - Huber, Inc. BAKER REP.: Jeri Trageser
DRILLER: Mark Fletcher BORING NO.: TBA-11 SHEET 2 OF 3

Baker

Baker Environmental, Inc.

TEST BORING RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: TBA-11

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
31.0							
31						SAND medium to coarse grained, 1 large gravel middle of sample; light grey; loose; wet	
32	SS-9	2.0	2 4 6 7		BG	CLAY, trace to little silty sand; grey; stiff	
33.0		100%					
33						TD @ 33.0'	
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							

DRILLING CO.: Hardin - Huber, Inc. BAKER REP.: Jeri Trageser
DRILLER: Mark Fletcher BORING NO.: TBA-11 SHEET 3 OF 3

BAKER ENVIRONMENTAL, INC.

TEST BORING & WELL CONSTRUCTION RECORDS, AREA A (1992)

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-20WSS
COORDINATES: EAST: 2641475.85 NORTH: 224122.95
ELEVATION: SURFACE: 13.60 TOP OF STEEL CASING: 15.01

RIG: Mobile B-60	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"		3 7/8"		5/29/92	25.0'	Overcast, 60°F	≈16.0'	
LENGTH	2.0'		5.0'						
TYPE	SS		HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		1.41'							

REMARKS: TD reached 5-29-92. Well set 5-29-92. OVA Background is 1.0 ppm.

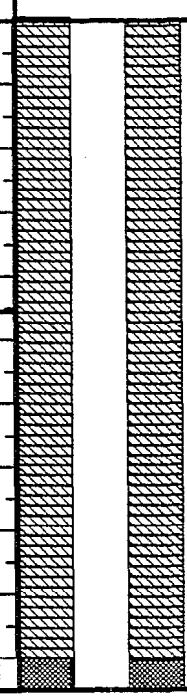
SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Riser	2.0	Steel	+1.41	15.0
Well Screen	2.0	Steel 0.01 inch slots	15.0	25.0

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description
1						**silty SAND**; fine grained; dark grey; damp; from cuttings
2						
3						
4						
5	A/N	A/N				
6						
7						
8						**SILT** w/some fine grained sand; dark grey; damp; from cuttings
9					20-30	OVA hits on drummed cuttings
10						Match to Sheet 2

Well Installation Detail



Elevation

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: B-20WSS SHEET 1 OF 2

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 19084-50-SRN BORING NO.: B-20WSS

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description	Well Installation Detail	Elevation
11								
12								
13							13.0'	
14								
15							15.0'	
16	A/N	A/N				SILT w/trace fine grained sand; dark grey; wet		▼
17								
18								
19								
20								
21								
22								
23								
24						flowing silt entering augers, used rollerbit to clean out augers to 25.0'		
25							25.0'	
26						TD @ 25.0'		
27								
28								
29								
30								

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: B. Steffes

DRILLER: T. Mize BORING NO.: B-20WSS SHEET 2 OF 2

Baker

Baker Environmental, Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW1C
COORDINATES: EAST: 2641969.35 NORTH: 225375.40
ELEVATION: SURFACE: 11.73 TOP OF STEEL CASING: 13.68

RIG:	Mobile B-80								
	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	6.0"	4 1/4" ID		4/28/92	30.0	Overcast, 40°F	7.5	
LENGTH	2.0'	30.0'	5.0'		4/30/92	137.0	Sunny, 40°F		
TYPE	SS	Schedule 40 PVC	HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		1.95'							

REMARKS: Surface casing set 4/28/92. TD reached 4/30/92. Well set 4/30/92. HNu Background 2.8 to 3.6 ppm.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Surface Casing	6.0	Schedule 40 PVC	Grade	30.0
Well Riser	2.0	Schedule 40 PVC	+1.95	120.6
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	120.6	130.6

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
1 – 2.0	S-1	1.3 / 65%	2 6 13 18		BG	SAND, fine grained, some silt/clay; trace gravel w/trace shells; brown; roots, medium dense, damp		
3 – 4.0	S-2	0.6 / 30%	4 12 13 7		BG	SAND, medium to fine grained w/little silt and trace clay; greyish brown; medium dense; damp to moist		
5 – 6.0	S-3	1.0 / 50%	3 3 4 2		BG	SAND, fine to coarse grained grading to medium at base w/some silt/clay and occasional gravel; greyish brown; mottled; cohesive; loose; damp to moist		
7 – 8.0	S-4	1.0 / 50%	1 1 2 4		BG	CLAYEY SAND, medium to fine grained; greyish brown to black; mottled; soft; wet		▼
9 – 10.0	S-5	1.4 / 70%	3 3 4 7		BG	SAND, medium to coarse grained, trace silt; greyish brown; well sorted; unstratified; loose; wet		

Match to Sheet 2

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz
DRILLER: Mike Corran BORING NO.: A-MW1C

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

S.O. NO.: 0084 BORING NO.: A-MW1C

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
11 – 12.0	S-6	1.2 60%	4 5 4 3		BG	**SAND**, medium to coarse grained w/trace silt; greyish brown; poorly graded, loose; wet		
13 – 14.0	S-7	0.5 25%	4 3 3 2		BG	**SAND**, medium to coarse grained w/trace silt; yellowish orange brown; loose; wet		
15 – 16.0	S-8	1.2 60%	2 2 2 2		BG	**CLAY** w/trace silt; grey with orange and occasional pockets of medium sand/silt; discoloration; very plastic, unstratified; soft; wet		
17 – 18.0	S-9	2.0 100%	4 3 2 6		BG			
19 – 20.0	S-10	2.0 100%	2 1 1 1		BG	**SAND** medium to coarse grained w/trace silt; grey with orange; very loose; non cohesive; wet		
						as above little silt/clay and occasional gravel; discoloration; medium dense		
21 – 22.0	S-11	1.7 85%	3 3 3 13		BG	**SAND** coarse to very coarse grained w/quartz gravel; grading to medium sand at base yellow; loose; wet		
23 – 24.0	S-12	1.1 55%	9 10 14 18		BG	**SAND** medium to coarse grained w/trace silt, yellowish orange brown; medium dense; wet		
25 – 26.0	S-13	0.0 0%	8 12 7 6		BG	No Recovery		
27 – 28.0	S-14	2.0 100%	3 4 4 5		BG	**SAND** medium to coarse grained w/trace silt and occasional gravel; light brown; loose; wet		
29 – 30.0	S-15	0.5 25%	4 4 5 5		BG	**CLAY** w/trace silt; grey; medium stiff; occasional lenses of medium to coarse grained sand, very plastic, damp		
						Match to Sheet 3	30.0'	

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz

DRILLER: Mike Corran BORING NO.: A-MW1C SHEET 2 OF 8

TEST BORING AND WELL CONSTRUCTION RECORD

Baker
Baker Environmental, Inc.

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: A-MW1C

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
31 32.0	S-16	1.5 75%	3 3 3 4		BG	CLAY w/trace silt; dark grey; medium stiff; sand medium coarse grained in pockets or lamina throughout very plastic, damp		
33 34 35								
36 37.0	S-17	2.0 100%	2 4 7 12		BG	silty CLAY; grey; medium stiff; very plastic; moist clayey SILT; brown to yellowish brown; stiff; moist		
38 39 40								
41 42.0	S-18	1.5 75%	4 12 6 6		BG	SAND, medium to coarse grained w/little silt/clay; brown; stiff; moist SAND, medium to coarse grained; little silt w/ trace clay; grey; medium dense; moist		
43 44 45								
46 47.0	S-19	1.2 60%	18 20 19 19		BG	SAND medium to fine grained w/shell material; greenish grey; dense; moist		
48 49 50						Match to Sheet 4		

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz
DRILLER: Mike Corran BORING NO.: A-MW1C SHEET 3 OF 8

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: A-MW1C

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
51 – 52 (52.0)	S-20	1.4 / 70%	16 17 15 21		BG	**Shell** material w/trace silt, larger shells oriented horizontal; greenish grey; dense; wet		
53 – 55								
56 – 57 (57.0)	S-21	1.3 / 65%	16 15 24 31		BG	clayey **SILT** and sand, fine grained w/trace shell fragments; greenish grey; medium dense; wet		
58 – 60								
61 – 62 (62.0)	S-22	1.3 / 65%	22 22 18 18		BG	**SHELL** material w/little silt; shell fragments oriented horizontally; greenish grey; dense; wet		
63 – 65								
66 – 67 (67.0)	S-23	1.5 / 75%	9 25 27 23		BG	**SAND**, fine grained and silt w/little shell material; greenish grey; dense; wet **CLAY** and **SILT** interlaminated w/layers of sand, fine grained shell material present; greenish grey; very dense; wet		
68 – 70						Match to Sheet 5		

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz
DRILLER: Mike Corran BORING NO.: A-MW1C SHEET 4 OF 8

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

S.O. NO.: 0084 BORING NO.: A-MW1C

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
71, 72 (72.0)	S-24	1.7 / 85%	6 15 16 18		BG	**clayey SILT** interlaminated w/shell material,; greenish grey; medium dense; layers 0.1' - 0.02' thick. wet. **SHELL** material w/trace silt; greenish grey; dense; wet		
73, 74, 75								
76, 77 (77.0)	S-25	1.9 / 95%	6 16 20 21		BG	**clayey SILT** and **sand**, fine grained w/shell material; greenish grey; dense; moist to wet		
78, 79, 80								
81, 82 (82.0)	S-26	1.3 / 65%	14 20 22 36		BG	**SHELL** material w/little sand, fine grained and trace silt; greenish grey; dense; wet		
83, 84, 85								
86, 87 (87.0)	S-27	1.2 / 60%	16 22 28 32		BG	**SAND**, fine to medium grained w/shell material; greenish grey; very dense; wet		
88, 89, 90						Match to Sheet 6		

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz

DRILLER: Mike Corran BORING NO.: A-MW1C SHEET 5 OF 8

TEST BORING AND WELL CONSTRUCTION RECORD

Baker
Baker Environmental, Inc

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: A-MW1C

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
91–92 (92.0)	S-28	1.7 / 85%	19 12 17 24		BG	SAND, fine to medium grained w/little silt/clay; trace shell material; slightly plastic; greenish grey; dense; wet		
93–95								
96–97 (97.0)	S-29	2.0 / 100%	5 7 9 18		BG	SAND, fine to medium grained w/little silt/clay; trace shell material; slightly plastic greenish grey; medium dense; moist to wet		
98–100								
101–102 (102.0)	S-30	0.9 / 450%	4 6 7 12		BG	SAND, fine to medium grained w/little silt/clay; trace shell material; slightly plastic greenish grey; medium dense; moist to wet		
103–105								
106–107 (107.0)	S-31	1.6 / 80%	7 9 12 18		BG	SAND, fine to medium grained w/little silt/clay; trace shell material; greenish grey; medium dense; moist		
108–110						Match to Sheet 7		

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz
DRILLER: Mike Corran BORING NO.: A-MW1C SHEET 6 OF 8

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: A-MW1C

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
111, 112 (112.0)	S-32	1.4 / 70%	12 13 11 12		BG	SAND, fine to medium grained w/little silt/clay, trace of shell material; greenish grey; medium dense; cohesive, moist to wet		
113, 114, 115							115.0'	
116, 117 (117.0)	S-33	1.3 / 65%	12 18 22 23		BG	SAND, fine to medium grained w/little silt/clay; greenish grey; medium dense; moist		
118, 119, 120							118.0'	
121, 122 (122.0)	S-34	1.2 / 60%	6 18 38 40		BG	SAND, fine to medium grained w/trace silt/clay; greenish grey to yellowish brown; very dense; moist color variations due to oxidation,	120.6'	
123, 124, 125								
126, 127 (127.0)	S-35	0.9 / 45%	18 32 31 36		BG	SAND, fine grained w/trace silt; dark grey; very dense; moist		
128, 129, 130						Match to Sheet 8		

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz
DRILLER: Mike Corran BORING NO.: A-MW1C SHEET 7 OF 8

TEST BORING AND WELL CONSTRUCTION RECORD

Baker
Baker Environmental, Inc

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: A-MW1C

SAMPLE TYPE
S = Split Spoon A = Auger
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R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
131 132.0	S-36	NR	WH WH WH 8		--	No Recovery	130.6'	
133 134.0	S-37	1.7 85%	9 12 18 17		BG	CLAY w/some sand, fine grained and silt; greenish grey; stiff plastic; moist		
135								
136 137.0	S-38	1.7 85%	2 5 7 14		BG	CLAY w/little silt; greenish grey; stiff; plastic; moist		
138						TD @ 137.0'		
139								
140								
141								
142								
143								
144								
145								
146								
147								
148								
149								
150								

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz
DRILLER: Mike Corran BORING NO.: A-MW1C SHEET 8 OF 8

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW8B
COORDINATES: EAST: 2641243.91 NORTH: 224064.63
ELEVATION: SURFACE: 7.82 TOP OF STEEL CASING: 9.62

RIG: Mobile Drill B-80

	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	6.0"	4 1/4" ID		5/11/92	18.0	Clear, 60° F	5.0	
LENGTH	2.0'	32.0'	5.0'		5/12/92	32.0	Overcast, 50° F		
TYPE	SS	Schedule 40 PVC	HSA		5/15/92	67.0	Cloudy, 60° F		
HAMMER WT.	140#								
FALL	30"								
STICK UP		1.8'							

REMARKS: Surface casing set 5-12-92. TD reached 5-15-92. Well set 5-15-92. HNu Background 0.4 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Surface Casing	6.0	Schedule 40 PVC	Grade	32.0
Well Riser	4.0	Schedule 40 PVC	+1.8	53.0
Well Screen	4.0	Schedule 40 PVC 0.01 inch slots	53.5	63.5

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
1 – 2.0	S-1	1.3 / 65%	3 7 8 12		BG	clayey SILT, (topsoil), rooted; black to brown; medium stiff; moist. SAND coarse to fine grained, w/some clay/silt; yellowish brown; mottled medium dense; plastic, moist
3 – 4.0	S-2	1.0 / 50%	3 4 5 2		BG	SAND coarse to fine grained, occasional gravel, w/little clay/silt; yellowish brown mottled; loose to stiff; coarse sand layer <.01' thick at top and base, moist
5 – 6.0	S-3	1.4 / 70%	2 1 0 1		BG	SAND coarse to medium grained w/little silt/clay; grey to greyish brown; very loose; wet, slight mottling
7 – 8.0	S-4	0.9 / 45%	1 4 5 2		BG	
9 – 10.0	S-5	1.0 / 50%	1 0 3 5		BG	SAND coarse to medium grained w/some clay/silt; greyish brown; stiff. SAND coarse to medium grained w/trace clay/silt; greyish brown; loose; slightly mottled
10						Match to Sheet 2

Well Installation Detail

Elevation

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz
DRILLER: Mike Corran BORING NO.: A-MW8B SHEET 1 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: A-MW8B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
11 – 12.0	S-6	1.4 / 70%	2 4 3 9		BG	**SAND** fine to coarse grained w/little to some silt/clay; 0.2 foot thick (lense) of charcoal fragments; greyish brown; loose; moist		
13 – 14.0	S-7	0.9 / 45%	3 7 16 17		BG	**SAND** medium to coarse grained w/trace silt/clay; grey; medium dense; wet		
15 – 16.0	S-8	0.8 / 40%	11 15 10 8		BG			
17 – 18.0	S-9	0.7 / 35%	3 3 3 3		BG			
19 – 20.0	S-10	1.0 / 50%	4 4 5 4		BG			
21 – 22.0	S-11	1.0 / 50%	1 2 2 1		BG	**SAND** medium to coarse grained w/some silt/clay; greyish brown; loose; wet, cohesive **SAND** medium to coarse grained w/trace silt/clay; greyish brown, mottled; loose to medium dense; wet		
23 – 24.0	S-12	1.0 / 50%	1 3 1 1			**SAND** medium to coarse grained w/trace silt/clay; greyish brown, mottled; loose to medium dense; wet		
25 – 26.0	S-13	1.0 / 50%	1 5 5 5					
27 – 28.0	S-14	1.1 / 55%	2 1 2 1					
29 – 30.0	S-15	0.7 / 35%	3 4 4 4			Match to Sheet 3		

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz

DRILLER: Mike Corran BORING NO.: A-MW8B SHEET 2 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW8B

SAMPLE TYPE

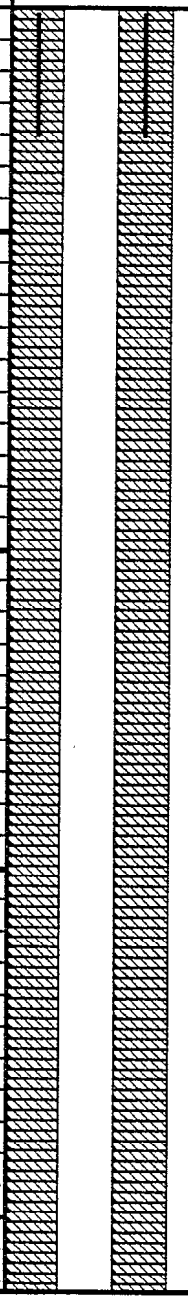
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
31 – 32.0	S-16	1.5 / 75%	3 2 3 4		BG	**CLAY** w/little silt; steel grey; medium stiff; wet
33 – 35						**CLAY** w/some silt, trace fine sand; brown; soft; wet; plant material throughout, organic rich
36 – 37.0	S-17	2.0 / 100%	WH WH 3 3		BG	**CLAY** w/little silt; grey; soft; wet; yellow plant material in lamina; organic rich; wet
38 – 40						
41 – 42.0	S-18	2.0 / 100%	WH 3 2 3		BG	**CLAY** w/little silt; grey; soft; wet; yellow plant material in lamina; organic rich wet
43 – 45						
46 – 47.0	S-19	1.6 / 80%	16 14 4 3		BG	**SAND** medium to fine grained w/little silt/clay; brownish grey; medium dense; wet; slight cementation from iron-oxide deposits cohesive grading to fine sand w/shell material at base
48 – 49					1.1-1.5 / 1.5-1.6	
50						Match to Sheet 4

Well Installation Detail



Elevation

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz
DRILLER: Mike Corran BORING NO.: A-MW8B SHEET 3 OF 4

Baker

Baker Environmental, Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: A-MW8B

SAMPLE TYPE

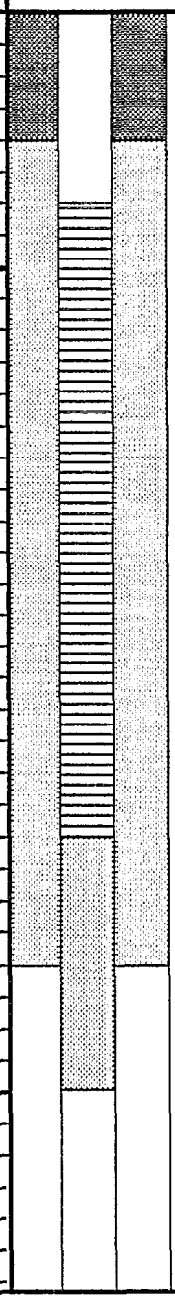
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
51 – 52.0	S-20	1.8 / 90%	26 21 17 18		BG	**GRAVEL** and **SHELL** material in clay/silt matrix, clast supported w/some silt/clay; grey; very dense; wet grading to **SHELL** material w/little fine sand and trace silt/clay; yellowish brown; dense; wet
53 – 54 – 55						
56 – 57.0	S-21	1.5 / 75%	15 18 21 28		BG	**SHELL** material w/little fine grained sand and trace silt; grey; dense; wet
58 – 59 – 60						
61 – 62.0	S-22	1.2 / 60%	13 21 17 28		BG	**SHELL** material w/little fine grained sand and trace silt; grey; dense; wet
63 – 64 – 65						
66 – 67.0	S-23	1.2 / 60%	18 21 20 17		BG	**SHELL** material w/little fine grained sand and trace silt; grey; dense; wet
68 – 69 – 70						TD @ 67.0'

Well Installation Detail



Elevation

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz

DRILLER: Mike Corran BORING NO.: A-MW8B SHEET 4 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW9C
COORDINATES: EAST: 2641271.51 NORTH: 224182.60
ELEVATION: SURFACE: 11.14 TOP OF STEEL CASING: 13.68

RIG: Mobile B-80	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	6.0"	4 1/4" ID		4/29/92	30.0	Partly Sunny, 60°F	5.0	
LENGTH	2.0'	30.0'	5.0'		5/1/92	137.0	Clear, 70°F		
TYPE	SS	Schedule 40 PVC	HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		2.47'							

REMARKS: Surface casing set 4-29-92. TD reached 5-1-92. Well set 5-1-92. HNu Background 0.5 ppm.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Surface Casing	6.0	Schedule 40 PVC	Grade	30.0
Well Riser	2.0	Schedule 40 PVC	+2.47	104.8
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	104.8	114.8

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
1 – 2.0	S-1	0.8 40%	4 5 7 2		BG	SILT, SAND, and CLAY; brown; medium dense; heavily rooted, damp
3 – 4.0	S-2	0.7 35%	3 4 4 5		BG	silty SAND, w/trace clay and occasional gravel; brown; loose; damp
5 – 6.0	S-3	0.6 30%	3 2 2 2		BG	clayey SILT, w/occasional gravel; blackish brown; soft; rootlets, wet
7 – 8.0	S-4	0.5 25%	2 2 2 1		BG	silty CLAY; grey; soft; wet
9 – 10.0	S-5	2.0 100%	WH WH WH WH		1.0-1.3	SAND, medium to coarse grained, w/some silt and clay; brown; w/yellow straining soft; wet
10					1.3-2.0	clayey SILT; black; soft

Match to Sheet 2

Well Installation Detail

Elevation

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz
DRILLER: Mike Corran BORING NO.: A-MW9C SHEET 1 OF 8

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

S.O. NO.: 0084 BORING NO.: A-MW9C

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
11 – 12.0	S-6	1.7 85%	1 0 1 0		BG	clayey SILT, dark grey; soft		
13 – 14.0	S-7	2.0 100%	W O H		BG	silty CLAY, clayey SILT; dark grey; very soft; wet to moist		
15 – 16.0	S-8	1.0 50%	W O H		BG			
17 – 18.0	S-9	2.0 100%	W O H		BG			
19 – 20.0	S-10	1.0 50%	W O H		BG	silty CLAY, clayey SILT; very soft; wood at 1.5' w/sand, medium to coarse grained; wet to moist		
21 – 22.0	S-11	2.0 100%	W O H 1		BG	silty CLAY, clayey SILT; w/wood/ vegetation throughout; very soft; wet to moist		
23 – 24.0	S-12	2.0 100%	W O H		BG	silty CLAY, clayey SILT; very soft; sand, gravel and silt lens w/wood fragments; wet to moist		
25 – 26.0	S-13	1.0 50%	WH WH 2 1		BG	silty CLAY, clayey SILT; very soft; vegetation/plant material scattered throughout; wet to moist		
27 – 28.0	S-14	1.7 85%	WH WH 1 2		BG			
29 – 30.0	S-15	1.5 75%	WH WH 2 2		BG	Match to Sheet 3	30.0'	

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz

DRILLER: Mike Corran BORING NO.: A-MW9C SHEET 2 OF 8

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

S.O. NO.: 0084 BORING NO.: A-MW9C

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
31 – 32.0	S-16	1.5 / 75%	WH 1 2 3		BG	silty CLAY and CLAYEY SILT; w/ plant material; grey; very soft; moist		
33 – 35								
36 – 37.0	S-17	2.0 / 100%	1 2 1 2		BG	silty CLAY and CLAYEY SILT; grey; very soft; layer of sand, at base medium to fine grained; moist		
38 – 40								
41 – 42.0	S-18	2.0 / 100%	1 2 1 2		BG	silty CLAY and CLAYEY SILT; grey; very soft; w/sand medium to fine grained; moist		
43 – 45								
46 – 47.0	S-19	1.3 / 65%	3 2 2 1		BG	SAND medium to fine grained w/some silt/clay; greenish grey; medium stiff; wet		
48 – 50						Match to Sheet 4		

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz

DRILLER: Mike Corran BORING NO.: A-MW9C SHEET 3 OF 8

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

S.O. NO.: 0084 BORING NO.: A-MW9C

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
51	S-20 52.0	1.5 70%	16 17 15 21		BG	SAND, medium to fine grained, w/some silt/clay; grey; medium stiff; damp
52						SHELL material w/trace silt; yellowish brown; medium dense; damp
53						
54						
55						
56	S-21 57.0	1.3 65%	16 15 24 31		BG	SHELL material w/gravel very fine grained and trace silt; grey to yellowish brown; dense; wet. Fragments oriented horizontally.
57						
58						
59						
60						
61	S-22 62.0	1.5 75%	22 22 18 18		BG	SHELL material w/gravel very fine grained and trace silt; grey to yellowish brown; dense; wet. Fragments oriented horizontally.
62						
63						
64						
65						
66	S-23 67.0	1.3 65%	9 25 27 23		BG	SHELL material w/gravel very fine grained and trace silt; grey to yellowish brown; dense; wet. Fragments oriented horizontally.
67						
68						
69						
70						Match to Sheet 5

Well Installation Detail

Elevation

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz

DRILLER: Mike Corran BORING NO.: A-MW9C SHEET 4 OF 8

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

S.O. NO.: 0084 BORING NO.: A-MW9C

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
71, 72 — 72.0	S-24	1.3 / 65%	13 21 27 50		BG	**SHELL** material w/silty **SAND**, fine grained and little clay; grey; dense; wet		
73, 74, 75								
76, 77 — 77.0	S-25	1.3 / 65%	19 28 32 33		BG	**SHELL** material w/silty sand, fine grained and little clay; grey; dense; wet		
78, 79, 80								
81, 82 — 82.0	S-26	1.4 / 70%	27 21 26 29		BG	**SHELL** material w/little sand, fine to very fine grained, trace silt; grey; dense; wet		
83, 84, 85								
86, 87 — 87.0	S-27	1.5 / 75%	24 26 22 23		BG	**SHELL** material w/little sand, fine to very fine grained, trace silt; grey; dense; wet		
88, 89, 90						Match to Sheet 6		

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz

DRILLER: Mike Corran BORING NO.: A-MW9C SHEET 5 OF 8

TEST BORING AND WELL CONSTRUCTION RECORD

Baker
Baker Environmental, Inc.

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: A-MW9C

SAMPLE TYPE

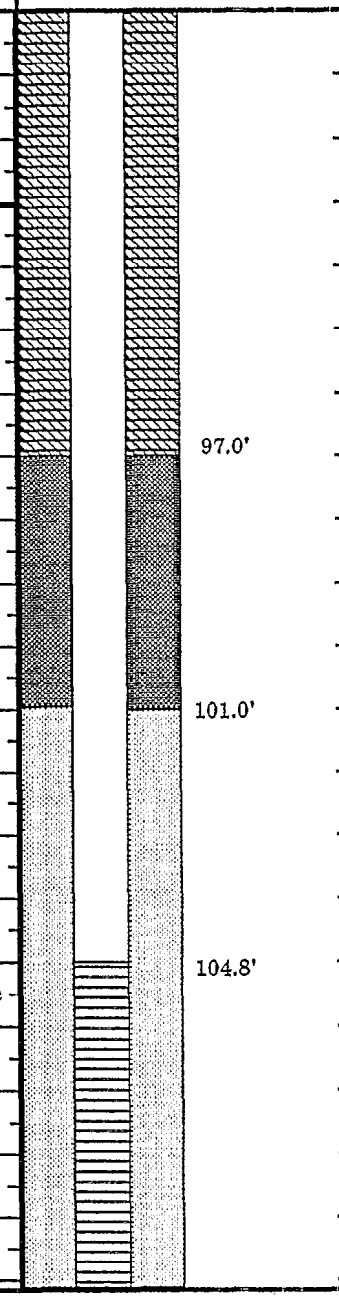
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
91 92.0	S-28	1.8 90%	29 27 39 30		BG	SAND, fine to medium grained w/some silt and shell material; grey; very dense; wet
93 94 95						
96 97.0	S-29	1.5 75%	8 6 11 19		BG	SAND, fine to medium grained, w/some silty/clay and large shell fragments; greenish grey; medium dense; wet
98 99 100						
101 102.0	S-30	1.6 80%	7 10 12 15		BG	SAND, fine to medium grained, w/some silty/clay and little to very large gravel-sized shell fragments; greenish grey; medium dense; wet
103 104 105						
106 107.0	S-31	1.6 80%	11 9 10 17		BG	SAND, medium grained to coarse grained, w/little silt/clay; greenish grey; medium dense; wet
108 109 110						

Well Installation Detail



Elevation

Match to Sheet 7

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz
DRILLER: Mike Corran BORING NO.: A-MW9C SHEET 6 OF 8

TEST BORING AND WELL CONSTRUCTION RECORD

Baker
Baker Environmental, Inc

PROJECT: Camp Allen Landfill RI/FS
S.O. NO.: 0084 BORING NO.: A-MW9C

SAMPLE TYPE

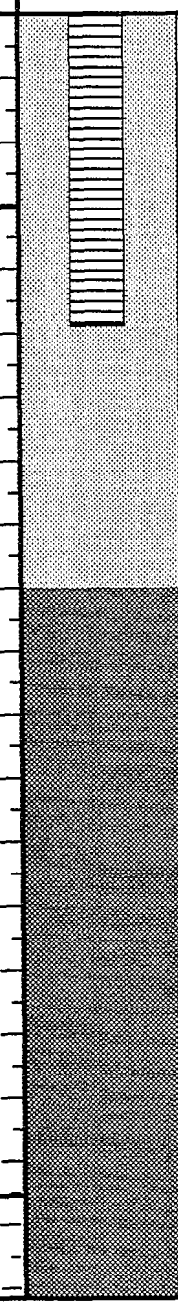
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)		Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
111			2.0	7 8 11 13		BG	SAND, very fine to medium grained, some silt, trace clay, occasional small shell fragments at top; grey; medium dense; wet
112	112.0	S-32	100%				
113							
114							
115							
116			2.0	20 16 15 8		BG	SAND, very fine to medium grained, w/some silt/clay; grey; dense; moist
117	117.0	S-33	100%				
118							
119							
120							
121			0.6	2 4 5 6		BG	SAND, fine to medium grained, w/some silt/clay; greenish grey; stiff; moist
122	122.0	S-34	30%				
123							
124							
125							
126			2.0	5 7 9 8		BG	SAND, fine to medium grained, w/some silt/clay; greenish grey; stiff; moist
127	127.0	S-35	100%				
128							
129							
130							Match to Sheet 8

Well Installation Detail



Elevation

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz
DRILLER: Mike Corran BORING NO.: A-MW9C SHEET 7 OF 8

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

S.O. NO.: 0084 BORING NO.: A-MW9C

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
131	S-36	2.0	2 3 7		BG	SAND, fine to medium grained, w/little clay and trace coarse shell fragments; greyish green; medium dense; moist		
132 132.0		100%	10			sandy CLAY, trace of very large gravel-sized shell fragments; greyish green; stiff; moist		
133								
134								
135							135.0'	
136	S-38	2.0	5 8 11		BG	CLAY, little silt; greyish green; very stiff; moist		
137 137.0		100%	11				137.0'	
138						TD @ 137.0'		
139								
140								
141								
142								
143								
144								
145								
146								
147								
148								
149								
150								

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz

DRILLER: Mike Corran BORING NO.: A-MW9C SHEET 8 OF 8

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW13B
COORDINATES: EAST: 2640763.67 NORTH: 223921.69
ELEVATION: SURFACE: 10.41 TOP OF STEEL CASING: 10.19

RIG: Mobile B-80	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	6.0"	4 1/4" ID		5/13/92	40.0	Warm, 70°F	7.0	
LENGTH	2.0'	40.0'	5.0'		5/14/92	67.0	Warm, 70°F		
TYPE	SS	Schedule 40PVC	HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		Flush							

REMARKS: Surface casing set 5-13-92. TD reached 5-14-92. Well set 5-14-92. HNu Background 1.0 ppm.

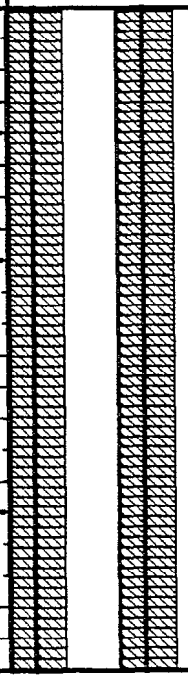
SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Surface Casing	6.0	Schedule 40 PVC	Grade	40.0
Well Riser	2.0	Schedule 40 PVC	0.22	54.0
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	54	64.0

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
1 – 2.0	S-1	0.5 / 25%	1 2 3 4		BG	**SILT** and **CLAY** w/trace sand, medium grained, and some fill; light pinkish brown; loose; damp,
3 – 4.0	S-2	0.5 / 25%	2 4 4 3		BG	**SILT** and **CLAY** w/trace sand , fine to medium grained; brown, loose; damp
5 – 6.0	S-3	1.25 / 63%	1 2 1 1		2	**SAND**, fine to coarse grained, w/trace silt; light brown, very loose; moist
7 – 8.0	S-4	1.0 / 50%	1 2 2 2		3	**SAND**, fine to coarse grained, w/some silt; light brown; very loose; wet
9 – 10.0	S-5	2.0 / 100%	1 2 2 2		3	**SAND**, very fine to fine grained, w/some silt; light brown w/grey streaks; very loose; wet

Well Installation Detail



Elevation

Match to Sheet 2

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Donald C. Shields
DRILLER: Terry Mize (0-42'); Steve Uhlrich (42-67 1/2') BORING NO.: A-MW13B SHEET 1 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: A-MW13B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
11 – 12.0	S-6	1.5 / 75%	3 2 2 3		2	**SAND**, very fine to fine grained, w/some silt, some clay; light brown to light grey; loose; wet		
13 – 14.0	S-7	2.0 / 100%	3 6 3 3		2	**SAND,** fine to coarse grained, w/some silt and trace clay; light grey w/light orangish to brown streaks; loose; wet		
15 – 16.0	S-8	2.0 / 100%	1 2 4 6		2	**SAND,** fine to coarse grained, w/trace silt; light tan; loose; wet		
17 – 18.0	S-9	2.0 / 100%	4 6 7 7		3	**SAND,** fine to coarse grained, w/trace silt and trace gravel; light grey w/light orangish brown streaks; loose; wet		
19 – 20.0	S-10	2.0 / 100%	2 1 1 1		3			
21 – 22.0	S-11	2.0 / 100%	4 5 8 7		3	**SAND,** fine to coarse grained, w/trace silt, and trace gravel; light grey to light brown; medium dense; wet		
23 – 24.0	S-12	1.5 / 75%	4 6 9 12		3	**SAND,** fine to coarse grained w/trace silt, mottled; light grey to light orangish brown; medium dense; wet		
25 – 26.0	S-13	2.0 / 100%	6 9 13 20		2	**SAND**, fine to coarse grained, w/trace silt; light orangish brown; medium dense; wet **SAND**, very fine to fine grained, some silt, w/trace clay; light grey w/light, brown streaks; medium dense; wet		
27 – 28.0	S-14	2.0 / 100%	14 20 27 23		4	**SAND.** fine to coarse grained, w/trace silt; light grey w/light orangish brown and dark pinkish brown streaks; dense; wet		
29 – 30.0	S-15	1.0 / 50%	13 16 14 15		4	Match to Sheet 3		

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Donald C. Shields

DRILLER: Terry Mize (0-42'); Steve Uhlrich (42 - 67 1/2') BORING NO.: A-MW13C SHEET 2 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: A-MW13B

SAMPLE TYPE

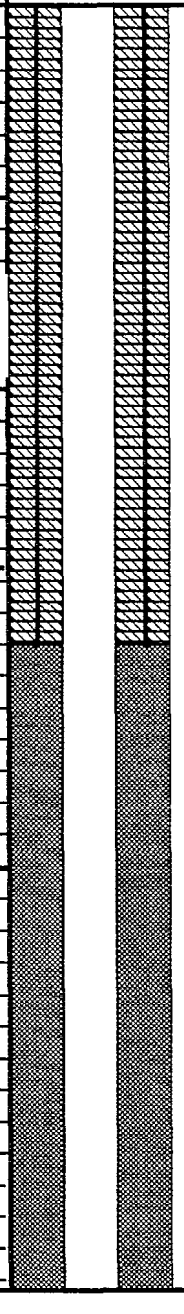
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
31 – 32.0	S-16	1.5 / 75%	5 4 8 7		4	SAND, fine to medium grained, w/trace silt; light grey w/light orange brown spots; medium dense; wet
33 – 34.0	S-17	2.0 / 100%	3 5 11 12		2	SAND, fine to medium grained, some silt; light grey; loose; wet SILT w/sand, very fine to medium grained; light grey; stiff; wet
35 – 36.0	S-18	1.75 / 88%	3 10 12 8		BG	SILT w/clay, and sand, fine grained; light orangish w/brown light gray streaks; very stiff; wet
37 – 38.0	S-19	2.00 / 100%	3 1 2 4		2	CLAY, w/silt, and some sand, fine grained; light grey w/light organish brown streaks; soft; moist, wet
						SAND, medium grained w/silt; light orangish brown; loose; wet,
39 – 40.0	S-20	1.5 / 75%	1 3 2 2		2	CLAY, w/trace silt; micaccous; very dark grey w/dark olive green streaks; stiff; damp
41 – 42.0	S-21	1.0 / 50%	1 1 1 1		2	CLAY, w/trace silt, micaccous; very dark grey w/dark olive green streaks, redish orange; very soft; damp to moist
43 – 44 – 45						
46 – 47.0	S-22	2.0 / 100%	12 12 13 19		BG	SAND, fine to coarse grained w/shell material and w/trace gravel, trace silt and trace clay; light brown w/reddish brown spots; dense; wet
48 – 49 – 50						Match to Sheet 4

Well Installation Detail



Elevation

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Donald C. Shields

DRILLER: Terry Mize (0 - 42') Steve Uhlrich (42 - 67 1/2') BORING NO.: A-MW13B SHEET 3 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW13B

SAMPLE TYPE

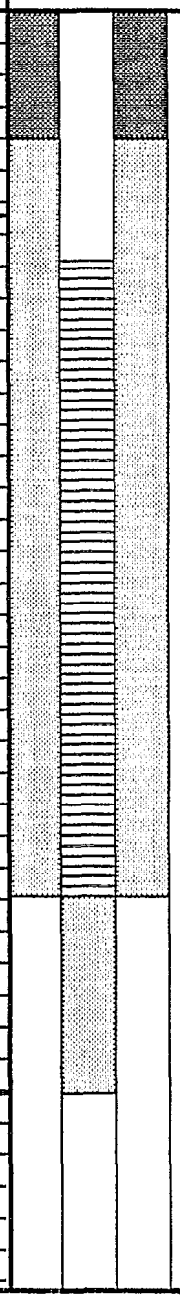
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
51 – 52.0	S-23	1.5 / 75%	15 17 19 30		BG	**SAND**, fine to coarse grained, w/shell material; and trace silt and trace clay; light orangish brown/sharp contact/light grey; dense; wet
53 – 55						
56 – 57.0	S-24	1.5 / 75%	11 23 30 37		BG	**SAND**, fine to coarse grained, w/shell material and trace silt and little clay; light grey; very dense; wet
58 – 60						
61 – 62.0	S-25	1.0 / 50%	7 24 26 25		BG	**SAND**, fine to coarse grained, w/shell material and trace silt and little clay; light grey; dense; wet
63 – 65						
66 – 67.0	S-26	1.0 / 50%	13 19 21 23		BG	**SAND**, fine to coarse grained, w/shell material and little silt and little clay; light grey; dense; wet
68 – 70						TD @ 67.0' borehole collapsed to 64.0'

Well Installation Detail



Elevation

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Donald C. Shields
DRILLER: Terry Mize (0 - 42'); Steve Uhlrich (42 - 67 1/2') BORING NO.: A-MW13B SHEET 4 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW14B
COORDINATES: EAST: 2640822.82 NORTH: 224252.41
ELEVATION: SURFACE: 10.83 TOP OF STEEL CASING: 10.48

RIG: 0-37' - Mobile B-61; 37' - 67' - Mobile B-80									
	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	6.0"	4 1/4" ID		5/12/92	37.0	Overcast, 50° F	5.0	
LENGTH	2.0'	37.0'	5.0'		5/13/92	67.0	Warm, 70° F		
TYPE	SS	Schedule 40PVC	HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		Flush							

REMARKS: Surface casing set 5/12/92. TD reached 5/13/92. Well set 5/13/92. HNu Background 1.0 ppm.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Surface Casing	6.0	Schedule 40 PVC	Grade	37.0
Well Riser	2.0	Schedule 40 PVC	0.35	54.0
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	54.0	64.0

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
1 – 2.0	S-1	1.0 50%	8 2 6 4		BG	SILT, and SAND, fine to medium grained; brown; medium dense; damp		
3 – 4.0	S-2	0.5 25%	2 2 2 2		BG	SILT and SAND, fine to medium grained; brown to light orangish brown; loose; damp		
5 – 6.0	S-3	2.0 100%	2 2 2 5		BG	SAND, medium grained ,some silt; grey w/black streaks; loose; wet		▼
7 – 8.0	S-4	.33 17%	7 12 1 1		BG	SAND, medium grained w/some silt; grey; loose; wet		
9 – 10.0	S-5	1.5 75%	8 8 8 8		BG			
						Match to Sheet 2		

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Donald C. Shields
DRILLER: T. Mize (0-37'); S. Uhlrich (37-65') BORING NO.: A-MW14B

Baker

Baker Environmental, Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW14B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
11 – 12.0	S-6	.16 / 8%	8 8 7 8		BG	SAND, medium grained, w/some silt; grey; loose; wet		
13 – 14.0	S-7	1.0 / 50%	8 8 6 7		BG	SAND, medium to coarse grained, w/some silt; light brown; loose; wet		
15 – 16.0	S-8	1.0 / 50%	10 8 9 10		BG			
17 – 18.0	S-9	1.0 / 50%	7 8 8 9		BG	SAND, fine to coarse grained, w/little silt; light brown; medium dense; wet		
19 – 20.0	S-10	1.0 / 50%	5 3 4 4		BG	SAND, fine grained, w/silt and trace clay, clay streaks; light brown; loose; wet		
21 – 22.0	S-11	.16 / 8%	8 9 9 10		BG	SAND, fine grained, w/silt, and trace clay; light brown; medium dense; wet		
23 – 24.0	S-12	2.0 / 100%	5 7 12 14		BG	SAND, medium to coarse grained, w/trace gravel and trace clay; light brown; medium dense; wet		
25 – 26.0	S-13	2.0 / 100%	60 23 25 22		BG	SAND, fine to coarse grained, w/trace gravel and trace silt; light brown; very dense; wet		
27 – 28.0	S-14	2.0 / 100%	12 20 22 19		BG	SAND, fine to coarse grained, w/trace gravel and trace silt; light brown w/orangish brown and pinkish brown streaks; dense; wet		
29 – 30.0	S-15	2.0 / 100%	8 10 10 9		BG	SAND, fine to medium grained, w/trace silt,; light brown; medium dense; wet		

Match to Sheet 3

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Donald C. Shields
DRILLER: T. Mize (0-37'); S. Uhlrich (37 - 65') BORING NO.: A-MW14B

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: A-MW14B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
31		2.0	5 4			SAND, fine to coarse grained, w/trace silt; light brown; loose; wet		
32.0	S-16	100%	5 5		BG	silty CLAY, some sand very fine; light grey; medium stiff; damp		
33		0.5	2 2			CLAY, SILT, some sand, very fine; light grey with orangish streak; stiff; moist to wet		
34.0	S-17	50%	5 5		BG			
35		1.5	5 3			CLAY, SILT, very fine grained; micacous reddish brown, orange and light grey; very stiff; damp		
36.0	S-18	75%	16 14		BG		35.0'	
37		1.00	10 6			CLAY, SILT, dark organish brown; very stiff; moist	37.0'	
38.0	S-19	50%	7 6		BG			
39						No Recovery		
40.0		NR	--		--			
41		2.0	10 12			SAND, fine to coarse grained, w/shell material and some silt, tracky; light brown; dense; wet		
42.0	S-20	100%	16 19		--			
43								
44								
45							Bentonite slurry 51 to 35'	
46		1.0	12 9			SAND, fine to coarse grained w/trace silt and trace clay; light brown; dense; wet		
47.0	S-21	50%	22 14		--	1' thick claystone/shale layer near base; olive green		
48								
49								
50						Match to Sheet 4		

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Donald C. Shields

DRILLER: T. Mize (0 - 37'); S. Uhlrich (37 - 65') BORING NO.: A-MW14B SHEET 3 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: A-MW14B

SAMPLE TYPE

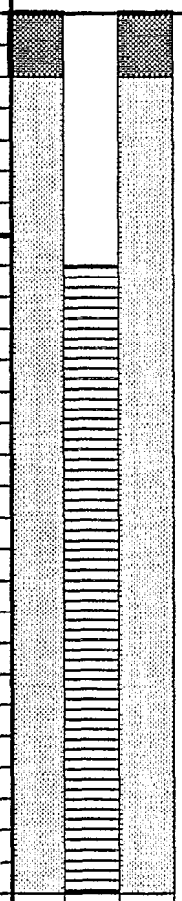
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
51 – 52.0	S-22	NR	--		--	No Recovery
53 – 55						
56 – 57.0	S-23	1.5 / 75%	13 12 15 24		--	SAND, fine to coarse grained, w/shell material and some silt and trace clay; olive greenish grey; dense; wet
58 – 60						
61 – 62.0	S-24	1.0 / 50%	7 21 16 20		--	SAND, fine to coarse, w/shell material and trace silt and trace clay; light olive green, light grey; dense; wet
63 – 65						
66 – 67.0	S-25	2.0 / 100%	6 12 15 16		--	SAND, fine to coarse grained, w/shell material and trace silt and trace clay; light olive greenish grey; dense; wet
68 – 70						TD @ 67.0' borehole collapsed to 64.0'

Well Installation Detail



Elevation

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Donald C. Shields

DRILLER: T. Mize (0 - 37'); S. Uhlrich (37 - 65') BORING NO.: A-MW14B SHEET 4 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW15B
COORDINATES: EAST: 2640773.07 NORTH: 224791.57
ELEVATION: SURFACE: 6.03 TOP OF STEEL CASING: 8.67

RIG: Mobile B-61	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	6.0"	4 1/4" ID		5/17/92	35	Partly Cloudy, 60°F	2.5	
LENGTH	2.0'	35.0'	5.0'		5/18/92	67	Sunny, 80°F		
TYPE	SS	Schedule 40 PVC	HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		2.64'							

REMARKS: Surface casing set 5-17-92. TD reached 5-18-92. Well set 5-18-92. HNu Background 1.9 ppm.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Surface Casing	6.0	Schedule 40 PVC	Grade	35.0
Well Riser	2.0	Schedule 40 PVC	+2.64	55.0
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	55.0	65.0

Depth (Ft.)		Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
1	2.0	S-1	1.6 80%	1/12" 1/12"		BG	SAND, silty w/some organic matter; brown; very loose; moist		
3	4.0	S-2	1.6 80%	1 5 4 4		BG	SAND, fine to medium grained, roots; brownish green; loose; wet		
5	6.0	S-3	2.0 100%	2 2 3 3		BG	SAND, silty to medium grained; brownish green; loose; wet		
7	8.0	S-4	2.0 100%	3 3 4 3		BG	SAND, silty to medium grained; buff to orange; loose; wet		
9	10.0	S-5	1.6 80%	2 2 4 2		BG	SAND, silty to medium grained; orange; loose; wet		

Match to Sheet 2

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: A-MW15B SHEET 1 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW15B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
11 – 12	S-6	2.0 / 100%	2 3 3 3		BG	SAND, coarse to fine grained, w/trace fine gravel; buff; loose; wet, orange lenses		
13 – 14	S-7	2.0 / 100%	2 2 4 3		BG	SAND, coarse grained; buff; loose; wet		
15 – 16	S-8	2.0 / 100%	3 3 4 3		BG	SAND, fine to coarse grained, w/trace silt; buff; loose; wet		
17 – 18	S-9	2.0 / 100%	5 7 6 4		BG	SAND, fine to coarse grained, w/trace silt; buff; medium dense; wet		
19 – 20	S-10	2.0 / 100%	5 4 5 6		BG	SAND, fine to coarse grained, w/trace silt; buff to grey; loose; wet		
21 – 22	S-11	2.0 / 100%	2 2 3 2		BG	SAND, coarse to fine grained, w/trace silt; buff; loose; wet		
23 – 24	S-12	2.0 / 100%	4 3 5 6		BG			
25 – 26	S-13	2.0 / 100%	5 4 3 3		BG			
27 – 28	S-14	2.0 / 100%	3 7 8 4		BG	SAND, coarse to fine grained, w/trace silt; buff; medium dense; wet		
29 – 30	S-15	2.0 / 100%	6 9 4 4		BG	SAND, clayey; rust; damp Match to Sheet 3		

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: A-MW15B SHEET 2 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: A-MW15B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
31 – 32.0	S-16	2.0 100%	2 1 5 2		BG	**SAND** and **silt**; rust; loose; wet
33 – 34.0	S-17	2.0 100%	1/12" 1/12"		BG	
35 – 36.0	S-18	0.5 25%	3 2 2 2		BG	
37 – 38.0	S-19	2.0 100%	W O H		BG	
39 – 40.0	S-20	2.0 100%	W O H		BG	
41 – 42.0	S-21	1.5 50%	11 12 14 18		BG	**SAND**, fine to coarse grained, w/shell material and little gravel, and trace clay; light brown; dense; wet
43						
44						
45						
46 – 47.0	S-22	1.0 50%	6 12 7 21		BG	**SAND**, fine to coarse grained, w/shell material and little gravel, and trace silt and trace clay; light brown; medium dense; wet
48						
49						
50						Match to Sheet 4

Well Installation Detail

35.0'

48.5'

Elevation

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Donald C. Shields

DRILLER: Steve Uhlrich BORING NO.: A-MW15B SHEET 3 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW15B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
51 – 52 (52.0)	S-23	1.0 50%	14 26 27 30		BG	SAND, fine to coarse grained, w/shell material and little silt and little clay; light grey; very dense; wet	52.0'	
53 – 55								
56 – 57 (57.0)	S-24	1.0 50%	15 23 24 23		BG	SAND, fine to coarse grained, w/shell material and trace silt and trace clay; light grey; dense; wet	55.0'	
58 – 60								
61 – 62 (62.0)	S-25	1.0 50%	16 28 24 31		BG	SAND, fine to coarse grained, w/shell material and trace gravel and trace silt and trace clay; light grey; very dense; wet		
63 – 65							65.0'	
66 – 67 (67.0)	S-26	1.0 50%	19 37 37 35		BG	SAND, fine and coarse grained, w/shell material and trace gravel and trace silt and trace clay; light grey; very dense; wet		
68 – 70						TD @ 67.0'		

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich BORING NO.: A-MW15B SHEET 4 OF 4

Baker
Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW16B
COORDINATES: EAST: 2640841.34 NORTH: 225346.20
ELEVATION: SURFACE: 7.55 TOP OF STEEL CASING: 9.58

RIG: Mobile ATV	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	6.0"	4 1/4" ID		6/12/92	0 - 32	Sunny, warm	3.5	
LENGTH	2.0'	32.0'	5.0'		6/13/92	32 - 65	Sunny, warm		
TYPE	SS	Schedule 40PVC	HSA						
HAMMER WT.	140 #								
FALL	30"								
STICK UP		2.03'							

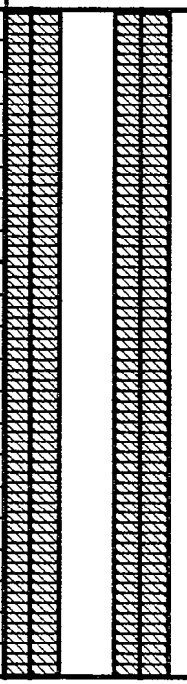
REMARKS: Surface casing set 6-12-92. Total Depth reached 6-13-92. Well set 6-13-92. OVA Background 1.0 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Surface Casing	6.0	Schedule 40 PVC	Grade	32.0
Well Riser	2.0	Schedule 40 PVC	+2.03	55.0
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	55.0	65.0

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description
1 – 2.0	S-1	1.6 / 80%	2 3 2 4		BG	**HUMUS**; light to dark brown; loose; moist
3 – 4.0	S-2	1.7 / 85%	2 3 4 4		BG	
5 – 6.0	S-3	1.8 / 90%	1 2 2 2		BG	**SAND**; medium grained; light to yellow brown; loose; wet
7 – 8.0	S-4	1.7 / 85%	1 2 3 2		BG	
9 – 10.0	S-5	1.0 / 50%	4 6 4 7		BG	

Well Installation Detail



Elevation

Match to Sheet 2

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J.E. Zimmerman
DRILLER: M. Fletcher BORING NO.: A-MW16B SHEET 1 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: A-MW16B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description	Well Installation Detail	Elevation
11 – 12.0	S-6	1.7 85%	3 7 6 6		BG	SAND; medium to coarse grained; light to yellow brown; medium dense; wet		
13 – 14.0	S-7	1.7 85%	3 2 1 1		BG	SAND; medium to coarse grained; grey; loose; wet clayey SILT; orange; soft; wet		
15 – 16.0	S-8	2.0 100%	3 2 1 1		BG	SAND; medium to coarse grained;yellow brown to grey; loose; wet clayey SILT; orange; soft; wet, (orange laminations)		
17 – 18.0	S-9	1.5 75%	3 2 4 4		BG	SAND; fine to medium grained; light brown to grey to orange; loose; wet SAND; medium w/gravel; light brown to grey to orange; loose; wet		
19 – 20.0	S-10	2.0 100%	5 6 7 6		BG	SAND; fine to medium grained w/coarse sand; light brown to grey ; medium dense; wet, lenses of coarse sand present at base		
21 – 22.0	S-11	.9 45%	5 7 8 8		BG	SAND; coarse grained w/gravel; light brown to grey ; medium dense; wet		
23 – 24.0	S-12	2.0 100%	7 7 12 7		BG	SAND; medium to coarse w/gravel; light brown to dark grey; medium dense; wet. (laminations at base are fine grained sand)		
25 – 26.0	S-13	2.0 100%	4 4 8 12		BG	SAND; medium grained; dark brown; medium dense; wet clayey SILT; dark brown; medium dense; wet		
27 – 28.0	S-14	2.0 100%	7 7 12 7		BG	SAND; medium grained; dark brown; medium dense; wet clayey SILT; dark brown; medium dense; wet		
29 – 30.0	S-15	1.8 90%	6 10 7 7		BG	clayey SILT, w/fine sand; dark brown to grey; medium dense; wet. (laminations are fine grained sand) Match to Sheet 3		

DRILLING CO.: Hardin Huber, Inc. BAKER REP.: J.E. Zimmerman

DRILLER: M. Fletcher BORING NO.: A-MW16B SHEET 2 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

S.O. NO.: 0084 BORING NO.: A-MW16B

SAMPLE TYPE

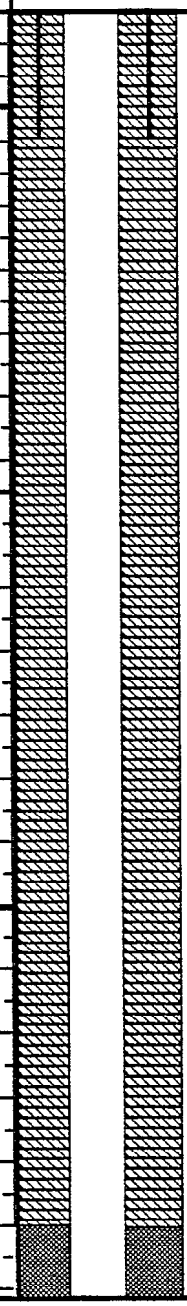
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description
31	S-16	2.0 / 100%	7 7 5 7		BG	clayey SILT; dark to light brown; medium dense; wet
32 (32.0)						
33	S-17	2.0 / 100%	6 11 12 14		BG	SHELL material; light brown; medium dense; wet
34 (34.0)						
35						
36						
37						
38	S-18	.7 / 35%	17 16 21 22		BG	SHELL material w/trace fine sand,; light brown; dense; wet.
39						
40 (40.0)						
41						
42						
43	S-19	1.1 / 55%	17 18 21 35		BG	SHELL material w/trace fine sand; light brown; dense; wet.
44						
45 (45.0)						clayey SILT, w/sand medium grained; green to rust; wet, (silt lenses at very top are oxidized)
46						
47						
48 (48.0)						
49	S-20	1.6 / 80%	14 35 40 23		BG	SHELL material; light brown; very dense; wet
50 (50.0)						Match to Sheet 4

Well Installation Detail



Elevation

DRILLING CO.: Hardin Huber, Inc. BAKER REP.: J.E. Zimmerman

DRILLER: M. Fletcher BORING NO.: A-MW16B SHEET 3 OF 4

Baker

Baker Environmental, Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW16B

SAMPLE TYPE

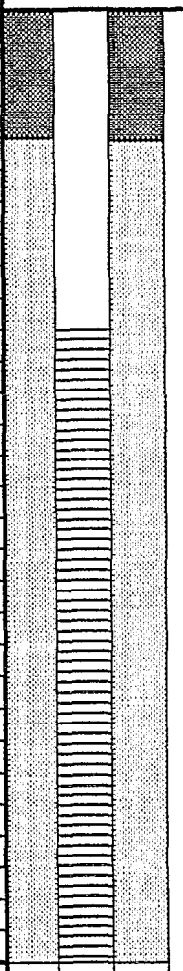
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description
51, 52, 53						
54, 55 (55.0)	S-21	1.7 / 85%	46 / 50 / 4		BG	SHELL material; grey; very dense; wet
56, 57, 58						
59, 60 (60.0)	S-22	.5 / 25%	50 / 3		BG	SHELL material; grey; very dense; wet
61, 62, 63						
64, 65 (63.0)	S-23	1.3 / 65%	42 / 37 / 25 / 22		BG	SHELL material; grey; very dense; wet
66, 67, 68, 69, 70						TD @ 65.0'

Well Installation Detail



Elevation

Match to Sheet 5

DRILLING CO.: Hardin Huber, Inc. BAKER REP.: J.E. Zimmerman
DRILLER: M. Fletcher BORING NO.: A-MW16B SHEET 4 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW17B
COORDINATES: EAST: 2641858.28 NORTH: 225543.18
ELEVATION: SURFACE: 7.44 TOP OF STEEL CASING: 9.05

RIG: Mobile B-53 ATV

	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	6.0"	4 1/4" ID		6/10/92	0 - 30	Sunny, warm	6.9	
LENGTH	2.0'	30.0'	5.0'		6/11/92	31 - 66	Sunny, warm		
TYPE	STD	PVC	HSA						
HAMMER WT.	140 #								
FALL	30"								
STICK UP		1.61'							

REMARKS: Surface casing set 6-10-92. Total Depth reached 6-11-92. Well set 6-11-92. OVA Background 1.0 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Surface Casing	6.0	Schedule 40 PVC	Grade	30.0
Well Riser	2.0	Schedule 40 PVC	+1.61	56.0
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	56.0	66.0

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description
1 – 2.0	S-1	1.6 / 80%	7 9 11 11		BG	**HUMUS** w/fine to medium sand and shell material; brown and white; medium dense; moist
3 – 4.0	S-2	1.6 / 80%	6 7 11 11		BG	**SAND,** fine to medium grained w/shell material; brown and white; medium dense; moist
5 – 6.0	S-3	1.6 / 80%	5 5 6 5		BG	**SAND** , fine to medium w/trace silt; brown to green; medium dense; moist
7 – 8.0	S-4	1.8 / 90%	3 2 2 4		5.0	**SILT** w/fine to medium sand; green to grey; loose; wet **SAND** , fine to medium grained w/shell material; green to grey; loose; wet
9 – 10.0	S-5	1.6 / 80%	2 1 1 2		200.0	**SAND** , fine to medium grained sand w/shell material; green to grey; loose; wet; Plant material at base **SILT** , and sand fine to medium; green and grey; loose; wet Match to Sheet 2

Well Installation Detail

Elevation

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J.E. Zimmerman/B. Jakub
DRILLER: M. Fletcher BORING NO.: A-MW17B SHEET 1 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW17B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description	Well Installation Detail	Elevation
11 – 12.0	S-6	2.0 / 100%	1 1 1 1		30.0 base	silty CLAY; grey; soft; wet		
13 – 14.0	S-7	2.0 / 100%	1 1 1 1		15.0 base			
15 – 16.0	S-8	2.0 / 100%	1 1 1 1		100.0 top 20.0 base			
17 – 18.0	S-9	2.0 / 100%	wt 18" 1 1		100.0	SAND medium grained; grey; very soft; wet		
19 – 20.0	S-10	2.0 / 100%	wt 12" 1 1		30.0 top 10.0 base	silty CLAY w/shell material and medium grained sand; grey; soft; wet, occasional sand lenses		
21 – 22.0	S-11	2.0 / 100%	1 1 1 1		70.0 top 10.0 base	silty CLAY w/medium grained sand; grey; very soft; wet		
23 – 24.0	S-12	2.0 / 100%	1 2 2 1		200.0 mid 100.0 base	silty CLAY w/occasional medium grained sand lenses; grey; loose; wet SAND medium to coarse grained; grey; loose; wet		
25 – 26.0	S-13	2.0 / 100%	1 1 1 1		34.0	silty CLAY w/medium to coarse grained sand; grey; very soft;wet silty CLAY; grey; very soft; wet, occasional medium sand lenses		
27 – 28.0	S-14	1.0 / 50%	1 2 3 3		5.0	CLAY; green and orange; stiff; moist, orange oxidation streaks		
29 – 30.0	S-15	1.0 / 50%	2 2 3 3		2.0	CLAY; green and orange; medium stiff; moist, orange oxidation streaks Match to Sheet 3		

DRILLING CO.: Hardin Huber, Inc. BAKER REP.: J.E. Zimmerman/B. Jakub
DRILLER: M. Fletcher BORING NO.: A-MW17B SHEET 2 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW17B

SAMPLE TYPE

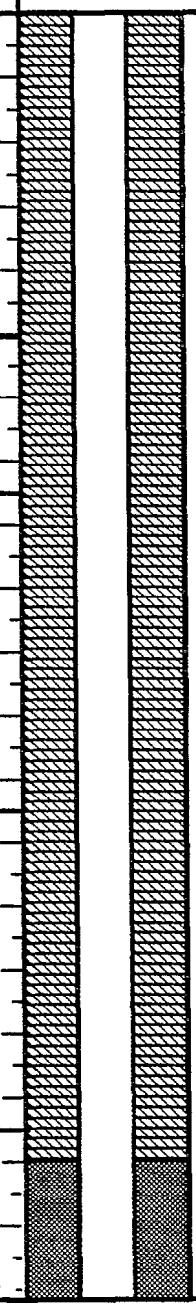
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description
31 – 32.0	S-16	1.7 / 85%	2 3 4 3		BG	**CLAY**; green to orange; medium stiff; moist, orange oxidation streaks
33 – 34.0	S-17	1.4 / 70%	1 2 3 3		BG	**CLAY**; green to orange; medium stiff; moist, orange oxidation streaks **SAND**, fine to medium grained; yellow to brown to grey to orange; medium dense; wet, orange oxidation streaks
35 – 36.0	S-18	2.0 / 100%	3 4 7 8		BG	**CLAY** w/fine to medium grained sand; grey to orange; stiff; wet
37 – 39						
40 – 41.0	S-19	1.6 / 80%	10 15 17 22		BG	**SAND** fine to medium grained; yellow to brown to grey; dense; wet
42 – 44						
45 – 46.0	S-20	2.0 / 100%	17 24 18 12		2.0	**SHELL** material; light brown; very dense; wet
47 – 49						
50		2.0	33 24		6.0	**SHELL** material; light to dark brown; very dense; wet Match to Sheet 4

Well Installation Detail



Elevation

DRILLING CO.: Hardin Huber, Inc. BAKER REP.: J.E. Zimmerman/B. Jakub
DRILLER: M. Fletcher BORING NO.: A-MW17B SHEET 3 OF 4

TEST BORING AND WELL CONSTRUCTION RECORD

Baker
Baker Environmental, Inc

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW17B

SAMPLE TYPE

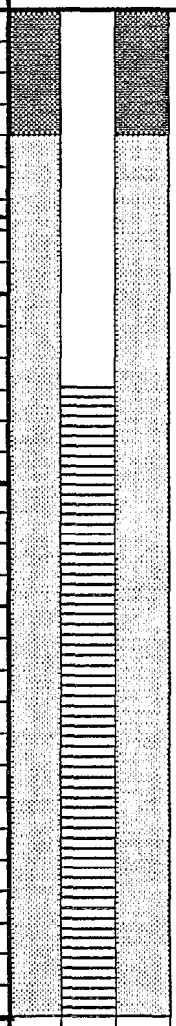
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description
51.0		100%	33 25			Larger fragments oriented horizontally
56.0	S-22	1.2 60%	38 47 51 4"		BG	SHELL material; dark brown; very dense; wet. Larger fragments oriented horizontally SAND fine to medium grained; dark grey to grey; very dense; wet
61.0	S-23	1.5 75%	38 39 50 3"		BG	CLAY, w/sand, fine; green and grey; very dense; wet SHELL material w/sand, fine grained; green to grey; very dense; wet. Laminations in clay (dark grey) Larger fragments are oriented horizontally
66.0	S-24	2.0 10%	28 39 42 18		BG	SHELL matieral; grey; very dense; wet. Larger fragments oriented horizontally
						TD @ 66.0'

Well Installation Detail



Elevation

DRILLING CO.: Harden Huber, Inc. BAKER REP.: J.E. Zimmerman/B. Jakub
DRILLER: M. Fletcher BORING NO.: A-MW17B SHEET 4 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW18B
COORDINATES: EAST: 2641799.38 NORTH: 225887.55
ELEVATION: SURFACE: 7.38 TOP OF STEEL CASING: 9.69

RIG: Mobile B-80	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	6.0"	4 1/4" ID		12/14/92	40.0	Overcast, 40°F	4.0	
LENGTH	2.0'	36.0'	5.0'		12/15/92	46.0	Overcast, 40°F		
TYPE	SS	Schedule 40PVC	HSA		12/16/92	76.0	Overcast, 40°F		
HAMMER WT.	140#								
FALL	30"								
STICK UP		2.31'							

REMARKS: Surface casing set 12-15-92. TD reached 12-16-92. Well set 12-16-92. HNu Background

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Surface Casing	6.0	Schedule 40 PVC	Grade	36.0
Well Riser	2.0	Schedule 40 PVC	+2.31	65.3
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	65.3	75.3

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
1	S-1	0.8	5 7 10 12		BG	Root zone w/plant material; dark brown		
2	2.0	40%				**HUMUS**, w/sand and trace clay and shell material throughout and brown to white (shell) to orange; medium dense; damp		
3	S-2	0.7	3 7 10 7		BG	**SHELL** material w/little sand fine to medium grained and trace clay; brown to white (shell); medium dense; moist to wet		
4	4.0	35%						▼
5	S-3	0.4	4 4 4 4		BG	**SHELL** material w/little sand fine to medium grained; brown; loose; wet		
6	6.0	20%						
7	S-4	0.2	3 2 2 1		BG			
8	8.0	10%						
9	S-5	0.2	1 -- -- --		BG	**SHELL** material w/little sand fine grained; brown; loose; wet		
10	10.0	10%						

Match to Sheet 2

DRILLING CO.: Hardin-Huber BAKER REP.: John E. Zimmerman
DRILLER: Mike Corran BORING NO.: A-MW18B SHEET 1 OF 5

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill
CTO NO.: 0084 BORING NO.: A-MW18B

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
11 12.0	S-6	0.7 35%	1 1 1 1		BG	silty CLAY,w/occasional shell material; green to grey to white (shells); very soft; wet		
13 14.0	S-7	0.5 25%	1 1 1 1		BG	silty CLAY,w/fine grained sand; green to grey to white (shells); soft; wet		
15 16.0	S-8	1.9 95%	1 1 1 1		BG	silty CLAY,w/occasional shell material; green to grey to white (shells); soft; wet		
17 18.0	S-9	1.9 95%	WH/6" 1		BG	silty CLAY,w/occasional oxidized material (wood); green to grey to white (shells); soft; wet		
19 20.0	S-10	1.7 85%	WH/24"		BG	silty CLAY; green to grey; very soft; wet		
21 22.0	S-11	2.0 100%	WH/12" 1 1		BG	silty CLAY; grey; very soft; wet		
23 24.0	S-12	1.9 95%	WH/24"		BG			
25 26.0	S-13	2.0 100%	WH/24"		BG			
27 28.0	S-14	2.0 100%	WH/24"		BG			
29 30.0	S-15	2.0 100%	WH/18" 2		BG	silty CLAY,w/occasional shell material; grey to white (shells); soft; wet		

Match to Sheet 3

DRILLING CO.: Hardin-Huber BAKER REP.: John E. Zimmerman
DRILLER: Mike Corran BORING NO.: A-MW18B SHEET 2 OF 5

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW18B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
31 – 32.0	S-16	2.0 100%	WH 18" 2		BG	silty CLAY,w/little shell material; grey to white (shells); soft; wet		
33 – 34.0	S-17	2.0 100%	WH 12" 1 1		BG			
35 – 36.0	S-18	2.0 100%	WH/6" 1 2 1		--	silty CLAY; greenish grey; soft; wet (top) to moist (bottom)	36.0'	
37 – 38.0	S-19	2.0 100%	2 1 1 4		--	silty CLAY; greenish grey; soft; wet		
39 – 40.0	S-20	2.0 100%	1 1 1 1		--			
41 – 42.0	S-21	2.0 100%	2 2 2 3		BG	as above w/layer of wood at 42'		
43 – 44.0	S-22	2.0 100%	2 2 3 2		BG	silty CLAY; greenish grey; medium stiff; wet		
						oxidized wood w/clay intermixed		
45 – 46.0	S-23	2.0 100%	1 1 2 1		BG	CLAY; w/orange oxidation streaks (bottom 1/2); greenish grey; soft; wet		
47 – 48.0	S-24	2.0 100%	2 1 2 4		BG	silty CLAY,w/oxidized wood chips/splinters; greenish grey; soft; moist		
49 – 50.0	S-25	2.0 100%	1/18" 4		BG	Match to Sheet 4		

DRILLING CO.: Hardin-Huber BAKER REP.: John E. Zimmerman
DRILLER: Mike Corran BORING NO.: A-MW18B SHEET 3 OF 5

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW18B

SAMPLE TYPE

S = Split Spoon A = Auger
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Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
51	S-26	2.0	3 3 7 9		BG	silty CLAY, w/oxidized wood chips/splinters; greenish grey; soft; moist silty CLAY; greenish grey; soft; moist CLAYEY sandy silt; dark brown to grey; medium dense; wet CLAYEY sandy silt; w/laminations of sand medium to coarsegrained
52 52.0		100%				
53	S-27	1.8	2 1/12" 5		BG	SAND medium to coarse grained; dark brown; loose; wet CLAYEY silt; dark brown; loose; wet SAND medium to coarse grained; dark brown
54 54.0		90%				
55	S-28	1.5	3 3 6 6		BG	SANDY clayey silt w/occasional wood splinters in medium sand; grey to dark brown to greenish grey to grey; loose to medium dense; wet
56 56.0		75%				
57	S-29	2.0	3 4 7 7		BG	
58 59.0		100%				
59	S-30	2.0	4 5 7 3		BG	silty SAND fine to medium (top) to fine grained (bottom); greyish brown; moist (top) to wet (bottom)
60 60.0		100%				
61	S-31	1.7	7 8 14 8		BG	silty SAND fine grained SAND medium grained w/silt laminations; greyish brown; medium dense; wet
62 62.0		85%				
63	S-32	1.3	15 18 26 38		BG	SAND coarse grained w/shell material (minor) and silt laminations; greyish brown; dense; wet
64 64.0		65%				
65						
66						
67						
68	S-33	1.8	24 36 26 24		BG	SHELL material w/some silt; green to white (shell); very dense; wet. Larger shell fragments oriented horizontally.
69 69.0		90%				
70						Match to Sheet 5

Well Installation Detail: 51.5' 62.3' 65.3'

Elevation

DRILLING CO.: Hardin-Huber BAKER REP.: John E. Zimmerman
DRILLER: Mike Corran BORING NO.: A-MW18B SHEET 4 OF 5

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW18B

SAMPLE TYPE

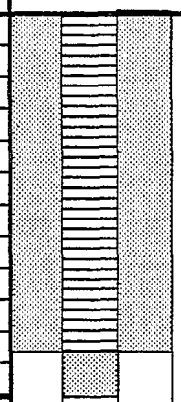
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
71						
72						
73						
74	S-34	1.8	18 27 38 47		BG	**SHELL** material w/some silt; green to white (shell); very dense; wet. Larger shell fragments oriented horizontally.
75	75.0	90%				
76	76.0	NA				TD @ 76.0'
77						
78						
79						
80						
81						
82						
83						
84						
85						
86						
87						
88						
89						
90						

Well Installation Detail



Elevation

DRILLING CO.: Hardin-Huber BAKER REP.: John E. Zimmerman
DRILLER: Mike Corran BORING NO.: A-MW18B SHEET 5 OF 5

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-MW19B
COORDINATES: EAST: 2643577.80 NORTH: 224506.04
ELEVATION: SURFACE: 10.41 TOP OF STEEL CASING: 12.88

RIG: B-80 Truck Mount									
	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	6.0"	4 1/4" ID		12/8/92	24.6	Partly Cloudy, 40°F	4.0	1423
LENGTH	2.0'	24.6'	5.0'		12/11/92	67.0	Partly Cloudy, 40°F		0833
TYPE	SS	Schedule 40PVC	HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		2.47'							

REMARKS: Surface casing set 12-8-92. TD reached 12-11-92. Well set 12-11-92. HNu Background 1.0 ppm. OVA Background is 1.0

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Surface Casing	2.0	Schedule 40 PVC	Grade	24.6
Well Riser	2.0	Schedule 40 PVC	+2.47	35.1/55.1
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	35.1/55.1	65.1

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	FID PID ppm HNu OVA	Visual Description	Well Installation Detail	Elevation
1 — 2.0	S-1	1.4 / 70%	5 7 10 12		BG	Root zone approximately 5"; dark brown silty SAND, fine to medium grained; grey to brown; loose; moist		
3 — 4.0	S-2	1.2 / 60%	3 7 10 7		BG	silty SAND, fine to medium grained w/trace clay fingers; dark grey to brown; micaceous; loose; wet		▼
5 — 6.0	S-3	.3 / 15%	4 4 4 4		BG	silty CLAY w/some sand fine grained; dark grey to grey w/black staining; medium dense; wet		
7 — 8.0	S-4	1.9 / 95%	3 2 2 1		BG	sandy SILT, w/little sand fine grained and some clay; buff grey to dark grey; oily staining; medium dense; wet silty SAND fine to medium grained w/little silt and trace clay; dark grey; medium dense; some oily staining carried down from above; wet		
10 — 10.0	S-5	1.7 / 85%	WOH 1 3 4		BG	SAND medium grained w/some fine to coarse and little silt; buff grey; loose; wet Match to Sheet 2		

DRILLING CO.: Hardin-Huber BAKER REP.: Tom Artman/J.E. Zimmerman
DRILLER: Mike Corran BORING NO.: B-MW19B SHEET 1 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW19B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID PID ppm HNu OVA	Visual Description	Well Installation Detail	Elevation
11 – 12 (12.0)	S-6	2.0 / 100%	3 3 4 4		4.0 (up to 10.0)	silty SAND, fine to medium grained w/some silt and trace clay; grey to greyish brown; loose to medium dense; wet		
13 – 14 (14.0)	S-7	2.0 / 100%	2 3 4 4		3.0	SAND, fine to medium grained w/trace silt; dark grey to greyish brown; loose; wet changed from OVA to HNu at S-7		
15 – 16 (16.0)	S-8	2.0 / 100%	7 4 4 5		2.6	SAND, fine to medium grained w/little silt and trace coarse sand; brown to buff; loose; wet		
17 – 18 (18.0)	S-9	2.0 / 100%	3 1 1 2		1.2	CLAY w/trace to little silt; grey with orange oxidation coloration; medium stiff to stiff; moist		
19 – 20 (20.0)	S-10	2.0 / 100%	1 1 5 11		BG	clayey SAND; very fine to fine grained; grey with orange coloration streaks; medium dense; moist to wet; clay content close to 50%; trace of silt	18.0'	
21 – 22 (22.0)	S-11	2.0 / 100%	2 3 2 3		2.8			
23 – 24 (24.0)	S-12	2.0 / 100%	2 3 7 12		2.1	CLAY w/trace silt; grey; stiff; moist to wet CLAY and SILT; brownish orange to grey; stiff; moist.		
25 – 26 (26.0)	S-13	0.8 / 40%	5 4 2 7		BG	SAND, fine to medium grained w/trace clay and silt; brown to grey w/orange staining; loose; wet		
27 – 28 (28.0)	S-14	1.7 / 85%	9 16 21 25		BG	SAND, fine to medium grained w/trace silt; brown to grey w/orange staining; loose; wet		
29 – 30 (30.0)	S-15	1.0 / 50%	12 20 20 22		BG	SAND, fine to medium grained; brown to grey w/orange staining; dense; wet Match to Sheet 3		

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Tom Artman/J. E. Zimmerman
DRILLER: Mike Corran BORING NO.: A-MW19B SHEET 2 OF 4

TEST BORING AND WELL CONSTRUCTION RECORD

Baker
Baker Environmental, Inc

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW19B

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
31, 32, 33						
34, 35 (35.0)	S-16	1.4 / 70%	4 4 7 8		BG	**SILT** w/trace sand fine grained, 90% organic material, decomposed wood, wood chunks and splinters; dark brown; medium dense; wet
36, 37, 38						
39, 40 (40.0)	S-17	1.7 / 85%	3 4 9 6		BG	**SAND**, fine grained w/some silt; lite green; medium dense; wet
41, 42, 43						
44, 45 (45.0)	S-18	NR	3 5 8 12		–	No Recovery
46, 47, 48						
49, 50 (50.0)	S-19	1.4 / 70%	14 18 16 28		BG	**SHELL** material w/silty sand, fine grained; greenish grey, white (shell); dense; wet; larger shell fragments oriented horizontally

Well Installation Detail: 47.0'

Elevation

Match to Sheet 4

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Tom Artman/J. E. Zimmerman
DRILLER: Mike Corran BORING NO.: A-MW19B SHEET 3 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW19B

SAMPLE TYPE

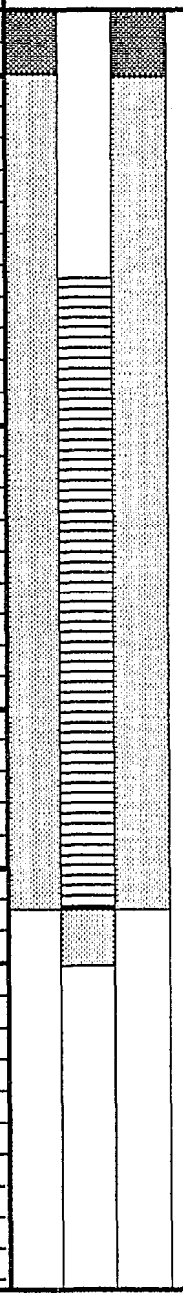
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description
51, 52, 53						
54, 55 (55.0)	S-20	1.5 / 75%	16 24 35 36		BG	SHELL material w/trace of sand, fine grained; green white (shell); very dense; wet
56, 57, 58						
59, 60 (60.0)	S-21	1.5 / 75%	14 28 24 26		BG	SHELL material; green; very dense; wet
61, 62, 63						
64, 65 (65.0)	S-22	1.6 / 65%	18 24 30 30		BG	SAND, fine grained w/some silt SHELL material w/silt lenses; green; very dense; wet
66, 67, 68, 69, 70						TD @ 65.0'

Well Installation Detail



51.0'
54.1'
64.1'
65.0'

Elevation

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Tom Artman/J.E. Zimmerman
DRILLER: Mike Corran BORING NO.: A-MW19B SHEET 4 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW20B
COORDINATES: EAST: 2642101.60 NORTH: 225008.35
ELEVATION: SURFACE: 16.22 TOP OF STEEL CASING: Abandoned

RIG: Mobile Truck Mount B-80	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"		4 1/4" ID		12/12/92	30.0	Cool, 40°F	~5.0	1310
LENGTH	2.0'		5.0'						
TYPE	SS		HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		---							

REMARKS: Borehole abandoned via pressure grouting 12-12-92. Borehole topped off w/heavy grout mixture 12-13-92. OVA background 1.0 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Riser				
Well Screen				

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description	Well Installation Detail	Elevation
						Root zone ~2"		
1 – 2.0	S-1	1.1 / 55%	4 8 11 12		4.2	**SANDY SILT** w/little sand; fine to medium grained and trace clay, wood; brown; medium dense; moist		
3 – 4.0	S-2	1.0 / 50%	4 6 8 4		4.0 (up to 10.0 instant)	**SANDY SILT** w/little sand, fine to medium grained; and trace wood, glass fragments; brownish grey; medium dense; moist		
5 – 6.0	S-3	1.1 / 55%	5 10 5 22		3.0 (up to 30.0 instant)	**SANDY SILT**; black to very dark grey; loose to medium dense; wet		▼
7 – 8.0	S-4	0.4 / 20%	12 26 8 11		0.2	**SILT** w/trace sand, glass; brown to very dark grey; loose, wet		
9 – 10.0	S-5	1.3 / 65%	1 2 1 6		10.0 (up to 40.0 instant)	**CLAY** w/some silt; dark grey; soft, wet,		
10						**SAND**, fine grained w/some shell material; grey to dark grey; loose; wet; (slight staining)	Match to Sheet 2	

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Tom Artman
DRILLER: Mike Corran BORING NO.: A-MW20B SHEET 1 OF 3

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-MW20B

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description	Well Installation Detail	Elevation
11 – 12.0	S-6	2.0 / 100%	6 14 12 17		4.0 (up to 30.0)	**SAND**, and **CLAY**, fine grained w/slight oily sheen at bottom, wood; grey to dark grey; loose; soft; wet		
13 – 14.0	S-7	0.3 / 15%	12 23 4 5		0.1	**WOOD** w/trace of sand and silt; slight oily sheen; dark grey; dense; wet		
15 – 16.0	S-8	0.4 / 20%	6 3 3 8		3.0	**WOOD** w/some shell material and silt; loose; wet		
17 – 18.0	S-9	2.0 / 100%	6 6 8 5		1.5	**SAND**, fine to medium grained w/trace to some silt; brown to grey; loose to medium dense; wet		
19 – 20.0	S-10	1.4 / 70%	6 6 2 1		1.0	**SAND**, fine to medium grained w/occasional coarse grains and little silt; light grey to light greyish brown; very loose; wet		
21 – 22.0	S-11	2.0 / 100%	3 4 6 7		6.0	**SAND**, medium to coarse grained w/some fine grains and trace to little silt; brownish grey; loose; wet		
23 – 24.0	S-12	2.0 / 100%	3 4 6 7		9.0			
25 – 26.0	S-13	2.0 / 100%	2 1 4 4		7.0	**SAND**, medium to coarse grained w/trace of silt; brownish grey; loose; wet		
27 – 28.0	S-14	2.0 / 100%	4 6 6 2		9.0	**SAND**, medium to coarse grained w/trace silt and gravel; brownish grey; loose; wet		
29 – 30.0	S-15	2.0 / 100%	3 2 4 5		15.0	Match to Sheet 3		

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Tom Artman
DRILLER: Mike Corran BORING NO.: A-MW20B SHEET 2 OF 3

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: A-MW20B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description	Well Installation Detail	Elevation
31	S-16	2.0 100%	6 7 9 7		11.0	clayey SAND w/little silt; grey, some orange oxide staining; loose to medium dense; wet to moist		
32								
33	S-17	2.0 100%	6 6 7 8		9.0	clayey SAND w/little silt; grey, some orange oxide staining; loose to medium dense; wet to moist		
34						Augered to 30.0' Sampled to 34.0'		
35						Boring abandoned via pressure grouting. Decision made not to construct well at location due to encountered waste materials, monitoring results, and apparent lack of a competent confining unit in which to set surface casing.		
36								
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
49								
50								

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Tom Artman

DRILLER: Mike Corran BORING NO.: A-MW20B SHEET 3 OF 3

Baker
Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-15WB
COORDINATES: EAST: 2641594.55 NORTH: 224741.26
ELEVATION: SURFACE: 8.44 TOP OF STEEL CASING: 10.31

RIG: Mobile Drill B-80

	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	6.0"	8 1/4" ID		5/3/92	44.0	Sunny, 60°F	7.5	
LENGTH	2.0'	44.0'	5.0'		5/5/92	76.0	Rainy, 40°F		
TYPE	SS	Schedule 40PVC	HSA		5/6/92	132.0	Cloudy, 50°F		
HAMMER WT.	140#								
FALL	30"								
STICK UP		1.87'							

REMARKS: Surface casing set 5-3-92. Total depth reached 5-6-92. Well set 5-6-92. HNu Background 0.4 to 3.5 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Surface Casing	6.0	Schedule 40 PVC	Grade	44.0
Well Riser	2.0	Schedule 40 PVC	+1.87	114.1
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	115	125

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
1 – 2.0	S-1	0.7 / 35%	2 2 2 16		BG	**TOPSOIL,** (rooted material) and fill material; dark brown to reddish; loose; dry (top) to damp (bottom)		
3 – 4.0	S-2	0.8 / 40%	3 3 2 3		BG	**TOPSOIL,** w/clayey material; dark brown to greenish; loose; dry (top) to damp (bottom)		
5 – 6.0	S-3	1.8 / 90%	1 1 1 1		BG	**CLAY** and **SILT,** w/sand fine to medium grained; greenish; loose; moist		
7 – 8.0	S-4	2.0 / 100%	1 1 1 12		BG	**CLAY** and **SILT,** w/sand fine to medium grained; and plant material; greenish; very loose; moist to wet		▼
9 – 10.0	S-5	2.0 / 100%	W O H		BG	**CLAY** and **SILT** w/plant material; greenish; very soft; wet		
						Match to Sheet 2		

DRILLING CO.: Hardin-Huber BAKER REP.: John E. Zimmerman
DRILLER: Mike Corran BORING NO.: B-15WB SHEET 1 OF 8

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill

CTO NO.: 0084 BORING NO.: B-15WB

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
11 – 12.0	S-6	2.0 100%	W O H		BG	CLAY and SILT, w/plant material; greenish; very soft; wet		
13 – 14.0	S-7	2.0 100%	W O H		BG			
15 – 16.0	S-8	2.0 100%	W O H		BG			
17 – 18.0	S-9	2.0 100%	W O H		BG			
19 – 20.0	S-10	1.7 85%	1 0 0 2		BG	SAND, fine to medium grained, w/little clay/silt; greenish; very loose; wet		
21 – 22.0	S-11	1.9 95%	3 3 3 3		BG	SAND, fine to medium grained; greenish; loose; wet		
23 – 24.0	S-12	.7 35%	2 2 3 3		BG	as above with trace silt		
25 – 26.0	S-13	1.7 85%	WH WH 1 2		BG	SAND, fine to medium grained, w/trace silt; brown to light brown; very loose; wet (coarse sand near bottom)		
27 – 28.0	S-14	.8 40%	W O H		BG	SAND, fine to medium grained, w/trace silt; light brown; very loose; wet		
29 – 30.0	S-15	1.7 85%	WH 1 3 10		BG	Match to Sheet 3		

DRILLING CO.: Hardin-Huber BAKER REP.: John E. Zimmerman

DRILLER: Mike Corran BORING NO.: B-15WB SHEET 2 OF 8

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-15WB

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
31 – 32.0	S-16	1.4 / 70%	5 6 16 12		BG	**SAND**, fine to medium grained w/trace silt; light brown; loose; wet		
33 – 34.0	S-17	1.6 / 80%	4 6 8 10		BG	**CLAY** w/some silt, and sand, fine to medium grained; greenish to light brown; medium loose;wet		
35 – 36.0	S-18	1.2 / 60%	3 3 3 5		BG	**SAND**, fine to medium grained w/silt/clay; greenish to grey to light brown to amber;loose; wet, (oxidized layers are alternating fine and coarse grained sand)		
37 – 38.0	S-19	1.9 / 95%	2 3 2 4		BG	**GRAVEL**, w/silt and clay layer;grey to light brown;dense; wet, clay silt layer is oxidized		
39 – 40.0	S-20	2.0 / 100%	6 12 16 20		BG			
41 – 42.0	S-21	2.0 / 100%	16 17 20 23		BG	**GRAVEL**, coarse to very coarse w/shell material and clay; grey to yellow to brown to amber; dense; wet		
43 – 44.0	S-22	1.2 / 60%	7 8 14 16		BG	**SHELL** material w/trace silt; yellowish to amber; medium dense; wet, shell fragments oriented horizontally	44.0'	
45								
46 – 47.0	S-23	1.5 / 75%	14 24 23 34		BG	**SHELL** material w/trace silt; dense;wet, shell fragments oriented horizontally		
48								
49								
50						Match to Sheet 4		

DRILLING CO.: Hardin-Huber BAKER REP.: John E. Zimmerman
DRILLER: Mike Corran BORING NO.: B-15WB SHEET 3 OF 8

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-15WB

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
51 – 52 (52.0)	S-24	.5 / 25%	14 43 50 5"		BG	**SHELL** material w/trace silt, and gravel; yellow to brown; dense;moist, larger shell fragments oriented horizontally
53 – 55						
56 – 57 (57.0)	S-25	1.3 / 65%	13 25 34 41		BG	**SHELL** material, w/sand fine grained and trace silt; yellow brown to green; very dense; moist
58 – 60						
61 – 62 (62)	S-26	1.2 / 60%	14 18 17 24		BG	**SHELL,** material w/sand coarse grained and trace silt; green to grey; dense; moist, occasional gravel sized shells
63 – 65						
66 – 67 (67.0)	S-27	1.0 / 50%	34 32 33 33		BG	**SHELL,** material w/sand fine to coarse grained and trace silt; grey; dense; moist
68 – 70						Match to Sheet 5

Well Installation Detail

Elevation

DRILLING CO.: HArdin-Huber BAKER REP.: John E. Zimmerman
DRILLER: Mike Corran BORING NO.: B-15WB SHEET 4 OF 8

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-15WB

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
71 – 72.0	S-28	NR 0%	33 50 3"		—	No Recovery.		
73 – 74.0	S-29	1.4 70%	28 30 18 12		BG	**SHELL** material w/sand fine to medium grained and trace silt; grey; dense; wet, shell fragments oriented horizontally		
75								
76 – 77.0	S-30	.9 45%	22 18 22 17		BG			
78								
79								
80								
81 – 82.0	S-31	.3 15%	16 13 15 17		BG	**SHELL** material w/sand fine to medium grained and trace silt; grey; medium dense; wet		
83								
84								
85								
86								
87 – 88.0	S-32	1.6 80%	7 12 27 34		BG	**SAND,** fine to medium grained w/shell material and trace silt; grey; dense; wet		
89								
90						Match to Sheet 6		

DRILLING CO.: Hardin-Huber BAKER REP.: John E. Zimmerman
DRILLER: Mike Corran BORING NO.: B-15WB SHEET 5 OF 8

TEST BORING AND WELL CONSTRUCTION RECORD

Baker
Baker Environmental, Inc

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-15WB

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
91 – 92.0	S-33	1.1 55%	7 11 18 20		BG	**SAND** fine to medium grained w/occasional shell material; grey; medium dense;wet Clay/silt layer exists at bottom		
93 – 95								
96 – 97.0	S-34	2.0 100%	8 10 16 25		BG	**SAND**, fine to medium grained w/trace silt; grey; medium dense; wet. Occasional gravel size to large shell fragments		
98 – 100								
101 – 102.0	S-35	1.7 85%	12 10 8 11		BG	**SAND**, fine to medium grained w/trace silt and clay; grey; medium dense; wet, shell fragments throughout		
103 – 105								
106 – 107.0	S-36	.4 20%	8 7 9 9		BG	**SAND**, fine to medium grained w/trace silt and clay; grey; medium dense; wet, shell fragments throughout		
108 – 110						Match to Sheet 7		

DRILLING CO.: HArdin-Huber BAKER REP.: John E. Zimmerman
DRILLER: Mike Corran BORING NO.: B-15WB SHEET 6 OF 8

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: B-15WB

SAMPLE TYPE

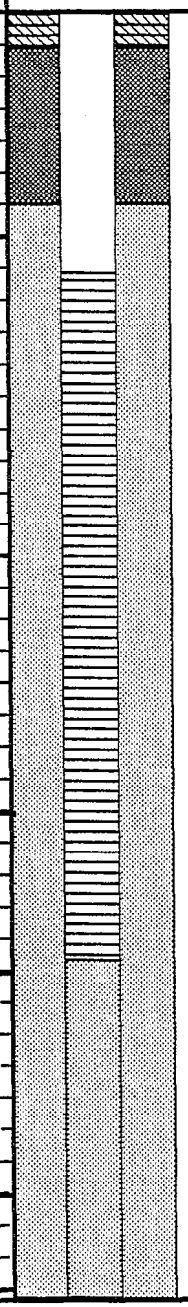
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
111 112.0	S-37	2.0 100%	10 8 12 15		BG	**SAND**, fine to medium grained w/trace silt and clay; grey;medium dense; wet
113 114 115						
116 117.0	S-38	.9 45%	13 18 14 16		BG	**SAND**, fine to medium grained w/trace silt and shell fragments, grey; dense; wet
118 119 120						
121 122.0	S-39	.2 10%	9 8 8 17		BG	**SAND**, fine to medium grained w/trace silt; grey; medium dense; wet
123						
124 125.0	S-40	2.0 100%	4 6 11 22		BG	**SAND**, fine to medium grained w/trace silt; grey; medium dense; wet
126 127.0	S-41	1.8 90%	5 4 8 13		BG	**SAND**, fine to medium grained w/trace silt and clay; grey; medium dense; wet
128 129 130						Match to Sheet 8

Well Installation Detail



Elevation

DRILLING CO.: Hardin-Huber BAKER REP.: John E. Zimmerman

DRILLER: Mike Corran BORING NO.: B-15WB SHEET 7 OF 8

Baker

Baker Environmental, Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: B-15WB

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
131	S-42	2.0	6 8 14 16		BG	SAND, fine to medium grained w/shell material and little silt/clay; grey to greenish; medium dense; moist		
132.0		100%					132.0'	
132						TD @ 132.0'		
133								
134								
135								
136								
137								
138								
139								
140								
141								
142								
143								
144								
145								
146								
147								
148								
149								
150								

DRILLING CO.: Hardin-Huber BAKER REP.: John E. Zimmerman

DRILLER: Mike Corran BORING NO.: B-15WB SHEET 8 OF 8

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-P8
COORDINATES: EAST: 2641245.13 NORTH: 224076.20
ELEVATION: SURFACE: 7.89 TOP OF STEEL CASING: 9.52

RIG: Mobile B-80	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	6.0"	4 1/4" ID		5/13/92	32.0	Warm, 70°F	6.0	
LENGTH	2.0'	32.0'	5.0'		5/14/92	67.0	Warm, 70°F		
TYPE	SS	Schedule 40 PVC	HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		1.63'							

REMARKS: Surface casing set 5-13-92. TD reached 5-14-92. Well set 5-14-92. HNu Background 0.5 ppm.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Surface Casing	6.0	Schedule 40 PVC	Grade	32.0
Well Riser	2.0	Schedule 40 PVC	+1.63	55.7
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	55.7	65.7

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
1	A/N							
2								
3								
4								
5								
6	S-1	0.5	1 2 1 2		BG	SAND, fine to coarse grained, w/some silt and plant material at base, yellowish brown to grey; very loose; wet		▼
7.0		25%						
8	A/N							
9								
10						Match to Sheet 2		

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz
DRILLER: Mike Corran BORING NO.: A-P8 SHEET 1 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: A-P8

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
11 / 12.0	S-2	1.2 / 60%	3 3 2 2		BG	SAND, fine to coarse grained, w/trace silt; grey loose; wet SAND, fine to medium grained, w/little silt/clay; brown; loose; wet
13 / 14 / 15						
16 / 17.0	S-3	1.1 / 55%	10 13 16 21		BG	SAND, fine to coarse grained; grey; medium dense; wet
18 / 19 / 20						
21 / 22.0	S-4	0.9 / 45%	2 2 3 2		BG	SAND, medium to very coarse grained, w/trace gravel-sized sand; greyish brown; loose; wet
23 / 24 / 25						
26 / 27.0	S-5	1.2 / 60%	2 1 3 3		BG	SAND, medium to very coarse grained, w/trace gravel-sized sand; greyish brown; loose; wet
28 / 29 / 30						

Well Installation Detail

Elevation

Match to Sheet 3

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz

DRILLER: Mike Corran BORING NO.: A-P8 SHEET 2 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: A-P8

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
31, 32 (32.0)	S-6	2.0 100%	1 1 2 2		BG	CLAY, w/little silt; grey; soft; wet	32.0'	
33, 34, 35								
36, 37 (37.0)	S-7	2.0 100%	WH WH 2 3		BG	CLAY, w/some silt and trace fine grained sand; plant material in layers throughout, brown; soft; wet		
38, 39, 40								
41, 42 (42.0)	S-8	2.0 100%	2 1 1 3		BG	CLAY, w/little silt and yellow plant material; grey; very soft; wet		
43, 44, 45								
46, 47 (47.0)	S-9	1.5 75%	8 5 3 2		BG	SAND, fine, medium, coarse grained, 0.3', silty clay lense; shell material at base; grey; loose; wet	49.0'	
48, 49, 50						Match to Sheet 4		

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz

DRILLER: Mike Corran BORING NO.: A-P8 SHEET 3 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: A-P8

SAMPLE TYPE

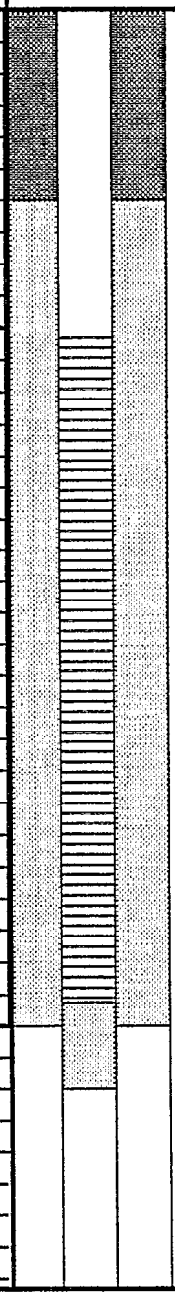
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
51 – 52.0	S-10	1.1 55%	15 16 18 19		BG	**SHELL** material w/trace sand, fine grained and trace silt; yellowish brown; dense; wet, shells oriented horizontal
53, 54, 55						
56 – 57.0	S-11	1.4 70%	16 24 22 26		BG	**SHELL**, material w/little sand and trace silt; grey; dense; wet, shells oriented horizontally
58, 59, 60						
61 – 62.0	S-12	1.3 65%	18 24 20 21		BG	**SHELL**, material w/little sand and trace silt; grey; dense; wet
63, 64, 65						
66 – 67.0	S-13	1.2 60%	17 24 25 28		BG	**SHELL**, material w/little sand and trace silt; grey; dense; wet
68, 69, 70						TD @ 67.0'

Well Installation Detail



53.0'
55.7'
65.7'
67.0'

Elevation

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. Kimberly Harriz
DRILLER: Mike Corran BORING NO.: A-P8 SHEET 4 OF 4

BAKER ENVIRONMENTAL, INC.

TEST BORING & WELL CONSTRUCTION RECORDS, AREA B (1992)

Baker

Baker Environmental, Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-MW12
COORDINATES: EAST: 2644256.69 NORTH: 224161.55
ELEVATION: SURFACE: 9.26 TOP OF STEEL CASING: 8.97

RIG: Mobil Rig B-61	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"		4 1/4" ID		5/15/92	14.0	Cloudy, 55°F	4.5	
LENGTH	2.0'		5.0'						
TYPE	SS		HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		Flush							

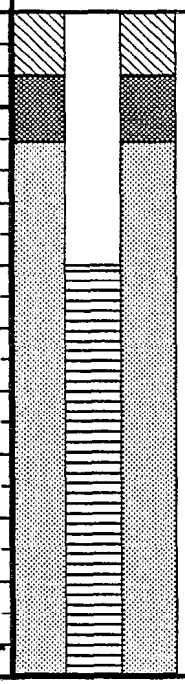
REMARKS: TD reached 5-15-92. Well set 5-15-92. HNu Background 0.5 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Riser	2.0	Schedule 40 PVC	0.29	4.0
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	4.0	14.0

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
1 – 2.0	S-1	NR			--	ASPHALT and GRAVEL SUB-BASE; No Recovery
2.0 – 4.0	S-2	1.0 50%	7 6 5 6		BG	SAND medium grained; green to brown; medium dense; dry to moist
4.0 – 6.0	S-3	2.0 100%	2 3 4 3		BG	SAND medium grained; grey; medium dense; wet
6.0 – 8.0	S-4	2.0 100%	3 2 2 2		BG	SAND medium grained w/ silt; green to brown; medium dense; wet
8.0 – 10.0	S-5	1.0 50%	3 2 1 1		BG	

Well Installation Detail



Elevation

DRILLING CO.: Harden-Huber BAKER REP.: R. Dabal
DRILLER: T. Mize BORING NO.: B-MW12 SHEET 1 OF 2

Baker

Baker Environmental, Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: B-MW12

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
11	S-6	2.0	1 12 1 12		BG	SAND fine grained, w/silt; green to grey to brown; medium dense; wet		
12 12.0		100%						
13	S-7	2.0	12 11 12 11		BG			
14 14.0		100%					14.0'	
15						TD @ 14.0'		
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Harden - Huber BAKER REP.: R. Dabal

DRILLER: T. Mise BORING NO.: B-MW12 SHEET 2 OF 2

Baker

Baker Environmental, Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-MW13
COORDINATES: EAST: 2644204.23 NORTH: 224049.09
ELEVATION: SURFACE: 9.93 TOP OF STEEL CASING: 9.75

RIG: Mobile B-61	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"		4 1/4"ID		5/14/92	14.0	Cloudy, 75°F	5.0	
LENGTH	2.0'		5.0'						
TYPE	SS		HSA						
HAMMER WT.	140#								
FALL	33"								
STICK UP		Flush							

REMARKS: TD reached 5-14-92. Well set 5-14-92. HNu Background 1.5 ppm.

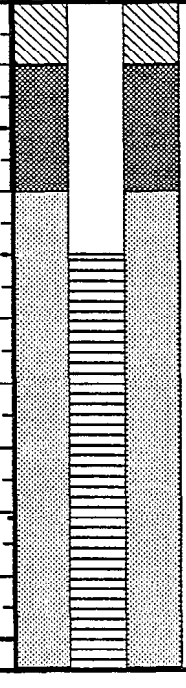
SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Riser	4.0	Schedule 40 PVC	Grade	4.0
Well Screen	4.0	Schedule 40 PVC 0.01 inch slots	4.0	14.0

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Elevation
1 – 2.0	S-1	1.0 / 50%	2 7 10 6		BG	**TOPSOIL**, humus, w/some sand; tan; medium dense; dry	
3 – 4.0	S-2	1.5 / 75%	4 6 8 7		BG	**SAND** fine to medium grained w/trace silt and clay; lite brown; medium dense; dry to moist	
5 – 6.0	S-3	1.5 / 75%	1 3 3 2		BG	**SAND** fine to coarse grained; brown; loose; wet	▼
7 – 8.0	S-4	2.0 / 100%	3 3 4 5		BG		
9 – 10.0	S-5	2.0 / 100%	3 2 2 2		BG	**SAND** fine to coarse grained; brown to grey; loose; wet	

Well Installation Detail



DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: B. Steffes
DRILLER: T. Mize BORING NO.: B-MW13 SHEET 1 OF 2

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

CTO: 0084 BORING NO.: B-MW13

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
11 – 12.0	S-6	2.0 100%	1 2 2 1		BG	silty SAND; buff, tint of green; loose; wet		
13 – 14.0	S-7	2.0 100%	1 2 1 1		BG	SAND; buff; very loose; wet	14.0'	
15						TD @ 14.0'		
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Hardin - Huber, Inc BAKER REP.: B. Steffes

DRILLER: T. Mize BORING NO.: B-MW13 SHEET 2 OF 2

Baker
Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-MW14
COORDINATES: EAST: 2644373.03 NORTH: 223766.20
ELEVATION: SURFACE: 10.20 TOP OF STEEL CASING: 9.80

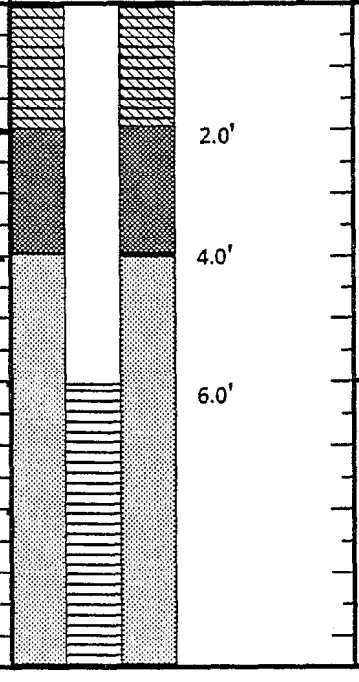
RIG: Mobile B-53 ATV	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"		4 1/4" ID		6/8/92	16.0	Partly Cloudy, 80°F	6.0	
LENGTH	2.0'		5.0'						
TYPE	SS		HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		Flush							

REMARKS: TD reached 6/8/92. Well set 6/8/92. OVA Background 1.0 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Riser	2.0	Schedule 40 PVC	0.4	6.0
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	6.0	16.0

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description	Elevation
1 – 2.0	S-1	0.5 / 25%	5 6 7 8		BG	Fill material; dark brown; medium dense; moist	
3 – 4.0	S-2	1.6 / 80%	7 9 8 6		BG	SAND, medium to coarse grained, w/little silt; yellowish brown; medium dense; moist	
5 – 6.0	S-3	1.3 / 65%	2 3 4 4		BG	SAND, medium to coarse grained, w/trace silt; yellowish brown; loose; moist to wet. Sample is wet at base	▼
7 – 8.0	S-4	1.7 / 85%	5 6 5 7		BG	SAND, medium to coarse grained; yellowish brown; medium dense; wet	
9 – 10.0	S-5	1.3 / 65%	4 5 4 6		BG	SAND, medium to coarse grained, w/trace fine gravel; yellowish brown; loose; wet	
10						Match to Sheet 2	



DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. E. Zimmerman/B. Jakub
DRILLER: M. Fletcher BORING NO.: B-MW14 SHEET 1 OF 2

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

S.O. NO.: 0084 BORING NO.: B-MW14

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description	Well Installation Detail	Elevation
11	S-6	1.3	4 5 4 6		BG	SAND, medium to coarse grained; yellowish brown; mottled; loose; wet.		
12 (12.0)		65%				CLAY with silt and fine grained sand; yellowish brown; loose; wet		
13	S-7	1.1	1 1 2 1		BG			
14 (14.0)		55%						
15	S-8	1.0	1 1 3 1		BG	SAND, fine to coarse grained, w/trace gravel; yellowish brown; loose; wet		
16 (16.0)		50%					16.0'	
17						TD @ 16.0'		
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. E. Zimmerman/B. Jakub

DRILLER: M. Fletcher BORING NO.: B-MW14 SHEET 2 OF 2

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-MW15
COORDINATES: EAST: 2643831.16 NORTH: 223349.12
ELEVATION: SURFACE: 8.44 TOP OF STEEL CASING: 7.62

RIG: Mobile B-53 ATV	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"		4 1/4" ID		6/8/92	16.0	Partly Cloudy, 80°F	3.5	
LENGTH	2.0'		5.0'						
TYPE	SS		HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		Flush							

REMARKS: TD reached 6/8/92. Well set 6/8/92. OVA Background 1.0 ppm.

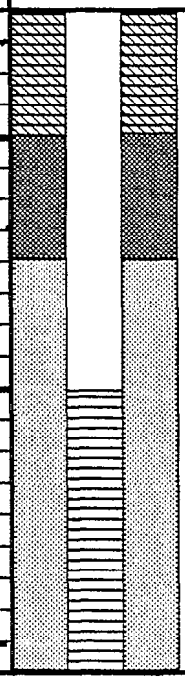
SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Riser	2.0	Schedule 40 PVC	0.82	6.0
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	6.0	16.0

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description
1 – 2.0	S-1	1.8 / 80%	5 7 11 12		BG	**HUMUS** w/sand, fine to medium grained and some shell material; lite to dark brown; medium dense; dry **SAND**, fine to medium grained, some shell material; lite brown; dry
3 – 4.0	S-2	1.8 / 80%	4 3 1 2		BG to 2.0	**SAND**, fine to medium grained with silt; yellowish brown; loose; wet **SAND**, with little silt; grey; loose; moist
5 – 6.0	S-3	0.8 / 40%	5 4 3 3		10	**SAND**, fine to medium grained; yellowish brown to grey; loose; wet to moist
7 – 8.0	S-4	1.7 / 85%	WOH 12" 2 2		100+	**CLAY/SILT**, organics with medium grained sand; dark brown to grey; medium dense; moist
9 – 10.0	S-5	1.8 / 90%	6 6 3 6		2.0	**SAND**, medium to coarse grained; dark brown to orange, grey; loose; wet Oxidated roots at 8.7' to 8.9'

Match to Sheet 2

Well Installation Detail



Elevation

DRILLING CO.: Hardin-Huber, Inc.82 BAKER REP.: J. E. Zimmerman/B. Jakub
DRILLER: M. Fletcher BORING NO.: B-MW15 SHEET 1 OF 2

Baker

Baker Environmental, Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

S.O. NO.: 0084 BORING NO.: B-MW15

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description	Well Installation Detail	Elevation
11 – 12.0	S-6	1.3 / 65%	2 3 3 2		2.8	SAND, medium to coarse grained; grey; loose; wet		
13 – 14.0	S-7	1.8 / 90%	2 1 2 3		2.5	SAND, medium grained; yellowish brown to grey; very loose; wet. yellowish brown oxidation layer from 13.3' to 13.8'		
15 – 16.0	S-8	2.0 / 100%	WOH 12" 2 2		BG	SAND, medium to coarse grained; yellowish brown; very loose; wet	16.0'	
17						TD @ 16.0'		
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. E. Zimmerman/B. Jakub

DRILLER: M. Fletcher BORING NO.: B-MW15 SHEET 2 OF 2

Baker
Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-MW16
COORDINATES: EAST: 2643742.23 NORTH: 223435.58
ELEVATION: SURFACE: 8.52 TOP OF STEEL CASING: 8.21

RIG: Mobile B-53 ATV	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"		4 1/4" ID		6/8/92	16.0	Partly Cloudy, 80°F	1.5	
LENGTH	2.0'		5.0'						
TYPE	SS		HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		Flush							

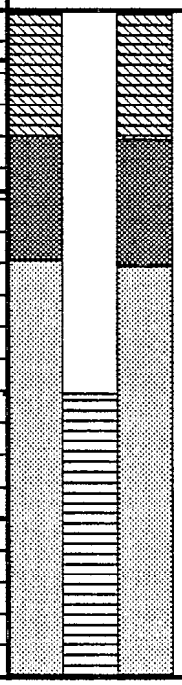
REMARKS: TD reached 6/8/92. Well set 6/8/92. OVA Background 1.0 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Riser	2.0	Schedule 40 PVC	0.31	6.0
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	6.0	16.0

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description
1 – 2.0	S-1	1.2 / 25%	4 6 7 9		BG	**sandy HUMUS**; dark brown; medium dense; dry **SHELL** material; light brown; loose; wet
3 – 4.0	S-2	0.9 / 45%	5 5 2 1		BG	No Recovery
5 – 6.0	S-3	2.0 / 100%	1 1 1 1		BG	**SAND**, medium to fine grained, w/trace silt; grey; very loose; wet
7 – 8.0	S-4	2.0 / 100%	W O H		12	**SAND**, medium to fine grained, w/trace silt and trace peat; very loose; wet
9 – 10.0	S-5	2.0 / 100%	1 1 1 1		17	**CLAY/SILT**, organic material; grey; soft; wet to damp Match to Sheet 2

Well Installation Detail



Elevation

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. E. Zimmerman/B. Jakub
DRILLER: M. Fletcher BORING NO.: B-MW16 SHEET 1 OF 2

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

S.O. NO.: 0084 BORING NO.: B-MW16

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description	Well Installation Detail	Elevation
11 – 12.0	S-6	2.0 100%	2 1 1 2		12			
12 – 14.0	S-7	2.0 100%	2 3 3 3		16	SAND, medium to coarse grained; light grey; loose; wet		
14 – 16.0	S-8	2.0 100%	2 3 3 2		BG		16.0'	
16 – 30						TD @ 16.0'		

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. E. Zimmerman/B. Jakub

DRILLER: M. Fletcher BORING NO.: B-MW16 SHEET 2 OF 2

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-MW17
COORDINATES: EAST: 2643766.67 NORTH: 223304.11
ELEVATION: SURFACE: 8.25 TOP OF STEEL CASING: 8.24

RIG: Mobile B-53 ATV	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"		4 1/4" ID		6/9/92	14.0	Overcast, 60°F	4.0	
LENGTH	2.0'		5.0'						
TYPE	SS		HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		Flush							

REMARKS: TD reached 6/9/92. Well set 6/9/92. OVA Background 1.0 ppm.

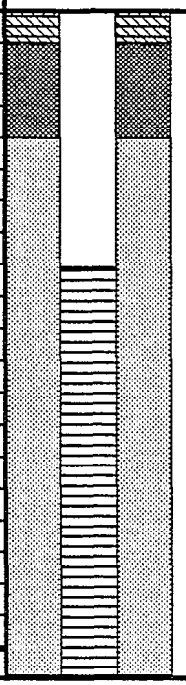
SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Riser	2.0	Schedule 40 PVC	0.01	4.0
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	4.0	14.0

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description
1 – 2 (2.0)	S-1	1.1 / 55%	4 7 7 6		BG	**sandy HUMUS**; light to dark brown; medium dense; damp
3 – 4 (4.0)	S-2	1.6 / 80%	4 9 7 7		BG	**SAND**, medium to coarse grained, w/trace shell material; brown to grey; medium dense; moist to wet
5 – 6 (6.0)	S-3	1.6 / 80%	4 7 7 5		BG	**SAND**, medium to coarse grained; brown to grey; medium dense; wet
7 – 8 (8.0)	S-4	1.6 / 80%	4 6 5 5		BG	**SAND**, medium to coarse grained, w/occasional shell material; brown to grey; medium dense; wet
9 – 10 (10.0)	S-5	1.6 / 80%	1 1 2 3		BG	**SAND**, medium to coarse grained; grey; very loose; wet

Well Installation Detail



Elevation

Match to Sheet 2

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. E. Zimmerman/B. Jakub
DRILLER: M. Fletcher BORING NO.: B-MW17 SHEET 1 OF 2

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

S.O. NO.: 0084 BORING NO.: B-MW17

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description	Well Installation Detail	Elevation
11 – 12.0	S-6	1.8 / 90%	1 1 4 3		BG	**SAND**, medium to coarse grained; grey to orange to light brown; loose; wet, mottled, oxidation near base		
12 – 14.0	S-7	1.6 / 80%	4 4 3 3		BG	**SILTY SAND** w/clay; grey to orange; loose; wet, mottled at base where oxidation occurred	14.0'	
14						TD @ 14.0'		
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: J. E. Zimmerman/B. Jakub

DRILLER: M. Fletcher BORING NO.: B-MW17 SHEET 2 OF 2

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-MW18A
COORDINATES: EAST: 2643407.98 NORTH: 224244.54
ELEVATION: SURFACE: 9.11 TOP OF STEEL CASING: 11.66

RIG: B-80 Truck Mount	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"		4 1/4" ID		12/8/92	15.0	Partly Cloudy, 40°F	4.3	
LENGTH	2.0'		5.0'						
TYPE	SS		HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		2.55'							

REMARKS: TD reached 12-8-92. Well set 12-8-92. HNu Background 0.5 ppm.

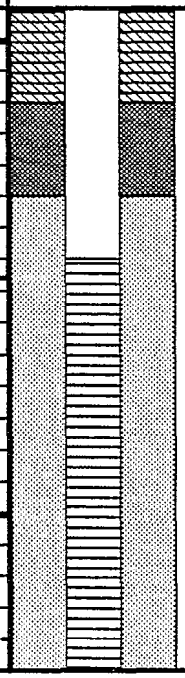
SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Riser	2.0	Schedule 40 PVC	2.55	3.9
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	3.9	13.9

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
						Root Zone approximately 5"
1 – 2.0	S-1	1.3 / 65%	4 3 4 4		BG	silty SAND, fine to medium grained w/little to some silt, trace gravel; dark brown to brownish orange; loose; damp
3 – 4.0	S-2	1.2 / 60%	2 2 2 2		BG	silty SAND, fine to medium grained w/some silt; brownish orange; medium dense; moist
5 – 6.0	S-3	1.0 / 50%	3 2 3 4		BG	SAND, medium to coarse grained w/some fine grains, trace silt; buff grey; loose; wet
7 – 8.0	S-4	0.8 / 40%	2 2 2 4		BG	
9 – 10.0	S-5	2.0 / 100%	1 3 5 7		BG	SAND, medium to coarse grained w/trace silt/gravel; buff grey; loose; wet
						Match to Sheet 2

Well Installation Detail



Elevation

DRILLING CO.: Hardin-Huber BAKER REP.: Thomas Artman
DRILLER: Mike Corran BORING NO.: B-MW18A SHEET 1 OF 2

Baker

Baker Environmental, Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill

CTO NO.: 0084 BORING NO.: B-MW18A

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
11 – 12.0	S-6	2.0 100%	3 3 4 6		BG	SAND, medium to coarse grained w/little silt; buff grey; loose; wet		
13 – 14.0	S-7	2.0 100%	3 4 5 6		BG	SAND, medium to coarse grained w/some fine; trace to little silt; buff grey to browninsh grey; loose; wet	13.9'	
15.0		A/N	--		--			
16						TD @ 15.0' Sampled to 14.0'		
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Hardin-Huber BAKER REP.: Thomas Artman

DRILLER: Mike Corran BORING NO.: B-MW18A SHEET 2 OF 2

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-MW19A
COORDINATES: EAST: 2643582.13 NORTH: 224511.13
ELEVATION: SURFACE: 10.31 TOP OF STEEL CASING: 12.84

RIG: B-80 Truck Mount	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"		4 1/4" ID		12/9/92	15.0	Partly Cloudy, 40°F	4.0	
LENGTH	2.0'		5.0'						
TYPE	SS		HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		2.53'							

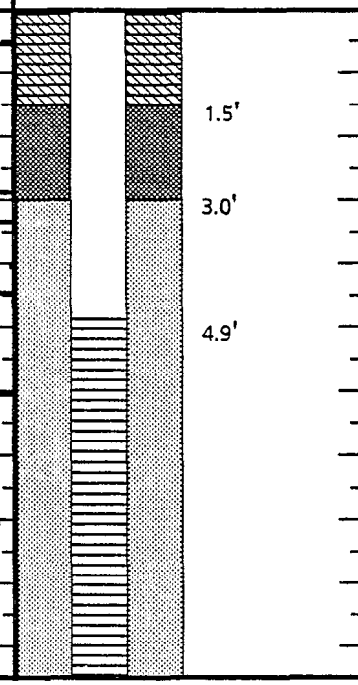
REMARKS: TD reached 12-9-92. Well set 12-9-92. OVA Background is 1.0 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Riser	2.0	Schedule 40 PVC	+2.53	4.9
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	4.9	14.9

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description
1	S-1	1.6	3 4 4 4		BG	Root Zone 5"; silty SAND fine grained w/little silt; dark grey to brown
2.0		80%				SAND, fine grained w/trace silt; lite grey to brown; loose; damp
3	S-2	2.0	WH 24"		BG	silty SAND, fine grained w/some silt; grey to brown; loose; damp; CLAY; blackish grey; soft; organic stain
4.0		100%				clayey SAND, fine grained w/some clay and little silt; grey; soft; wet; SAND fine grained w/trace gravel; brownish grey
5	S-3	2.0	WH 12" 2 3		3.8	sandy CLAY, fine grained; dark grey; medium stiff; wet
6.0		100%				
7	S-4	2.0	1 3 3 3		1.6	SAND, medium to coarse grained w/some fine and little silt; grey; loose; wet "Staining" coloration.
8.0		100%				
9	S-5	1.3	1 3 3 3		1.4	silty SAND, medium to coarse grained w/some fines and little silt; dark buff grey; loose; wet
10.0		65%				Match to Sheet 2

Well Installation Detail



Elevation

DRILLING CO.: Hardin-Huber BAKER REP.: Thomas Artman
DRILLER: Mike Corran BORING NO.: B-MW19A SHEET 1 OF 2

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill

CTO NO.: 0084 BORING NO.: B-MW19A

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description	Well Installation Detail	Elevation
11	S-6	2.0	WH 12" 2 6		1.1	silty SAND, medium to coarse grained w/some fine and little silt; dark buff grey; loose; wet		
12 12.0		100%						
13	S-7	2.0	6 6 8 6		3.0	SAND, medium to coarse grained w/trace silt; buff grey; loose; wet		
14 14.0		100%						
15 15.0		A/N	--		--		14.9'	
16						TD @ 15.0' Sampled to 14.0'		
17						* Hardin Huber hammers hole clean		
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Hardin-Huber BAKER REP.: Thomas Artman

DRILLER: Mike Corran BORING NO.: B-MW19A SHEET 2 OF 2

Baker

Baker Environmental, Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen RI/FS
CTO NO.: 0084 — BORING NO.: B-MW8B
COORDINATES: EAST: 2643799.61 — NORTH: 225071.61
ELEVATION: SURFACE: 11.82 — TOP OF STEEL CASING: 13.53

RIG: Mobil Rig B-61	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	6.0"	4 1/4" ID		5/13/92	24.0	Cloudy, 56°F	8.5	--
LENGTH	2.0'	24.0'	5.0'		5/16/92	69.0	Cloudy, 70°F		
TYPE	SS	Schedule 40PVC	HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		1.71'							

REMARKS: Surface casing set 5-13-92. TD reached 5-16-92. Well set 5-16-92. HNu Background 0.5 ppm.

SAMPLE TYPE
S = Split Spoon, A = Auger
T = Shelby Tube, W = Wash
R = Air Rotary, C = Core
D = Denison, P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Surface Casing	6.0	Schedule 40 PVC	Grade	24.0
Well Riser	2.0	Schedule 40 PVC	Grade	55.0
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	55.0	65.0

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
1 – 2 (2.0)	S-1	1.0 / 50%	3 6 6 3		BG	**SAND**, fine to medium grained; w/humus dark brown; medium dense; damp		
3 – 4 (4.0)	S-2	1.5 / 75%	4 5 5 3		BG	**SAND** medium grained w/clay; buff to golden brown; stiff; damp		
5 – 6 (6.0)	S-3	1.0 / 50%	2 2 3 3		BG	**SAND** medium grained, w/peat material; yellow to brown; loose; damp		
7 – 8 (8.0)	S-4	1.3 / 66%	1 2 1 3		BG	**SAND**, medium grained; buff to grey; loose; moist		
9 – 10 (10.0)	S-5	1.5 / 75%	3 2 3 3		BG	**SAND**, coarse grained; grey; loose; wet		▼

DRILLING CO.: Harden-Huber — BAKER REP.: J. E. Zimmerman
DRILLER: T. Mize — BORING NO.: B-MW8B — SHEET 1 OF 4

TEST BORING AND WELL CONSTRUCTION RECORD

Baker

Baker Environmental, Inc.

PROJECT: Camp Allen RI/FS

CTO NO.: 0084 BORING NO.: B-MW8B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
11 – 12 (12.0)	S-6	1.5 / 75%	4 2 3 3		BG	SAND, coarse grained, w/silt; grey; loose; wet		
13 – 14 (14.0)	S-7	2.0 / 100%	4 4 5 8		BG	SAND, coarse grained; w/silt greyish green; loose; wet		
15 – 16 (16.0)	S-8	2.0 / 100%	4 4 8 9		BG	SAND, coarse grained; greyish-green; medium dense; wet, small lense of buff colored fine grained sand at 15.5'		
17 – 18 (18.0)	S-9	2.0 / 100%	5 3 4 4		BG	SAND, fine grained, w/some silt; loose; grey to green; wet		
19 – 20 (20.0)	S-10	2.0 / 100%	5 3 2 1		BG	SAND, medium grained; grey/green to buff; loose; wet		
21 – 22 (22.0)	S-11	2.0 / 100%	3 2 1 1		BG	SAND, fine to medium grained, w/a small layer of clay at 22'; grey; wet		
23 – 24 (24.0)	S-12	2.0 / 100%	2 22 12 12		BG	CLAY; grey; dense; wet	24.0'	
25 – 26 (26.0)	S-13	1.0 / 50%	5 3 2 9		2.0	CLAY, trace silt; grey; medium stiff; wet SAND, fine to medium grained w/silt and clay; grey; medium dense; wet		
27 – 28 (28.0)	S-14	1.5 / 75%	3 10 12 6		BG	SAND, fine to medium grained w/silt and clay; grey; very stiff; moist		
29 – 30 (30.0)	S-15	1.5 / 75%	4 11 4 8		BG	CLAY, w/some silt and some sand very fine to medium grained; grey; very stiff; moist to wet		

DRILLING CO.: Harden - Huber BAKER REP.: Donald C. Shields

DRILLER: Steve Uhlrich BORING NO.: B-MW8B SHEET 2 OF 4

TEST BORING AND WELL CONSTRUCTION RECORD

Baker

Baker Environmental, Inc.

PROJECT: Camp Allen RI/FS

CTO NO.: 0084 BORING NO.: B-MW8B

SAMPLE TYPE

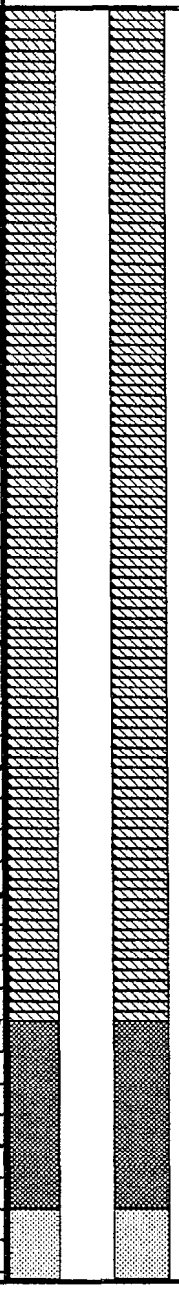
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)		Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
31	32.0	S-16	1.5 / 75%	7 13 9 12		BG	**SAND** fine grained, w/some silt and some clay, trace gravel at base; grey; very stiff; wet
33	34.0	S-17	1.5 / 75%	6 3 2 8		BG	**CLAY**, trace silt, wood at base; grey; stiff; moist
35	36.0	S-18	1.5 / 75%	9 9 7 10		BG	**WOOD**; dark reddish brown; stiff; moist **CLAY**; dark reddish brown; stiff; moist
37	38.0	S-19	1.5 / 75%	7 12 15 21		BG	**WOOD/PEAT**; dark reddish brown to orangish brown; medium dense; stiff; wet
39	40.0	S-20	1.0 / 50%	6 11 15 40		BG	**WOOD/PEAT**; dark reddish brown; medium dense; stiff; wet
41	42.0	S-21	1.0 / 50%	5 6 5 9		BG	**WOOD/PEAT**, some sand fine to medium grained at base; dark reddish brown; medium dense; wet
43	44.0	S-22	2.0 / 100%	4 5 4 3		BG	**SAND** very fine to coarse grained w/silt and clay; grey; stiff; wet
45	46.0	S-23	1.75 / 88%	3 2 3 2		BG	**SAND** very fine to coarse grained, w/some silt, some clay, trace organic material; grey; medium stiff; wet
47	48.0	S-24	2.0 / 100%	5 4 8 13		BG	**SAND** very fine to coarse grained, shell fragments abundant, some silt, little clay; light grey; medium dense; wet
49							Match to Sheet 4
50							

Well Installation Detail



Elevation

DRILLING CO.: Hardin - Huber BAKER REP.: Donald C. Shields

DRILLER: Steve Uhlrich BORING NO.: B-MW8B SHEET 3 OF 4

TEST BORING AND WELL CONSTRUCTION RECORD

Baker

Baker Environmental, Inc.

PROJECT: Camp Allen RI/FS

CTO NO.: 0084 BORING NO.: B-MW8B

SAMPLE TYPE

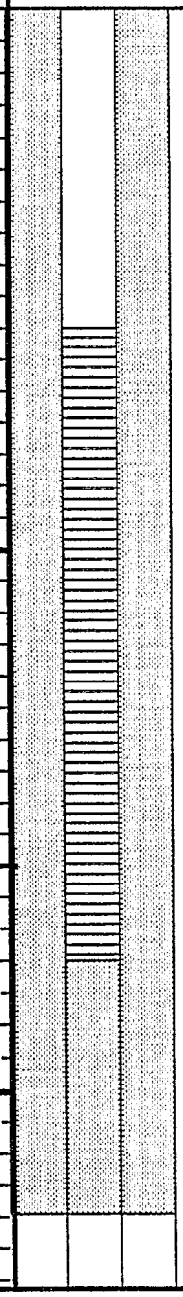
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
51, 52 (52.0)	S-25	1.5 / 75%	7 11 13 15		BG	SAND fine to coarse grained, w/shell material and some silt and some clay; light grey; medium dense; wet
53, 54, 55						
56, 57 (57.0)	S-26	1.0 / 50%	6 6 15 12		BG	SAND fine to coarse grained, w/shell material and little silt, and ittle clay; light grey; medium dense; wet
58, 59, 60						
61, 62 (62.0)	S-27	1.5 / 75%	14 21 24 25		BG	SAND fine to coarse grained, w/shell material and some gravel and little silt, w/little clay; light grey; dense; wet
63, 64, 65						
66, 67 (67.0)	S-28	1.0 / 50%	12 24 24 35		BG	SAND fine to coarse grained, w/shell material and some silt and some clay; light grey; dense; wet
68, 69, 70						TD @ 69.0'. Well Set at 65'

Well Installation Detail



Elevation

DRILLING CO.: Hardin - Huber BAKER REP.: Donald C. Shields

DRILLER: Steve Uhlrich BORING NO.: B-MW8B SHEET 4 OF 4

TEST BORING AND WELL CONSTRUCTION RECORD

Baker
Baker Environmental, Inc.

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-MW9B
COORDINATES: EAST: 2644137.05 NORTH: 224894.82
ELEVATION: SURFACE: 12.31 TOP OF STEEL CASING: 12.17

RIG: Mobil Rig R-61

	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	6.0"	4 1/4" ID		5/12/92	30.0	Cloudy, 65°F	6.0	--
LENGTH	2.0'	30.0'	5.0'		5/16/92	67.0	Cloudy, 70°F		
TYPE	SS	Schedule 40PVC	HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		Flush							

REMARKS: Surface casing set 5-12-92. TD reached 5-16-92. Well set 5-16-92. HNu Background 4.2 ppm.

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Surface Casing	6.0	Schedule 40 PVC	Grade	30.0
Well Riser	2.0	Schedule 40 PVC	0.14	55.4
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	55.4	65.4

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
1 – 2.0	S-2	0.5 / 25%	1 2 2 1		5.3	TOPSOIL, humus; black, tan; hard loose;dry SAND; buff; loose; damp		
3 – 4.0	S-2	2.0 / 100%	3 2 2 4		4.5	SAND mix of fine and coarse grains; buff; loose; moist SAND, tan-buff; loose; moist		
5 – 6.0	S-3	2.0 / 100%	2 2 3 3		4.3	SAND color; buff; medium density; moist SILTY SAND consistent in size and distribution; light buff; loose; moist		▼
7 – 8.0	S-4	2.0 / 100%	2 2 1 2		BG	SAND and silt; buff; soft; wet SAND and SILT ; light green; soft; wet		
9 – 10.0	S-5	2.0 / 100%	3 3 3 2		BG	SAND and silt; buff; soft; wet SAND and SILT, sorting is uniform; buff to rust; soft; wet		

DRILLING CO.: Harden-Huber BAKER REP.: R. Dabal/ J. Kimberly Harriz
DRILLER: Steve Ulrich/ Mike Corran BORING NO.: B-MW9B SHEET 1 OF 4

TEST BORING AND WELL CONSTRUCTION RECORD

Baker

Baker Environmental, Inc.

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: B-MW9B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
11 – 12 (12.0)	S-6	2.0 / 100%	3 3 2 3		BG	SAND, some silt; buff-rust; medium; medium stiff; moist Same material as in previous block; rust-buff
13 – 14 (14.0)	S-7	2.0 / 100%	1 1 2 2		BG	Same color, moisture content as before; buff; medium; same as previous 2' Same as above; buff
15 – 16 (16.0)	S-8	2.0 / 100%	2 2 3 2		BG	SAND and SILT; buff; medium; moisture, stiffness remaining consistent
17 – 18 (18.0)	S-9	2.0 / 100%	2 4 4 5		BG	
19 – 20 (20.0)	S-10	2.0 / 100%	3 5 6 12		BG	same as above, rust
21 – 22 (22.0)	S-11	2.0 / 100%	7 7 11 7		BG	SAND, fine grained; buff; medium dense; moist
23 – 24 (24.0)	S-12	2.0 / 100%	11 7 5 7		BG	GRAVEL; buff; gravel at transition line is white-grey; grading to rust to damp
25 – 26 (26.0)	S-13	1.5 / 75%	7 4 4 9		BG	GRAVEL in a sand and silt matrix; white-grey; moist to damp
27 – 28 (28.0)	S-14	2.0 / 100%	3 2 2 3		BG	SILTY CLAY; dark grey; medium stiff, small sand lense at 26' and 28'
29 – 30 (30.0)	S-15	2.0 / 100%	4 4 3 5		BG	30.0'

Well Installation Detail

Elevation

DRILLING CO.: Harden - Huber BAKER REP.: R. Dabal/ J. Kimberly Harriz

DRILLER: Steve Orritz/ Mike Corran BORING NO.: B-MW9B SHEET 2 OF 4

TEST BORING AND WELL CONSTRUCTION RECORD

Baker

Baker Environmental, Inc.

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: B-MW9B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
31								
32	A/N							
33								
34								
35								
36	S-16	1.5	3 8 16 31		BG	CLAY w/little silt and wood; grey; soft; wet		
37	37.0	50%						
38	W-N							
39								
40								
41	S-17	1.5	31 38 35 36		BG	WOOD(possible buried tree); yellow brown; very dense; wet		
42	42.0	75%						
43	W-N							
44								
45								
46	S-18	1.0	5 12 17 25		BG	WOOD; yellowish brown; medium dense; wet DECAYED WOOD and SILT; dark brown; medium dense; wet		
47	47.0	50%						
48	W-N							
49								
50						Match to Sheet 4		

DRILLING CO.: Hardin - Huber BAKER REP.: J. Kimberly Harriz

DRILLER: Mike Corran BORING NO.: B-MW9B SHEET 3 OF 4

TEST BORING AND WELL CONSTRUCTION RECORD

Baker

Baker Environmental, Inc.

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: B-MW9B

SAMPLE TYPE

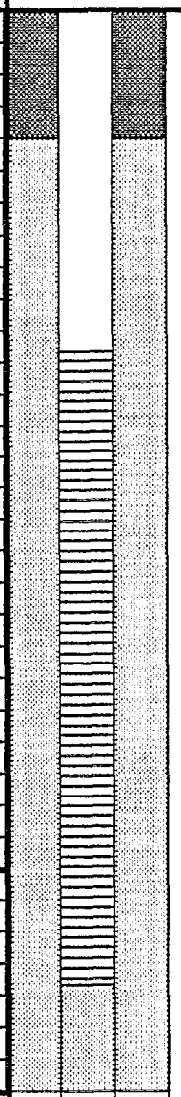
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
51	S-19	NR	6 5 5 8		--	No Recovery
52 (52.0)						
53	W-N					
54						
55						
56						
57						
58	S-20	2.0	8 7 14 17			SAND, fine to medium grained w/little shell material and trace silt/clay; occassional gravel; grey to green; medium dense; wet
59 (59.0)		100%				
60	W-N					
61	S-21	1.4	14 11 20 21			SAND, fine to medium grained w/little shell material and trace silt/clay; occassional gravel; grey to green; medium dense; wet
62 (62.0)		70%				
63	W-N					
64						
65						
66	S-22	1.5	8 21 20 40		BG	SAND fine to medium grained w/little silt; grey to green; dense; wet
67 (67.0)		75%				
68						TD @ 67.0'
69						
70						

Well Installation Detail



52.0'
55.4'
65.4'
67.0'

Elevation

DRILLING CO.: Hardin - Huber BAKER REP.: J. Kimberly Harriz

DRILLER: Mike Corran BORING NO.: B-MW9B SHEET 4 OF 4

Baker

Baker Environmental, Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-MW11B
COORDINATES: EAST: 2644105.53 NORTH: 224206.67
ELEVATION: SURFACE: 9.71 TOP OF STEEL CASING: 9.51

RIG: Mobil Rig B-61

	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	6.0"	4 1/4"ID		5/14/92	28.0	Calm, 70°F	5.0	WD
LENGTH	2.0'	28.0'	5.0'		5/15/92	68.0	Sunny, 80°F		
TYPE	SS	Schedule 40PVC	HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		Flush							

REMARKS: Surface casing set 5-14-92. TD reached 5-15-92. Well set 5-15-92. HNu Background -

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION (INCHES)	DIAM	TYPE (FT)	TOP DEPTH (FT)	BOTTOM DEPTH
Well Surface Casing	6.0	Schedule 40 PVC	Grade	28.0
Well Casing	2.0	Schedule 40 PVC	0.2	55.0
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	55.0	65.0

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
1 – 2.0	S-1	1.5 / 75%	2 3 6 6		BG	**TOPSOIL**, sand; brown to buff; loose; moist, well formed		
3 – 4.0	S-2	1.0 / 50%	3 8 7 5		BG	**SAND**, well sorted, 1mm size; buff; medium dense; moist		
5 – 6.0	S-3	1.5 / 75%	2 3 3 3		BG	**SAND** w/silt; grey; loose; wet		▼
7 – 8.0	S-4	2.0 / 100%	2 1 2 1		BG	**silty SAND**; grey to green; very loose; wet		
9 – 10.0	S-5	2.0 / 100%	1 2 3 2		BG			

DRILLING CO.: Harden-Huber BAKER REP.: R. Dabal/ Donald C. Shields
DRILLER: T. Mize/ Steve Uhlrich BORING NO.: B-MW11B SHEET 1 OF 4

TEST BORING AND WELL CONSTRUCTION RECORD

Baker

Baker Environmental, Inc.

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-MW11B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
11 – 12.0	S-6	2.0 100%	2 2 3 2		BG			
13 – 14.0	S-7	1.5 75%	2 3 4 5		BG			
15 – 16.0	S-8	2.0 100%	2 3 3 3		BG			
17 – 18.0	S-9	2.0 100%	2 2 3 5		BG	silty SAND; buff; loose; wet		
19 – 20.0	S-10	2.0 100%	2 4 5 6		BG	silty SAND; green to buff; loose; wet		
21 – 22.0	S-11	2.0 100%	4 5 5 5		BG	silty SAND; green; loose; wet		
23 – 24.0	S-12	2.0 100%	2 3 4 2		BG	sandy CLAY; buff to grey; loose; wet		
25 – 26.0						CLAY; grey; stiff; wet		
27 – 28.0								
29 – 30.0		2.0 100%	8 2 4 4		BG	CLAY, w/little silt and trace sand very fine grained and trace gravel; micaceous; grey; stiff; damp	28.0'	

DRILLING CO.: Harden - Huber BAKER REP.: R. Dabal/ Donald C. Shields
DRILLER: T. Mize/ Steve Uhlrich BORING NO.: B-MW11B SHEET 2 OF 4

TEST BORING AND WELL CONSTRUCTION RECORD

Baker
Baker Environmental, Inc.

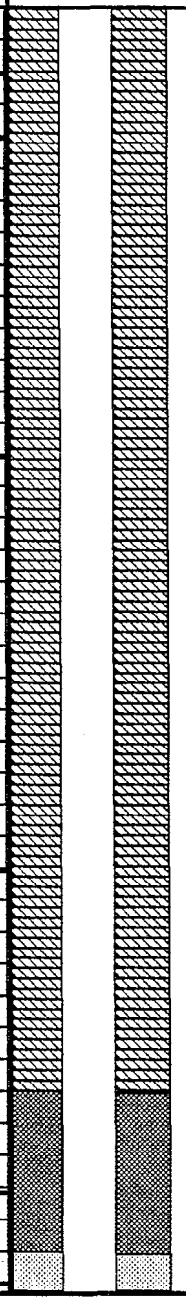
PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-MW11B

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
31		2.0	2 2 2 11		BG	SAND fine to coarse grained, w/trace silt and trace clay; light brown; wet
32	32.0	100%				
33		1.0	9 10 15 21		BG	SAND very fine to coarse grained, w/trace silt and some gravel; light brown; dense; wet
34	34.0	50%				
35						
36		NR	9 15 13 13			No Recovery
37	37.0					
38						
39						
40						
41		1.75	2 3 4 4		BG	SILT and CLAY and SAND fine grained; micaceous; light brown to tan with light orangish brown streaks; stiff; moist,
42	42.0	88%				
43						
44						
45						
46		2.0	3 2 4 4		BG	SAND fine grained, w/some silt and some clay; micaceous; light brown; loose; wet,
47	47.0	100%				
48						
49						
50						Match to Sheet 4

Well Installation Detail



Elevation

DRILLING CO.: Hardin - Huber BAKER REP.: Donald C. Shields
DRILLER: Steve Uhlrich (28'-69') BORING NO.: B-MW11B SHEET 3 OF 4

TEST BORING AND WELL CONSTRUCTION RECORD

Baker

Baker Environmental, Inc.

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: B-MW11B

SAMPLE TYPE

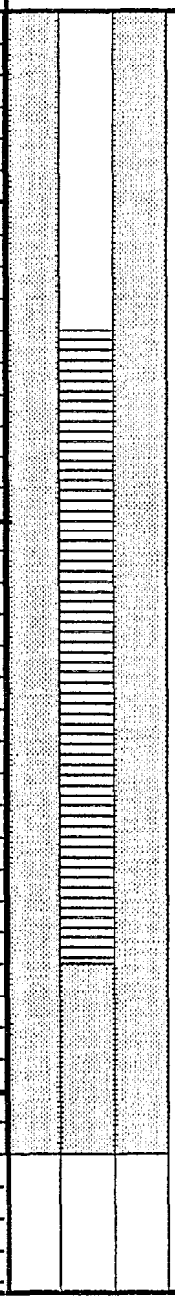
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
51, 52 — 52.0		2.0 / 100%	2 2 5 9		BG	SAND fine to medium grained w/silt and clay, clay streaks near base; streaked light brown to light grey to reddish brown; medium dense; wet
53, 54, 55						
56, 57 — 57.0		2.0 / 100%	12 13 16 18		ND	CLAY and SILT 2" layer near top w/sand fine to coarse grained; shell material and silt, some clay; light brown, grey; dense; wet
58, 59, 60						
61, 62 — 62.0		1.25 / 63%	15 17 19 20		ND	SAND fine to coarse grained, w/shell material and some silt and little clay; light grey; dense; wet
63, 64, 65						
66, 67 — 67.0		2.0 / 100%	7 8 10 25		ND	SAND fine to coarse grained, w/shell material, some clay (in layers near base) and some silt; light grey; dense; wet
68, 69, 70						TD @ 68.0' Collapse to 65.0'

Well Installation Detail



52.0' 55.0' 65.0' 68.0'

Elevation

DRILLING CO.: Hardin - Huber BAKER REP.: Donald C. Shields

DRILLER: Steve Uhlrich BORING NO.: B-MW11B SHEET 4 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-MW18B
COORDINATES: EAST: 2643396.58 NORTH: 224230.28
ELEVATION: SURFACE: 8.69 TOP OF STEEL CASING: Abandoned

RIG: Mobile Truck Mount B-80	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	6.0"	4 1/4" ID		12/8/92	23.0	Partly Cloudy, 40°F	4.0	
LENGTH	2.0'	23.0'	5.0'		12/9/92	62.0	Partly Cloudy, 40°F		
TYPE	SS	Schedule 40PVC	HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		N/A							

REMARKS: Borehole abandoned via pressure grouting. HNu Background 0.5 ppm.

SAMPLE TYPE

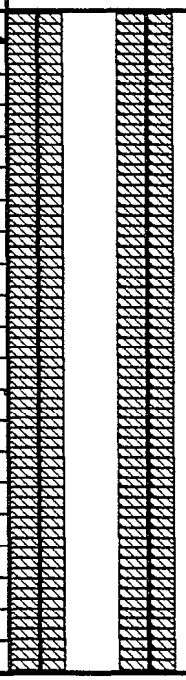
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Surface Casing	6.0	Schedule 40 PVC	Grade	23.0
Well Riser				
Well Screen				

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
1 – 2.0	S-1	1.4 / 70%	4 5 6 8		BG	silty SAND, medium grained; brownish grey; damp to moist sandy SILT, fine to medium grained w/little clay; brown; medium dense; damp
3 – 4.0	S-2	1.2 / 60%	2 2 2 3		BG	sandy SILT, fine to medium grained w/trace clay; brown; loose to medium dense; damp to moist
5 – 6.0	S-3	0.3 / 15%	2 2 2 5		.7	SAND, medium to coarse grained; buff grey to grey; w/little silt; loose; wet
7 – 8.0	S-4	1.9 / 95%	3 2 3 4		.8	SAND, medium to coarse grained w/little silt and trace "pea gravel"; buff grey; loose; wet
9 – 10.0	S-5	1.7 / 85%	5 4 4 5		.8	

Well Installation Detail

Elevation



Match to Sheet 2

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Tom Artman/J.E. Zimmerman
DRILLER: Mike Corran BORING NO.: B-MW18B SHEET 1 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill
CTO NO.: 0084 BORING NO.: B-MW18B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
11 – 12.0	S-6	2.0 / 100%	4 4 4 5		BG	SAND, medium to coarse grained w/trace fines and silt; brown; loose; wet
13 – 14.0	S-7	2.0 / 100%	5 9 4 5		BG	SAND, medium to coarse grained w/trace silt; buff grey to brownish orange to grey; loose; wet
15 – 16.0	S-8	2.0 / 100%	5 6 6 8		BG	SAND, medium to coarse grained w/trace silt and some organics; fine sand at bottom; wet, loose
17 – 18.0	S-9	2.0 / 100%	7 6 7 8		BG	SAND, medium grained w/trace to little coarse sand and little silt; brownish grey; loose; wet
19 – 20.0	S-10	2.0 / 100%	8 8 6 3		BG	SAND, medium grained w/some fines and w/trace silt; brownish grey; loose; wet
21 – 22.0	S-11	2.0 / 100%	2 1 1 2		BG	SAND, medium grained w/silt/clay; brownish grey; loose; wet
22 – 23						CLAY, w/little silt; grey w/orange staining; soft to medium stiff; wet
24 – 25.0	NS	NR			--	No Recovery
26 – 27.0	S-12	1.7 / 85%	2 2 1 6		BG	SAND, medium to coarse grained w/fine grained sand lenses; light grey to light brown w/yellow staining; loose; wet
28 – 29.0	S-13	1.0 / 50%	14 12 13 11		BG	SAND, medium grained w/trace to little clay; buff grey w/orange streaks; medium dense; wet
30						Match to Sheet 3

Well Installation Detail: 23.0'

Elevation

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Tom Artman/J. E. Zimmerman
DRILLER: Mike Corran BORING NO.: B-MW18B SHEET 2 OF 4

Baker

Baker Environmental, Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: B-MW18B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
31								
32								
33								
34	S-14	0.5	7 15 15 14		BG	SAND, medium grained; dark grey; dense; wet		
35 (35.0)		25%						
36								
37								
38								
39	S-15	0.7	7 8 6 7		3.5	SAND, medium to coarse grained w/gravel; dark grey; medium dense; wet		
40 (42.0)		35%						
41								
42								
43								
44	S-16	0.7	10 20 21 22		BG	SHELL material w/trace fine grained sand and silt lense near bottom; green and white (shell); dense; wet. Larger shell fragments oriented horizontally		
45 (47.0)		35%						
46								
47								
48								
49						SHELL material w/trace fine grained sand; green and white (shell); dense; wet. Larger shell fragments oriented horizontally		
50						Match to Sheet 4		

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Tom Artman/J. E. Zimmerman

DRILLER: Mike Corran BORING NO.: B-MW18B SHEET 3 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-MW18B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D-1586) (Blows/0.5')
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description	Well Installation Detail	Elevation
51	S-17	0.9	12 38 38 32		BG	**SHELL** material w/silt lense near top; green and white (shell); dense; wet		
52 (52.0)		45%						
53								
54								
55								
56	S-17	1.0	16 40 38 32		BG	**SHELL** material w/silt lenses throughout; green and white (shell); dense; wet		
57 (57.0)		50%						
58								
59								
60								
61	S-21	1.1	28 38 38 42		BG	**SHELL** material; green and white (shell); dense; wet		
62 (62.0)		55%						
63						TD @ 62.0'		
64						Repeated borehole cave-ins below 24.0' due to voided area adjacent to well site.		
65						Borehole is abandoned and pressure grouted to ground surface. Surface casing was left in place as part of borehole abandonment procedure.		
66								
67								
68								
69								
70								

DRILLING CO.: Hardin-Huber, Inc. BAKER REP.: Tom Artman/J.E. Zimmerman
DRILLER: Mike Corran BORING NO.: B-MW18B SHEET 4 OF 4

Baker

Baker Environmental, Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-MW19B
COORDINATES: EAST: 2643577.80 NORTH: 224506.04
ELEVATION: SURFACE: 10.41 TOP OF STEEL CASING: 12.88

RIG: B-80 Truck Mount	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	2.0"	6.0"	4 1/4" ID		12/8/92	24.6	Partly Cloudy, 40°F	4.0	1423
LENGTH	2.0'	24.6'	5.0'		12/11/92	67.0	Partly Cloudy, 40°F		0833
TYPE	SS	Schedule 40PVC	HSA						
HAMMER WT.	140#								
FALL	30"								
STICK UP		2.47'							

REMARKS: Surface casing set 12-8-92. TD reached 12-11-92. Well set 12-11-92. HNu Background 1.0 ppm. OVA Background is 1.0

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION	DIAM (INCHES)	TYPE	TOP DEPTH (FT)	BOTTOM DEPTH (FT)
Well Surface Casing	2.0	Schedule 40 PVC	Grade	24.6
Well Riser	2.0	Schedule 40 PVC	+2.47	35.1/55.1
Well Screen	2.0	Schedule 40 PVC 0.01 inch slots	35.1/55.1	65.1

Depth (Ft.)	Sample Type and No.	Samp. Rec. Ft. & %	SPT or RQD	Lab. Class. or Pen. Rate	FID PID ppm HNu OVA	Visual Description	Well Installation Detail	Elevation
						Root zone approximately 5"; dark brown		
1	S-1		5 7 10 12		BG	**silty SAND**, fine to medium grained; grey to brown; loose; moist		
2.0								
3	S-2		3 7 10 7		BG	**silty SAND**, fine to medium grained w/trace clay fingers; dark grey to brown; micaceous; loose; wet		
4.0								▼
5	S-3		4 4 4 4		BG	**silty CLAY** w/some sand fine grained; dark grey to grey w/black staining; medium dense; wet		
6.0								
7	S-4		3 2 2 1		BG	sandy SILT, w/little sand fine grained and some clay; buff grey to dark grey; oily staining; medium dense; wet. **silty SAND** fine to medium grained w/little silt and trace clay; dark grey; medium dense; some oily staining carried down from above; wet		
8.0								
9	S-5		WOH 1 3 4		BG	**SAND** medium grained w/some fine to coarse and little silt; buff grey; loose; wet		
10.0								
						Match to Sheet 2		

DRILLING CO.: Hardin-Huber BAKER REP.: John E. Zimmerman
DRILLER: Mike Corran BORING NO.: B-MW19B SHEET 1 OF 4

Baker

Baker Environmental, Inc

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: B-MW19B

SAMPLE TYPE

S = Split Spoon A = Auger
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DEFINITIONS

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Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description
11 – 12.0	S-6	2.0 100%	5 8 11 15		10.0	SAND, medium to coarse grained w/trace silt; buff grey; medium dense; wet
13 – 14.0	S-7	2.0 100%	4 9 11 13		22.0	SAND, medium to coarse grained, grains subangular to rounded w/trace silt; buff grey; medium dense; wet
15 – 16.0	S-8	2.0 100%	5 6 6 3		BG	SAND, fine grained; brown; medium dense; wet
17 – 18.0	S-9	2.0 100%	5 6 6 11		4.0	SAND, medium to coarse grained w/trace silt; buff grey; loose; wet
19 – 20.0	S-10	2.0 100%	9 10 8 11		2.0	SAND, medium to coarse grained w/some fine grained grains subangular to rounded; buff grey; loose; wet
21 – 22.0	S-11	2.0 100%	5 7 9 9		3.0	SAND, medium to coarse grained w/some fine grains; buff grey; loose; wet
23 – 24.0	S-12	2.0 100%	5 4 3 1		3.0	SAND, fine to medium grained w/trace silt; black staining; loose; wet
25 – 26.0	S-13	2.0 100%	WH 24"		BG	silty CLAY, w/little silt and trace sand; grey to brown; medium dense; wet CLAY; w/trace silt; grey to orange w/orange streaks and staining; very soft; wet
27 – 28.0	S-14	2.0 100%	WH 24"		BG	
29 – 30.0	S-15	2.0 100%	WH 18" 2		BG	SAND, fine to medium grained; grey to orange; loose; wet

Well Installation Detail: 24.6'

Elevation

Match to Shee

DRILLING CO.: Hardin-Huber. BAKER REP.: John E. Zimmerman

DRILLER: Mike Corran BORING NO.: B-MW19B SHEET 2 OF 4

Baker

Baker Environmental, Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Allen Landfill RI/FS

CTO NO.: 0084 BORING NO.: B-MW19B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
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DEFINITIONS

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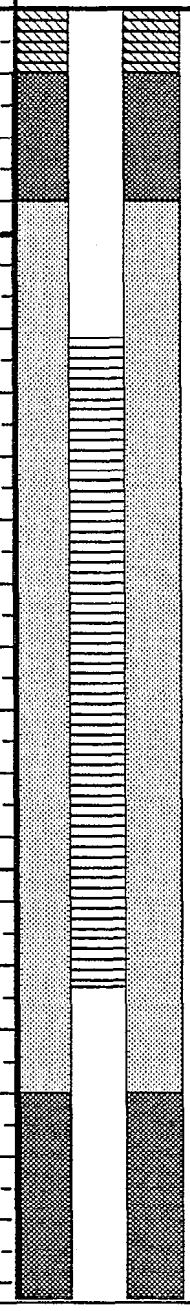
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	FID ppm OVA	Visual Description
31 – 32.0	S-16	2.0 100%	4 8 7 11		BG	**SAND**, fine to medium grained; brown to green; medium dense; wet
36 – 37.0	S-17	1.6 80%	5 6 9 11		BG	**SAND**, fine to medium grained; green to grey w/oxidation specks and streaks; medium dense; wet
41 – 42.0	S-18	1.0 50%	7 6 5 2		BG	**SAND**, fine to medium grained; grey to green, gravel lense near bottom; medium dense; wet
46 – 47.0	S-19	1.2 60%	13 11 12 22		BG	**SHELL** material w/trace fine sand; green/white (shells), shell fragments oriented horizontally; medium dense; wet

Well Installation Detail



Elevation

Match to Sheet 4

DRILLING CO.: Hardin-Huber BAKER REP.: John E. Zimmerman

DRILLER: Mike Corran BORING NO.: B-MW19B SHEET 3 OF 4

TEST BORING AND WELL CONSTRUCTION RECORD

Baker
Baker Environmental, Inc

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 BORING NO.: B-MW19B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

DEFINITIONS

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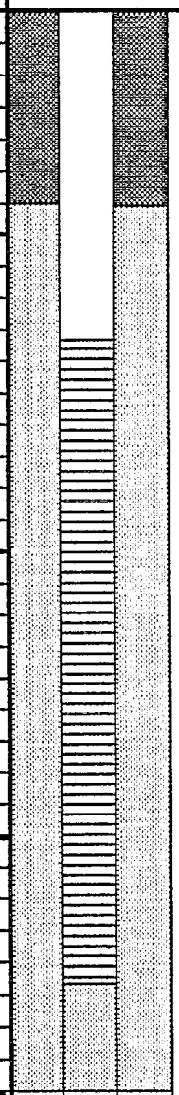
RQD = Rock Quality Designation (%)
Lab. Class. = USCS (ASTM D-2487) or AASHTO (ASTM D-3282)
Lab. Moist. = Moisture Content (ASTM D-2216) Dry Weight Basis

Depth (Ft.)	Sample Type and No.	Samp. Rec. (Ft. & %)	SPT or RQD	Lab. Class. or Pen. Rate	PID ppm HNu	Visual Description
51–52 (52.0)	S-20	2.0 / 100%	3 3 7 9		BG	**SHELL** material w/silt lenses throughout bottom half; green/white (shells), shell fragments oriented horizontally; very dense; wet
53–55						
56–57 (57.0)	S-21	1.5 / 75%	3 3 6 6		BG	**SHELL** material; green/white (shells), shell fragments oriented horizontally; very dense; wet
58–60						
61–62 (62.0)	S-31	1.7 / 85%	7 8 14 8		BG	**SAND**, fine grained w/little silt and trace clay; green; medium dense; wet
63–65						
66–67 (67.0)	S-32	1.3 / 65%	15 18 26 38		BG	**SHELL** material w/trace fine sand; green/white (shells), shell fragments oriented horizontally; dense; wet
68–70						TD @ 67.0'

Well Installation Detail



Elevation

DRILLING CO.: Hardin-Huber BAKER REP.: John E. Zimmerman
DRILLER: Mike Corran BORING NO.: B-MW19B SHEET 4 OF 4

APPENDIX G

APPENDIX G
WELL DEVELOPMENT LOGS

AREA A

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: B-20WSS
DATE: 6-14-92
GEOLOGIST/ENGINEER: K.J. Martin/B.J. Cummings

TIME START	1725
TIME FINISH	1820
INITIAL WATER LEVEL (FT)	6.05'
TOTAL WELL DEPTH (TD)	25.0'
WELL DIAMETER (INCHES)	2"
CALCULATED WELL VOLUME	3.08
BOREHOLE DIAMETER (INCHES)	8"
BOREHOLE VOLUME	65.27 x 3 = 195.82
AMOUNT OF WATER ADDED DURING DRILLING	None
DEVELOPMENT METHOD	Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	45 min.
AVERAGE FLOW (GPM)(B)	0.46
TOTAL ESTIMATED WITHDRAWAL AxB =	5.3 gallons**
HNU/OVA READING	119 ppm above BG

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
1725	2.0	7.9	19.5	6000	22.0	Grey/Black Very Silty
1740	3.4	8.3	24.3	10,900	24.0	Grey/Black Very Silty
1750	4.4	8.4	24.4	11,200	23.8	Grey/Black Very Silty
1800	4.9	8.5	22.6	11,200	24.0	Grey/Black Very Silty
1810	5.3	8.5	23.8	12,000	24.0	Grey/Black Very Silty

OBSERVATIONS/NOTES

No elevated OVA readings. Well was purged dry at 1810 hours. Readings within well were as high as 120 parts per million on OVA. Dissipated as well vented.
Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed.
**Note: Initial flow was approximately 2.0 gpm decreased immediately to 0.1 gpm - therefore, approximately 5.3 gallons evaluated from well.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: A-MW1C
DATE: 5-4-92
GEOLOGIST/ENGINEER: J.K. Harriz/J.E. Zimmerman

TIME START	1055
TIME FINISH	1215
INITIAL WATER LEVEL (FT)	9.5'
TOTAL WELL DEPTH (TD)	137.0'
WELL DIAMETER (INCHES)	2"
CALCULATED WELL VOLUME	20.7
BOREHOLE DIAMETER (INCHES)	8"
BOREHOLE VOLUME	357.70 x 3 = 1073.12
AMOUNT OF WATER ADDED DURING DRILLING	Circulated 400 gallons
DEVELOPMENT METHOD	Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	1 hr. 20 min.
AVERAGE FLOW (GPM)(B)	8.1
TOTAL ESTIMATED WITHDRAWAL AxB =	650 gallons
HNU/OVA READING	BG 0-0.5

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
1100	40	8.98	20.7	700	--	Grey/Very Silty
1110	150	8.62	21.8	1200	--	Grey/Very Silty
1112	200	8.63	19.8	1200	--	Grey/Very Silty
1121	250	8.66	19.2	1100	--	Visibly Clear
1125	300	8.71	19.0	1100	--	Clear/Trace Silt
1126	350	8.74	18.7	1175	--	Clear/Trace Silt
1129	400	8.44	18.3	1100	--	Clear/Trace Silt
1157	450	8.54	20.6	1100	--	Clear/Trace Silt
1202	500	8.25	19.4	1340	--	Gray/Silty
1207	550	8.27	18.8	1700	--	Clear/Trace Silt
1212	600	8.57	18.7	1180	--	Clear/Trace Silt
1215	650	8.70	18.8	1100	--	Clear/Trace Silt

OBSERVATIONS/NOTES

No elevated OVA readings. At 1130 shut off pump (air compressor) to retrieve more drums.

Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: A-MW8B
DATE: 5-20-92
GEOLOGIST/ENGINEER: J.E. Zimmerman

TIME START	1145
TIME FINISH	1447
INITIAL WATER LEVEL (FT)	2.25'
TOTAL WELL DEPTH (TD)	67.0
WELL DIAMETER (INCHES)	4"
CALCULATED WELL VOLUME	42.28
BOREHOLE DIAMETER (INCHES)	8"
BOREHOLE VOLUME	174.9 x 3 = 524.81
AMOUNT OF WATER ADDED DURING DRILLING	None
DEVELOPMENT METHOD	Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	3 hr. 2 min.
AVERAGE FLOW (GPM)(B)	6.65
TOTAL ESTIMATED WITHDRAWAL AxB =	1,210 gallons
HNU/OVA READING	BG 0-0.5

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
1220	30	11.0	19.3	1425	--	Light Brown with Silt
1236	60	12.4	18.7	3150	--	Brown with Silt
1252	90	10.5	20.6	1900	--	Grey/Silty
1308	150	9.4	20.1	2020	--	Grey/Silty
1319	200	9.0	19.9	2100	--	Grey/Silty
1327	280	8.5	20.0	2200	--	Grey/Silty
1335	380	8.5	20.0	2225	--	Grey/Silty
1347	480	8.5	20.2	2390	--	Grey/Silty
1357	550	8.5	19.3	2400	--	Light Grey/Silty
1420	750	7.9	19.8	2550	--	Clear/Trace Silt
1426	900	7.8	18.2	2500	--	Clear/Trace Silt
1442	1,045	7.8	18.8	2425	--	Clear/Trace Silt
1447	1,210	7.7	18.0	2225	--	Clear/Trace Silt

OBSERVATIONS/NOTES

No elevated OVA readings.
Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: A-P-8
DATE: 6-16-92
GEOLOGIST/ENGINEER: J.E. Zimmerman

TIME START	0832
TIME FINISH	0839
INITIAL WATER LEVEL (FT)	4.8'
TOTAL WELL DEPTH (TD)	67.0'
WELL DIAMETER (INCHES)	2"
CALCULATED WELL VOLUME	10.13
BOREHOLE DIAMETER (INCHES)	8"
BOREHOLE VOLUME	174.93 x 3 = 524.81
AMOUNT OF WATER ADDED DURING DRILLING	None
DEVELOPMENT METHOD	Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	7 min.
AVERAGE FLOW (GPM)(B)	15.7
TOTAL ESTIMATED WITHDRAWAL AxB =	110 gallons
HNU/OVA READING	BG 0-0.5

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
0835	55	7.6	19	2200	--	Light Brown/Very Silty
0836	56	7.5	17.9	2200	--	Clear with Little Silt
0839	110	7.5	18	2150	--	Clear with Trace Silt

OBSERVATIONS/NOTES

No elevated OVA readings.

Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: A-MW9C
DATE: 5-4-92
GEOLOGIST/ENGINEER: J.E. Zimmerman

TIME START	1405
TIME FINISH	1730
INITIAL WATER LEVEL (FT)	4.90'
TOTAL WELL DEPTH (TD)	137.0'
WELL DIAMETER (INCHES)	2"
CALCULATED WELL VOLUME	21.53
BOREHOLE DIAMETER (INCHES)	8"
BOREHOLE VOLUME	357.70 x 3 = 1073.12
AMOUNT OF WATER ADDED DURING DRILLING	None
DEVELOPMENT METHOD	Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	3 hr. 25 min.
AVERAGE FLOW (GPM)(B)	0.5
TOTAL ESTIMATED WITHDRAWAL AxB =	100 gallons
HNU/OVA READING	BG 0-0.5

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
1425	25	6.81	20.4	1000	--	Grey/Very Silty
1441	30	6.81	21.2	1285	--	Grey/Very Silty
1522	50	7.11	22.3	2600	--	Grey/Very Silty
1616	65	7.01	22.6	2400	--	Grey/Very Silty
1648	80	6.87	21.2	2400	--	Clear/Trace Silt
1729	100	6.89	20.7	2200	--	Clear/Trace Silt

OBSERVATIONS/NOTES

No elevated OVA readings.

Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: A-MW13B
DATE: 5-19-92
GEOLOGIST/ENGINEER: J.E. Zimmerman

TIME START	1112
TIME FINISH	1150
INITIAL WATER LEVEL (FT)	6.0'
TOTAL WELL DEPTH (TD)	67.0
WELL DIAMETER (INCHES)	2"
CALCULATED WELL VOLUME	9.94
BOREHOLE DIAMETER (INCHES)	8"
BOREHOLE VOLUME	174.93 x 3 = 524.81
AMOUNT OF WATER ADDED DURING DRILLING	None
DEVELOPMENT METHOD	Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	38 min.
AVERAGE FLOW (GPM)(B)	10.5
TOTAL ESTIMATED WITHDRAWAL AxB =	400 gallons
HNU/OVA READING	BG 0-0.5

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
1120	10	10.50	17.4	1300	--	Brown/Very Silty
1124	50	9.33	17.2	1290	--	Brown/Some Silt
1128	100	9.30	17.0	1300	--	Brown/Some Silt
1132	150	9.00	17.0	1290	--	Clear/Little Silt
1136	200	8.80	17.0	1290	--	Clear/Trace Silt
1140	250	8.70	17.0	1290	--	Clear/Trace Silt
1144	300	8.60	17.0	1290	--	Clear/Trace Silt
1148	350	8.50	16.9	1290	--	Clear/Trace Silt
1150	400	8.50	16.9	1290	--	Clear/Trace Silt

OBSERVATIONS/NOTES

No elevated OVA readings.

Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: A-MW14B
DATE: 5-19-92
GEOLOGIST/ENGINEER: J.E. Zimmerman

TIME START
0955

TIME FINISH
1045

INITIAL WATER LEVEL (FT)
5.66'

TOTAL WELL DEPTH (TD)
67.0'

WELL DIAMETER (INCHES)
2"

CALCULATED WELL VOLUME
9.99

BOREHOLE DIAMETER (INCHES)
8"

BOREHOLE VOLUME
174.93 x 3 = 524.81

AMOUNT OF WATER ADDED DURING DRILLING
None

DEVELOPMENT METHOD
Lift

PUMP TYPE
Compressor

TOTAL TIME (A)
50 min.

AVERAGE FLOW (GPM)(B)
8.0

TOTAL ESTIMATED WITHDRAWAL AxB =
400 gallons

HNU/OVA READING
BG 0.5 ppm

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
1004	50	12	17.3	1190	--	Brown/Very Silty
1016	140	11.7	17.2	1400	--	Brown/Very Silty
1023	170	11.6	17.3	1395	--	Light Brown/Some Silt
1030	200	11.5	17.3	1380	--	Light Brown/Some Silt
1034	280	11.3	17.3	1385	--	Clear/Trace Silt
1038	320	11.2	17.3	1390	--	Clear/Trace Silt
1040	360	10.9	17.3	1400	--	Clear/Trace Silt
1045	400	10.8	17	1380	--	Clear/Trace Silt

OBSERVATIONS/NOTES

No elevated OVA readings.

Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: A-MW15B
DATE: 5-20-92
GEOLOGIST/ENGINEER: J.E. Zimmerman

TIME START	0810
TIME FINISH	0850
INITIAL WATER LEVEL (FT)	2.8'
TOTAL WELL DEPTH (TD)	67.0'
WELL DIAMETER (INCHES)	2"
CALCULATED WELL VOLUME	10.46
BOREHOLE DIAMETER (INCHES)	8"
BOREHOLE VOLUME	174.93 X 3 = 524.81
AMOUNT OF WATER ADDED DURING DRILLING	Circulated 250 gallons
DEVELOPMENT METHOD	Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	40 min.
AVERAGE FLOW (GPM)(B)	10
TOTAL ESTIMATED WITHDRAWAL AxB =	400 gallons
HNU/OVA READING	BG 0-0.5

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
0814	50	9.10	16.9	1425	--	Brown/Very Silty
0818	105	8.90	16.8	1400	--	Brown/Very Silty
0822	155	8.50	17.0	1400	--	Brown/Very Silty
0826	185	8.30	16.7	1400	--	Light Brown with Silt
0832	200	8.20	16.8	1400	--	Clear with Little Silt
0836	250	8.00	16.8	1400	--	Clear with Trace Silt
0840	300	8.00	16.8	1400	--	Clear with Trace Silt
0844	350	8.00	16.8	1400	--	Clear with Trace Silt
0850	400	8.00	16.8	1400	--	Clear with Trace Silt

OBSERVATIONS/NOTES

No elevated OVA readings. Between 0822 and 0826 flow decreased from 12.9 gpm to 11.5 gpm. Beginning at 0832 gpm stabilized at 10.0 gpm until development was completed.
Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: B-15WB
DATE: 5-11-92
GEOLOGIST/ENGINEER: J.E. Zimmerman

TIME START	1409
TIME FINISH	1552
INITIAL WATER LEVEL (FT)	4.5
TOTAL WELL DEPTH (TD)	132.0'
WELL DIAMETER (INCHES)	2"
CALCULATED WELL VOLUME	20.78
BOREHOLE DIAMETER (INCHES)	12"
BOREHOLE VOLUME	775.5 x 3 = 2326.5
AMOUNT OF WATER ADDED DURING DRILLING	None
DEVELOPMENT METHOD	Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	1 hr. 38 min.
AVERAGE FLOW (GPM)(B)	2.4
TOTAL ESTIMATED WITHDRAWAL AxB =	235 gallons
HNU/OVA READING	BG 0-0.5

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
1414	5	10.58	24.0	880		Grey/Silty
1421	30	9.05	19.8	1700		Grey/Very Silty
1428	50	8.95	18.9	2000		Grey/Very Silty
1435	70	8.90	19.4	2800		Grey/Silty
1442	85	8.89	19.4	3000		Grey/Silty
1449	100	8.88	19.4	3075		Grey/Silty
1456	115	8.90	19.5	3150		Grey/Silty
1503	130	8.90	19.8	2925		Clear/Trace Silt
1510	145	8.89	19.8	3095		Clear/Trace Silt
1517	160	8.87	19.7	3190		Clear/Trace Silt
1524	175	8.88	19.5	3190		Clear/Trace Silt
1531	190	8.92	19.4	3200		Clear/Trace Silt
1538	205	8.93	19.4	3125		Clear/Trace Silt
1545	220	8.93	19.5	3200		Clear/Trace Silt
1552	235	8.90	19.4	3200		Clear/Trace Silt

OBSERVATIONS/NOTES

No elevated OVA readings. Between 1435 and 1442 flow decreased from 2.8 gpm to 2.1 gpm. Beginning at 1449 gpm stabilized at 2.1 gpm until development was completed.
Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: AMW-16B
DATE: 6-15-92
GEOLOGIST/ENGINEER: K.J. Martin/B.J. Cummings

TIME START	0847
TIME FINISH	1022
INITIAL WATER LEVEL (FT)	5.73'
TOTAL WELL DEPTH (TD)	65.0'
WELL DIAMETER (INCHES)	2"
CALCULATED WELL VOLUME	9.66
BOREHOLE DIAMETER (INCHES)	8"
BOREHOLE VOLUME	169.71 x 3 = 509.14
AMOUNT OF WATER ADDED DURING DRILLING	None
DEVELOPMENT METHOD	Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	1 hr. 35 min.
AVERAGE FLOW (GPM)(B)	4.63
TOTAL ESTIMATED WITHDRAWAL AxB =	440 gallons
HNU/OVA READING	BG 0-0.5

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
0847	3	12.4	17.7	4510	18.5	Brown with Silt
0855	55	12.2	18.3	4000	19.5	Brown with Silt
0900	80	11.8	18.2	3800	18.3	Brown with Silt
0907	110	11.6	17.7	3790	18.3	Light Brown with Silt
0913	135	11.2	17.5	3790	18.2	Light Brown with Silt
0920	165	11.1	17.4	3890	18.2	Clear with Silt
0926	190	10.9	17.7	3570	18.5	Clear with Silt
0932	220	10.7	17.5	3690	17.9	Clear with Silt
0938	245	10.1	17.6	3650	17.9	Clear with Little Silt
0944	275	9.8	17.5	3680	18.1	Clear with Little Silt
0951	300	9.6	17.5	3710	18.0	Clear with Little Silt
0957	330	9.4	17.3	3700	17.9	Clear with Little Silt
1003	355	9.4	17.3	3620	17.8	Clear with Trace Silt
1010	385	9.2	17.5	3710	17.9	Clear with Trace Silt
1016	410	9.1	17.3	3710	17.9	Clear with Trace Silt
1022	440	9.1	17.4	3710	17.9	Clear with Trace Silt

OBSERVATIONS/NOTES

No elevated OVA readings.

Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: A-MW17B
DATE: 6-14-92
GEOLOGIST/ENGINEER: K.J. Martin/B.J. Cummings

TIME START	1135
TIME FINISH	1320
INITIAL WATER LEVEL (FT)	4.58'
TOTAL WELL DEPTH (TD)	66.0'
WELL DIAMETER (INCHES)	2"
CALCULATED WELL VOLUME	10.01
BOREHOLE DIAMETER (INCHES)	8"
BOREHOLE VOLUME	172.32 x 516.97
AMOUNT OF WATER ADDED DURING DRILLING	None
DEVELOPMENT METHOD	Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	1 hr. 45 min.
AVERAGE FLOW (GPM)(B)	4.76
TOTAL ESTIMATED WITHDRAWAL AxB =	500 gallons
HNU/OVA READING	BG 0-0.5

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
1135	50	11.4	21.9	1990	25.0	Brown/Very Silty
1146	100	10.2	20.4	2320	22.0	Brown/Very Silty
1200	150	9.2	20.8	2620	22.5	Brown/Very Silty
1225	200	8.6	20.3	2790	26.5	Light Brown with Silt
1233	250	8.9	20.5	2790	23.0	Light Brown with Silt
1240	300	8.3	20.2	2800	23.0	Light Brown with Silt
1246	350	8.7	20.0	2800	21.5	Light Brown with Silt
1257	400	8.1	20.7	2790	22.0	Light Brown with Silt
1305	450	8.4	20.3	2790	22.0	Clear with Little Silt
1320	500	8.2	20.3	2790	24.0	Clear with Trace Silt

OBSERVATIONS/NOTES

No elevated OVA readings. Flow rates fluctuated significantly.

Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: A-MW18B
DATE: 12-18-92
GEOLOGIST/ENGINEER: J.E. Zimmerman

TIME START	0838
TIME FINISH	0916
INITIAL WATER LEVEL (FT)	8.3'
TOTAL WELL DEPTH (TD)	78.3'
WELL DIAMETER (INCHES)	2"
CALCULATED WELL VOLUME	11.41
BOREHOLE DIAMETER (INCHES)	6"
BOREHOLE VOLUME	115.02 x 3 = 345.06
AMOUNT OF WATER ADDED DURING DRILLING	None
DEVELOPMENT METHOD	Air Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	36 min.
AVERAGE FLOW (GPM)(B)	4.3 (GPM)
TOTAL ESTIMATED WITHDRAWAL AxB =	155 gallons
HNU/OVA READING	BG .1

DEVELOPMENT DATA3000

TIME	CUMULATIVE VOLUME (gallons)2000	pH250 0	TEMP (°C)200 0	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
0840	5	9.22	10.4	5000	17	Greyish Brown/V . Cloudy (sediment)
0843	15	12.17	15.9	3000	16	Greyish Brown/V. Cloudy (sediment)
0846	35	11.99	15.9	2000	16	Greyish Brown/V . Cloudy (sediment)
0848	55	11.86	16.1	2000	16	Greyish Brown/V . Cloudy (sediment)
0856	75	12.09	16.0	2500	16	Greyish Brown / Cloudy(some sed.)
0859	95	11.90	16.0	2000	16	Brown / Little Cloudy(little sed.)
0903	110	11.69	15.6	1500	16	Clear to Trace Fine Sediment
0910	125	11.98	15.9	1200	16	Clear to Trace Fine Sediment
0913	135	11.73	16.1	1200	16	Lite Brown Cloudy (little sed.)
0916	155	11.62	16.2	1200	16	Lite Brown Cloudy (little sed.)

OBSERVATIONS/NOTES

Met criteria for well development (stabilized pH, specific conductivity and temperature). An adequate volume of water was removed.

- Initial water level measured to top of PVC
- Total well depth measured to top of PVC

No elevated HNu readings.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc.

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: A-MW19B
DATE: 12-17-92
GEOLOGIST/ENGINEER: J.E. Zimmerman

TIME START
1120

TIME FINISH
1140

INITIAL WATER LEVEL (FT)
2.3'

TOTAL WELL DEPTH (TD)
61.8'

WELL DIAMETER (INCHES)
2"

CALCULATED WELL VOLUME
9.69

BOREHOLE DIAMETER (INCHES)
6"

BOREHOLE VOLUME
90.78 x 3 = 272.35

AMOUNT OF WATER ADDED DURING DRILLING
None

DEVELOPMENT METHOD
Air Lift

PUMP TYPE
Air Compressor

TOTAL TIME (A)
20 min.

AVERAGE FLOW (GPM)(B)
.9 (GPM)

TOTAL ESTIMATED WITHDRAWAL AxB =
18 gallons

HNU/OVA READING
BG .4

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
1126	6	6.38	14.9	2900	15	Greyish Brown / Very Cloudy
1134	12	6.22	15.0	2850	15	Greyish Brown / Very Cloudy
1140	18	6.27	14.8	2860	15	Greyish Brown / Very Cloudy

OBSERVATIONS/NOTES

- Initial water level corrected to ground surface.
- Water level measured at 1142 was 59.1'.
- Well pumped dry at 1140. Development ends.

Did not meet criteria for well development pH, specific conductivity and temperature. An adequate volume of water was not removed.In order to compensate for insufficient development extended purging (approximately 10 well volumes) was preformed prior to groundwater sampling (details are documented in project field log books). No elevated HNu readings.

AREA B

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: B-MW8B
DATE: 5.17-92
GEOLOGIST/ENGINEER: J.K. Harriz

TIME START	1610
TIME FINISH	1644
INITIAL WATER LEVEL (FT)	~6.2
TOTAL WELL DEPTH (TD)	65.0'
WELL DIAMETER (INCHES)	4"
CALCULATED WELL VOLUME	38.3
BOREHOLE DIAMETER (INCHES)	8"
BOREHOLE VOLUME	169.71 x 3 = 509.13
AMOUNT OF WATER ADDED DURING DRILLING	None
DEVELOPMENT METHOD	Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	34 min.
AVERAGE FLOW (GPM)(B)	16.2
TOTAL ESTIMATED WITHDRAWAL AxB =	550 gallons
HNU/OVA READING	BG 0-0.5

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
1610	50	6.73	21.5	30	--	Grey/Silty Sand
1612	100	6.73	19.9	280	--	Grey/Silty Sand
1614	150	6.75	19.4	280	--	Grey/Silty
1617	200	6.77	18.7	315	--	Clear/Trace Silt
1620	250	6.78	19.9	300	--	Clear/Trace Silt
1625	300	6.78	18.5	315	--	Clear/Trace Silt
1628	350	6.78	18.3	295	--	Clear/Trace Silt
1630	400	6.77	18.5	300	--	Clear/Trace Silt
1635	450	6.77	18.6	300	--	Grey/Silty
1640	500	6.79	18.2	285	--	Grey/Silty
1644	550	6.80	18.0	285	--	Clear

OBSERVATIONS/NOTES

No elevated OVA readings.

Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: B-MW9B
DATE: 5-19-92
GEOLOGIST/ENGINEER: J.E. Zimmerman

TIME START	1532
TIME FINISH	1603
INITIAL WATER LEVEL (FT)	6.9'
TOTAL WELL DEPTH (TD)	65.4'
WELL DIAMETER (INCHES)	2"
CALCULATED WELL VOLUME	9.53
BOREHOLE DIAMETER (INCHES)	8"
BOREHOLE VOLUME	170.7 x 3 = 512.1
AMOUNT OF WATER ADDED DURING DRILLING	None
DEVELOPMENT METHOD	Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	31 min.
AVERAGE FLOW (GPM)(B)	12.9
TOTAL ESTIMATED WITHDRAWAL AxB =	400 gallons
HNU/OVA READING	BG 0-0.5

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
1533	10	9.3	18.1	1370	--	Grey/Very Silty
1539	75	8.9	16.6	1225	--	Grey/Very Silty
1543	125	8.4	16.4	1250	--	Grey with Silt
1547	175	8.2	16.3	1225	--	Light Grey with Silt
1551	225	8.1	16.0	1225	--	Light Grey with Silt
1555	300	8.0	16.1	1200	--	Clear with Little Silt
1559	350	8.0	15.9	1225	--	Clear with Little Silt
1603	400	8.0	16.1	1225	--	Clear/Trace Silt

OBSERVATIONS/NOTES

No elevated OVA readings. Between 1547 and 1551 pump action reduced slightly.

Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc.

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: B-MW11B
DATE: 5-17-92
GEOLOGIST/ENGINEER: J.K. Harriz

TIME START	1430
TIME FINISH	1505
INITIAL WATER LEVEL (FT)	~6.2'
TOTAL WELL DEPTH (TD)	65.0'
WELL DIAMETER (INCHES)	2"
CALCULATED WELL VOLUME	9.58
BOREHOLE DIAMETER (INCHES)	8"
BOREHOLE VOLUME	169.7 x 3 = 509.1
AMOUNT OF WATER ADDED DURING DRILLING	None
DEVELOPMENT METHOD	Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	35 min.
AVERAGE FLOW (GPM)(B)	20
TOTAL ESTIMATED WITHDRAWAL AxB =	700 gallons
HNU/OVA READING	BG 0-0.5

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
1430	50	6.78	21.5	325	--	Grey/Silty
1437	100	6.79	20.1	300	--	Grey/Silty
1440	150	6.78	19.5	290	--	Grey/Silty
1441	200	6.78	19.5	297	--	Grey/Silty
1443	250	6.78	19.5	310	--	Grey/Silty
1445	300	6.77	19.1	280	--	Clear/Silty
1448	350	6.78	19.8	315	--	Clear
1450	400	6.79	19.5	270	--	Clear
1455	450	6.79	20.2	290	--	Clear
1456	500	6.79	18.8	290	--	Clear
1458	550	6.79	18.9	280	--	Clear
1500	600	6.79	18.8	280	--	Clear
1502	650	6.80	18.9	280	--	Clear
1505	700	6.80	19.7	285	--	Clear

OBSERVATIONS/NOTES

No elevated OVA readings.

Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: B-MW12
DATE: 5-19-92
GEOLOGIST/ENGINEER: J.E. Zimmerman

TIME START	1650
TIME FINISH	1758
INITIAL WATER LEVEL (FT)	3.7'
TOTAL WELL DEPTH (TD)	14.0'
WELL DIAMETER (INCHES)	2"
CALCULATED WELL VOLUME	1.67
BOREHOLE DIAMETER (INCHES)	8.0
BOREHOLE VOLUME	20.88 x 3 = 62.6
AMOUNT OF WATER ADDED DURING DRILLING	None
DEVELOPMENT METHOD	Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	68 min.
AVERAGE FLOW (GPM)(B)	1.2
TOTAL ESTIMATED WITHDRAWAL AxB =	80 gallons
HNU/OVA READING	BG 0-0.5

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
1655	10	6.8	21.8	1375	--	Brown/Very Silty
1704	20	6.9	19.5	1300	--	Brown/Very Silty
1713	30	6.9	19.5	1300	--	Brown/Very Silty
1722	40	6.9	18.9	1300	--	Brown/Very Silty
1731	50	6.9	19.2	1300	--	Brown/Very Silty
1740	60	6.9	19.7	1300	--	Brown/Very Silty
1749	70	6.9	19.4	1300	--	Brown/Very Silty
1758	80	6.9	19.1	1300	--	Brown/Very Silty

OBSERVATIONS/NOTES

No elevated OVA readings.

Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill RI/FS
CTO NO.: 0084 WELL NO.: B-MW13
DATE: 5/18/92 and 5/26/92
GEOLOGIST/ENGINEER: J.K. Harriz

TIME START
5/18.92 1705
5/26/92 1045

TIME FINISH
1822 1315

INITIAL WATER LEVEL (FT)
~6.2'

TOTAL WELL DEPTH (TD)
14.0'

WELL DIAMETER (INCHES)
4"

CALCULATED WELL VOLUME
5.09

BOREHOLE DIAMETER (INCHES)
8"

BOREHOLE VOLUME
36.5 x 3 = 109.5

AMOUNT OF WATER ADDED DURING DRILLING
None

DEVELOPMENT METHOD
Lift

PUMP TYPE
Air Compressor

TOTAL TIME (A)
1 hr. 17 min.

AVERAGE FLOW (GPM)(B)
0.5

TOTAL ESTIMATED WITHDRAWAL AxB =
30 gallons

HNU/OVA READING
BG 0 - 0.5

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
1705	0	6.78	25	340	–	Brown, Clayey
1725	5	7.00	21	310	–	Brown, Clayey, Transparent
1735	10	7.04	25	370	–	Brown, Clayey, Transparent
1748	17	7.05	25	350	–	Brown, Transparent
1756	19	7.04	25	370	–	Light Brown, Transparent
1803	21	7.05	25	350	–	Very Light Brown, Transparent
1810	25	7.03	25	345	–	Very, Very Light Brown, Transparent
1822	30	7.00	25	350	–	Very, Very Light Brown, Transparent
–	–	–	–	–	–	See Notes
1045	0					Date: 5/26/82
1315	50	–	–	–	–	

OBSERVATIONS/NOTES

No elevated OVA readings. This well was developed a second time to ensure that the three borehole volume criteria had been satisfied. Met criteria for well development (stabilized pH, specific conductivity and temperature). An adequate volume of water was removed.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: B-MW14
DATE: 6-13-92
GEOLOGIST/ENGINEER: J.E. Zimmerman

TIME START	1045
TIME FINISH	1145
INITIAL WATER LEVEL (FT)	5'
TOTAL WELL DEPTH (TD)	16.0'
WELL DIAMETER (INCHES)	2"
CALCULATED WELL VOLUME	1.793
BOREHOLE DIAMETER (INCHES)	8"
BOREHOLE VOLUME	41.77 x 3 = 125.3
AMOUNT OF WATER ADDED DURING DRILLING	None
DEVELOPMENT METHOD	Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	60 min.
AVERAGE FLOW (GPM)(B)	.41
TOTAL ESTIMATED WITHDRAWAL AxB =	25 gallons
HNU/OVA READING	BG 0-0.5

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
1055	5	7.4	27.0	250	--	Brown/Very Silty
1105	10	8.0	26.0	250	--	Light Brown with Silt
1115	15	8.1	26.7	250	--	Light Brown with Silt
1130	20	8.2	26.9	250	--	Light Brown with Silt
1145	25	8.2	26.4	250	--	Clear with Trace Silt

OBSERVATIONS/NOTES

No elevated OVA readings.

Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: B-MW15
DATE: 6-13-92
GEOLOGIST/ENGINEER: J.E. Zimmerman

TIME START
0915

TIME FINISH
1015

INITIAL WATER LEVEL (FT)
3'

TOTAL WELL DEPTH (TD)
16.0'

WELL DIAMETER (INCHES)
2"

CALCULATED WELL VOLUME
2.11

BOREHOLE DIAMETER (INCHES)
8"

BOREHOLE VOLUME
41.77 x 3 = 125.3

AMOUNT OF WATER ADDED DURING DRILLING
None

DEVELOPMENT METHOD
Lift

PUMP TYPE
Air Compressor

TOTAL TIME (A)
60 min.

AVERAGE FLOW (GPM)(B)
.5

TOTAL ESTIMATED WITHDRAWAL AxB =
30 gallons

HNU/OVA READING
BG 0-0.5

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
0925	5	7.5	25.5	1600	--	Brown/Very Silty
0935	10	7.8	26.3	1700	--	Brown/Very Silty
0945	15	8.0	26.5	1800	--	Brown/Very Silty
0955	20	8.2	27.5	1950	--	Brown/Very Silty
1005	25	8.1	27.5	1800	--	Brown/Very Silty
1015	30	8.2	27.4	1700	--	Light Brown/Silty

OBSERVATIONS/NOTES

No elevated OVA readings.

Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: B-MW16
DATE: 6-11-92
GEOLOGIST/ENGINEER: J.E. Zimmerman

TIME START	0745
TIME FINISH	0925
INITIAL WATER LEVEL (FT)	2.6'
TOTAL WELL DEPTH (TD)	16.0'
WELL DIAMETER (INCHES)	2"
CALCULATED WELL VOLUME	2.18
BOREHOLE DIAMETER (INCHES)	8"
BOREHOLE VOLUME	41.77 x 3 = 125.3
AMOUNT OF WATER ADDED DURING DRILLING	None
DEVELOPMENT METHOD	Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	1 hr. 40 min.
AVERAGE FLOW (GPM)(B)	1.65
TOTAL ESTIMATED WITHDRAWAL AxB =	165 gallons
HNU/OVA READING	BG 0-0.5

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
0755	20	7.3	20.7	1250	--	Brown/Very Silty
0805	40	7.6	20.8	1300	--	Brown/Very Silty
0815	60	7.6	21.1	1275	--	Light Brown with Silt
0825	80	7.5	21.4	1150	--	Light Brown with Silt
0835	100	7.5	21.4	1300	--	Light Brown with Silt
0845	120	7.4	21.4	1250	--	Clear with Little Silt
0900	135	7.4	21.3	1300	--	Clear with Little Silt
0915	150	7.3	21.7	1300	--	Clear with Trace Silt
0925	165	7.3	21.5	1375	--	Clear with Trace Silt

OBSERVATIONS/NOTES

No elevated OVA readings. Flow decreases slightly between 0845 and 0900.

Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: B-MW17
DATE: 6-14-92
GEOLOGIST/ENGINEER: K.J. Martin/B.J. Cummings

TIME START	0850
TIME FINISH	0925
INITIAL WATER LEVEL (FT)	3.11'
TOTAL WELL DEPTH (TD)	14.0'
WELL DIAMETER (INCHES)	2"
CALCULATED WELL VOLUME	1.77
BOREHOLE DIAMETER (INCHES)	8"
BOREHOLE VOLUME	36.55 x 3 = 109.66
AMOUNT OF WATER ADDED DURING DRILLING	None
DEVELOPMENT METHOD	Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	35 min.
AVERAGE FLOW (GPM)(B)	0.6
TOTAL ESTIMATED WITHDRAWAL AxB =	21 gallons
HNU/OVA READING	BG 0-0.5

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
0850	5	7.1	18.3	600	18.5	Brown/Silty
0900	10	7.3	18.6	620	19.0	Brown/Silty
0905	15	7.3	18.7	600	19.0	Brown/Silty
0915	20	7.4	19.3	630	19.8	Brown/Silty
0925	21	7.4	19.0	600	20.8	Brown/Silty

OBSERVATIONS/NOTES

No elevated OVA readings. Sample obtained for conductivity and pH analysis appeared layered, clear, colorless layer approximately 1/4 inch over brown silty layer.
Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: B-MW18A
DATE: 12-12-92
GEOLOGIST/ENGINEER: J.E.Zimmerman

TIME START	0947
TIME FINISH	1050
INITIAL WATER LEVEL (FT)	1.8'
TOTAL WELL DEPTH (TD)	15.0'
WELL DIAMETER (INCHES)	2"
CALCULATED WELL VOLUME	3.6
BOREHOLE DIAMETER (INCHES)	8"
BOREHOLE VOLUME	14.3 x 3 = 43
AMOUNT OF WATER ADDED DURING DRILLING	None
DEVELOPMENT METHOD	Air Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	1 hr. 3 min.
AVERAGE FLOW (GPM)(B)	2.6 (GPM)
TOTAL ESTIMATED WITHDRAWAL AxB =	165 gallons
HNU/OVA READING	BG .7

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
0950	5	6.93	13.6	160	14	Brown/ Very Cloudy
0955	30	6.73	15.5	150	15	Brown/ Very Cloudy
1000	50	6.83	15.0	151	15	Brown/ Very Cloudy
1015	70	6.59	15.2	145	15	Brown/ Very Cloudy
1020	90	6.73	15.5	145	15	Brown/ Cloudy
1025	110	6.73	15.5	145	15	Brown/ Cloudy
1040	130	6.81	16.1	145	16	Brown/ Cloudy
1045	150	6.73	15.9	145	16	Brown/ Cloudy
1050	165	6.73	15.9	145	16	Brown/ Cloudy

OBSERVATIONS/NOTES

Met criteria for well development. Since this location has a close proximity to the voided area, this well will be useful in providing chemical data for the shallow aquifer. However, it is unlikely the well will be utilized as a long term monitoring point. No elevated HNu readings.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: B-MW19A
DATE: 12-12-92
GEOLOGIST/ENGINEER: J.E. Zimmerman

TIME START	1154
TIME FINISH	1221
INITIAL WATER LEVEL (FT)	2.9'
TOTAL WELL DEPTH (TD)	15.0'
WELL DIAMETER (INCHES)	2"
CALCULATED WELL VOLUME	5.8
BOREHOLE DIAMETER (INCHES)	8"
BOREHOLE VOLUME	23.2 x 3 = 69.6
AMOUNT OF WATER ADDED DURING DRILLING	None
DEVELOPMENT METHOD	Air Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	37 min.
AVERAGE FLOW (GPM)(B)	2.9 (GPM)
TOTAL ESTIMATED WITHDRAWAL AxB =	110 gallons
HNU/OVA READING	BG .6

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
1157	20	7.13	16.2	360	16.5	Brown/Very Cloudy
1200	40	7.17	16.7	370	16.0	Brown/Very Cloudy
1203	55	7.19	16.9	370	16.0	Brown/Very Cloudy
1213	70	7.20	16.7	360	16.0	Brown/Very Cloudy
1217	90	7.20	16.9	370	16.5	Brown/Cloudy
1221	110	7.20	16.5	370	17.0	Lite Brown/Cloudy

OBSERVATIONS/NOTES

Met criteria for well development pH, specific conductivity and temperature. An adequate volume of water was removed. Extended purging was performed prior to groundwater sampling (details are documented in project field log books). No elevated HNu readings.

FIELD WELL DEVELOPMENT RECORD

Baker

Baker Environmental, Inc

PROJECT: Camp Allen Landfill
CTO NO.: 0084 WELL NO.: B-MW19B
DATE: 12-12-92
GEOLOGIST/ENGINEER: J.E. Zimmerman

TIME START	1509
TIME FINISH	1658
INITIAL WATER LEVEL (FT)	5.3'
TOTAL WELL DEPTH (TD)	65.0'
WELL DIAMETER (INCHES)	2"
CALCULATED WELL VOLUME	10.6
BOREHOLE DIAMETER (INCHES)	8"
BOREHOLE VOLUME	42.3 x 3 = 127
AMOUNT OF WATER ADDED DURING DRILLING	None
DEVELOPMENT METHOD	Air Lift
PUMP TYPE	Air Compressor
TOTAL TIME (A)	1 hr. 49 min.
AVERAGE FLOW (GPM)(B)	3.0 (GPM)
TOTAL ESTIMATED WITHDRAWAL AxB =	330 gallons
HNU/OVA READING	BG .5

DEVELOPMENT DATA

TIME	CUMULATIVE VOLUME (gallons)	pH	TEMP (°C)	SPEC. COND. (µmhos/cm)	TEMP (°C)	COLOR AND TURBIDITY
1512	25	12.1	15.2	1500	15.0	Brown/Very Cloudy
1515	50	12.0	15.0	1490	15.0	Brown/Very Cloudy
1518	80	11.6	15.2	1100	16.0	Brown/Very Cloudy
1523	110	10.7	15.2	1100	16.0	Brown/Very Cloudy
1533	130	9.6	14.9	1000	16.0	Lite Brown/Cloudy
1536	150	10.3	15.4	1100	16.0	Lite Brown/Cloudy
1539	165	9.8	14.6	1100	16.0	Lite Brown/Cloudy
1605	220	9.4	15.2	1400	16.0	Lite Brown/Cloudy
1630	240	9.4	15.4	1100	16.0	Lite Brown/Cloudy
1633	265	9.4	15.4	1400	16.0	Lite Brown/Cloudy
1638	285	8.9	14.9	1200	15.0	Lite Brown/Cloudy
1645	295	8.9	14.9	1300	16.0	Lite Brown/Cloudy
1650	305	8.4	14.5	1200	16.0	Lite Brown/Cloudy
1658	330	8.8	14.8	1200	16.0	Lite Brown/Cloudy

OBSERVATIONS/NOTES

Met criteria for well development. pH and specific conductivity are high. This could be caused by a double well screen construction requiring a greater amount of bentonite to be used for proper construction. An additional volume of water was removed to flush out high readings. Extended purging was performed prior to groundwater sampling (details are documented in project field log books).

APPENDIX H

APPENDIX H
GEOTECHNICAL PHYSICAL RESULTS

WADSWORTH/ALERT Laboratories
Division of Enseco Incorporated

Corporate and Laboratory:
4101 Shuffel Drive, NW
North Canton, OH 44720
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ANALYTICAL REPORT

19084-SRN

Presented to:

THOMAS ARTMAN

BAKER ENVIRONMENTAL INC

WADSWORTH/ALERT LABORATORIES

Jay Bernarding
Project Manager

Mark P. Nebiolo
Laboratory Manager

June 19, 1992

Laboratories:
Pittsburgh, PA
412-826-5477

Tampa, FL
813-621-0784

PROJECT NARRATIVE

The following report contains the analytical results for four solid samples submitted to WADSWORTH/ALERT Laboratories by Baker Environmental Inc. from the 19084-SRN Site. The samples were received June 2, 1992, according to documented sample acceptance procedures.

WADSWORTH/ALERT Laboratories utilizes only USEPA approved methods and instrumentation in all analytical work. The samples presented in this report were analyzed for physical testing parameters. They were sent to Applied Construction Technologies, Inc. and analyzed for the characteristics listed below.

<u>Parameters</u>

Moisture Content, As-received
Bulk Specific Gravity, As-received
Atterberg Limits
Grain Size Distribution

SAMPLE SUMMARY

The analytical results of the samples listed below are presented on the following pages.

WO #	LABORATORY ID	SAMPLE IDENTIFICATION	BAKER ENVIRONMENTAL ID
67902	A2F020039-001	GB-01 5-28-92 0910	TBA-01 (25-27')
67903	A2F020039-002	GB-02 5-29-92 1042	TBA-09 (20-22')
67904	A2F020039-003	GB-03 5-28-92 1736	TBA-05 (32-36')
67905	A2F020039-004	GB-04 5-27-92 1530	TBA-04 (31-33')

Sample Identification: A-2F020039-001 67902-1-01 Completed 06-15-92

Sample Description: Brown Silty Clay

Moisture Content, As-received	=	32.2%
Bulk Specific Gravity, As-received	=	1.594
Liquid Limit	=	30
Plastic Limit	=	14
Plasticity Index	=	16
Apparent Specific Gravity	=	2.625

Sample Identification: A-2F020039-002 67903-1-01

Sample Description: Brown and Gray Silty Clay

Moisture Content, As-received	=	28.5%
Bulk Specific Gravity, As-received	=	1.751
Liquid Limit	=	41
Plastic Limit	=	15
Plasticity Index	=	26
Apparent Specific Gravity	=	2.596

Sample Identification: A-2F020039-003 67904-1-01

Sample Description: Tan Silty Clay

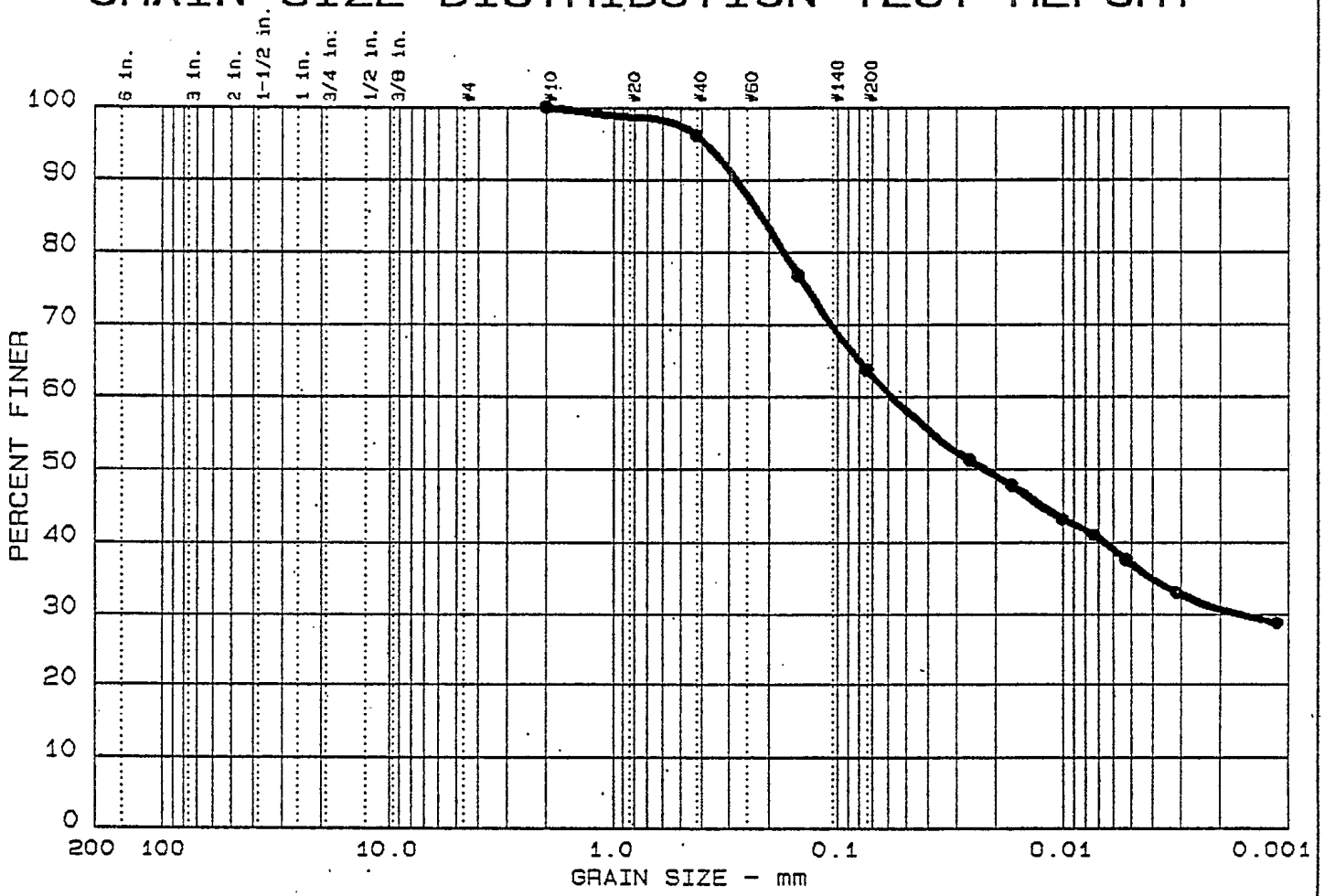
Moisture Content, As-received	=	28.6%
Bulk Specific Gravity, As-received	=	1.760
Liquid Limit	=	33
Plastic Limit	=	20
Plasticity Index	=	13
Apparent Specific Gravity	=	2.627

Sample Identification: A-2F020039-004 67905-1-01

Sample Description: Grayish Tan Silty Clay

Moisture Content, As-received	=	27.6%
Bulk Specific Gravity, As-received	=	1.851
Liquid Limit	=	33
Plastic Limit	=	18
Plasticity INdex	=	15
Apparent Specific Gravity	=	2.635

GRAIN SIZE DISTRIBUTION TEST REPORT



	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	0.0	36.3	26.7	37.0

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	30	16	0.22		0.02	0.002				

MATERIAL DESCRIPTION	USCS	AASHTO
● BROWN SILTY CLAY	CL	A-6 (7)

Project No.:
Project: CLIENT CODE: 039984
● Location: RECEIVED ON 6/3/92

Date: 6/15/92

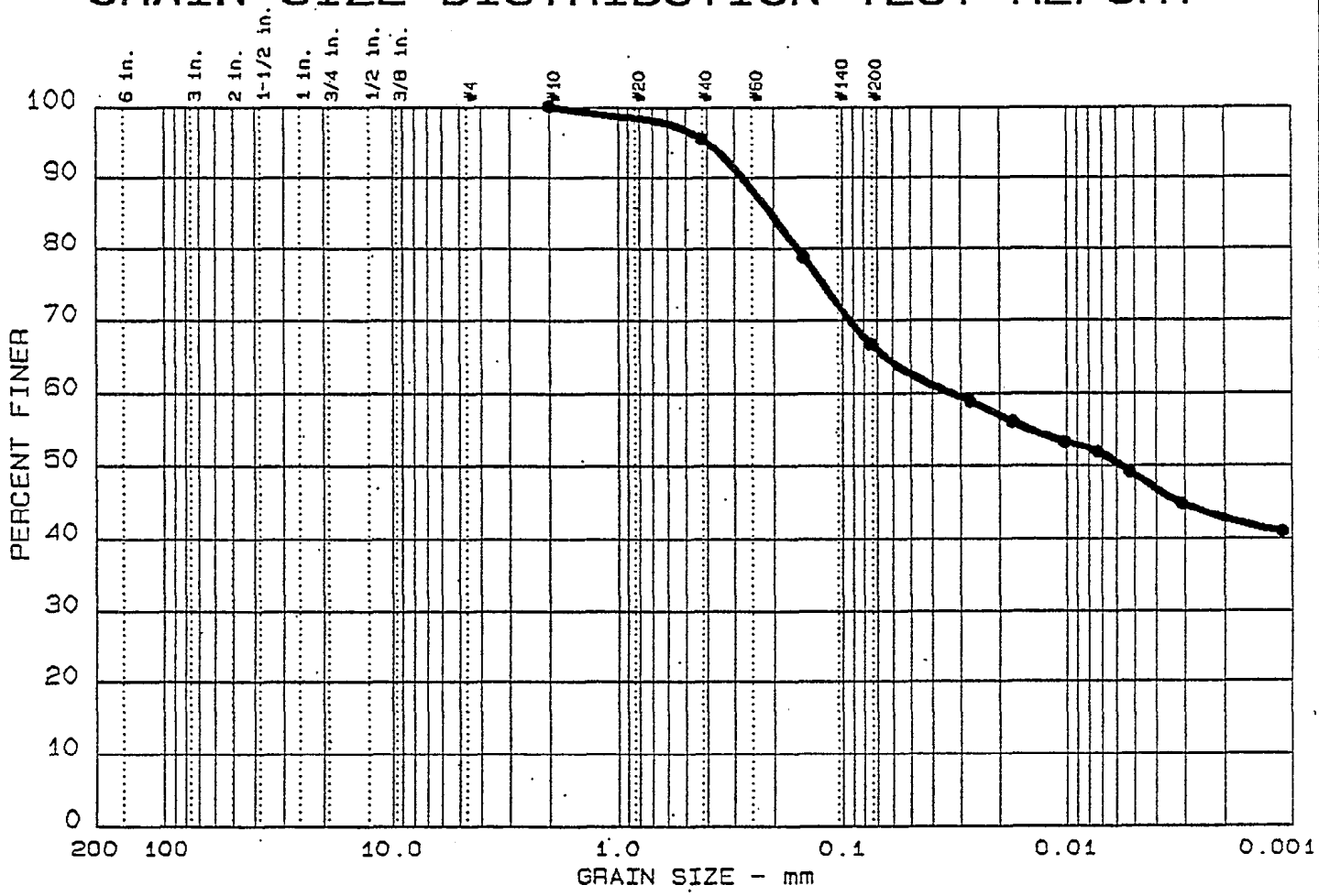
Remarks:
CLIENT: WADSWORTH/ALERT
LAB P.O. SR002232
SMPL.I.D. A-2F020039-001
67902-1-01

GRAIN SIZE DISTRIBUTION TEST REPORT

APPLIED CONSTRUCTION TECH., INC.

Figure No. 1

GRAIN SIZE DISTRIBUTION TEST REPORT



	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	0.0	33.4	18.0	48.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	41	26	0.20		0.01					

MATERIAL DESCRIPTION	USCS	AASHTO
● BROWN SILTY CLAY	CL	A-7-6 (15)

Project No.:
Project: CLIENT CODE: 039984
● Location: RECEIVED ON 6/3/92

Date: 6/15/92

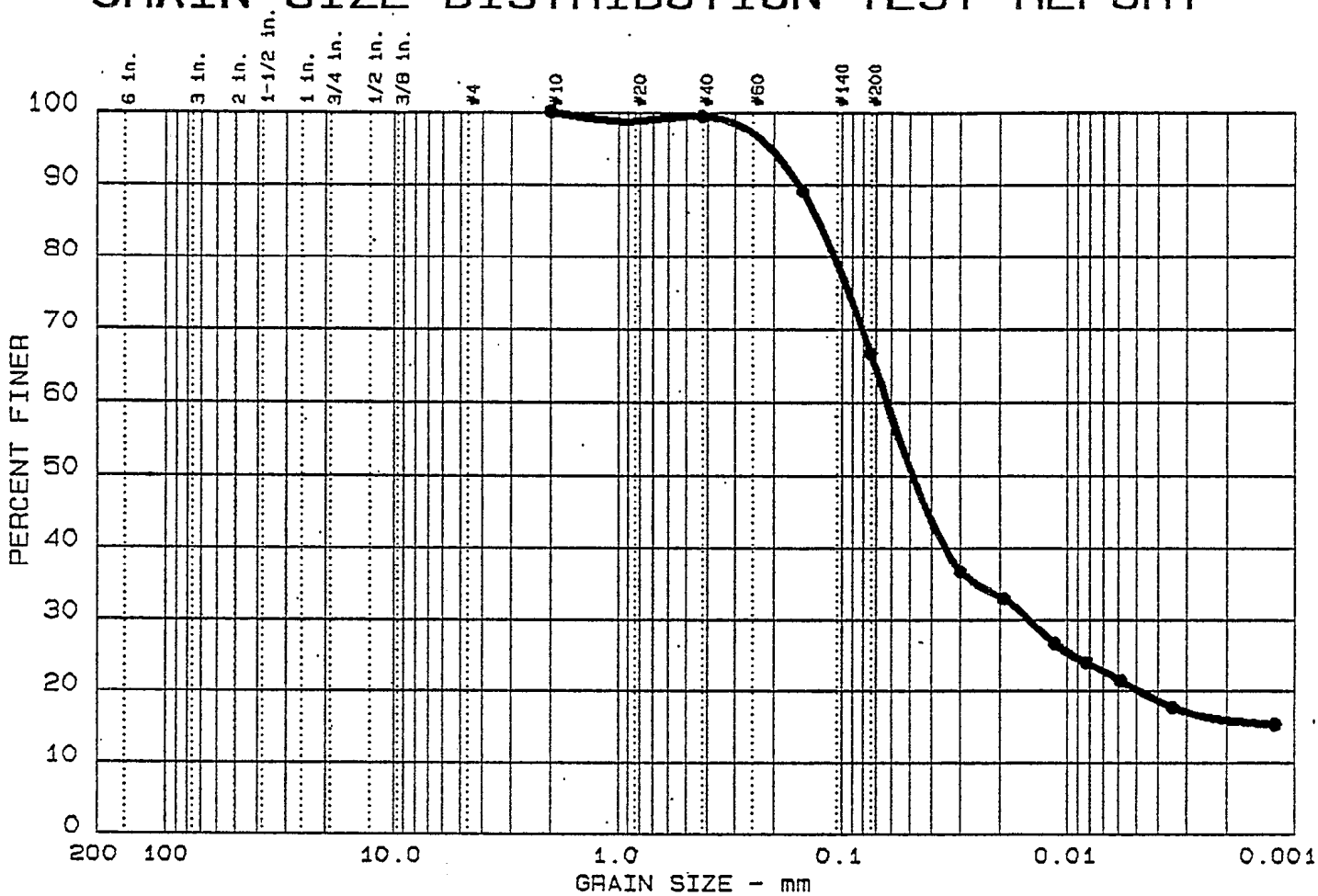
Remarks:
CLIENT: WADSWORTH/ALERT
LAB P.O. SR002232
SMPL.I.D. A-2F020039-002
67902-1-01

GRAIN SIZE DISTRIBUTION TEST REPORT

APPLIED CONSTRUCTION TECH., INC.

Figure No. 2

GRAIN SIZE DISTRIBUTION TEST REPORT



	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	0.0	33.3	46.5	20.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	33	13	0.13		0.05	0.015				

MATERIAL DESCRIPTION	USCS	AASHTO
● TAN SILTY CLAY	CL	A-6 (7)

Project No.:
Project: CLIENT CODE: 039984
◆ Location: RECEIVED ON 6/3/92

Date: 6/15/92

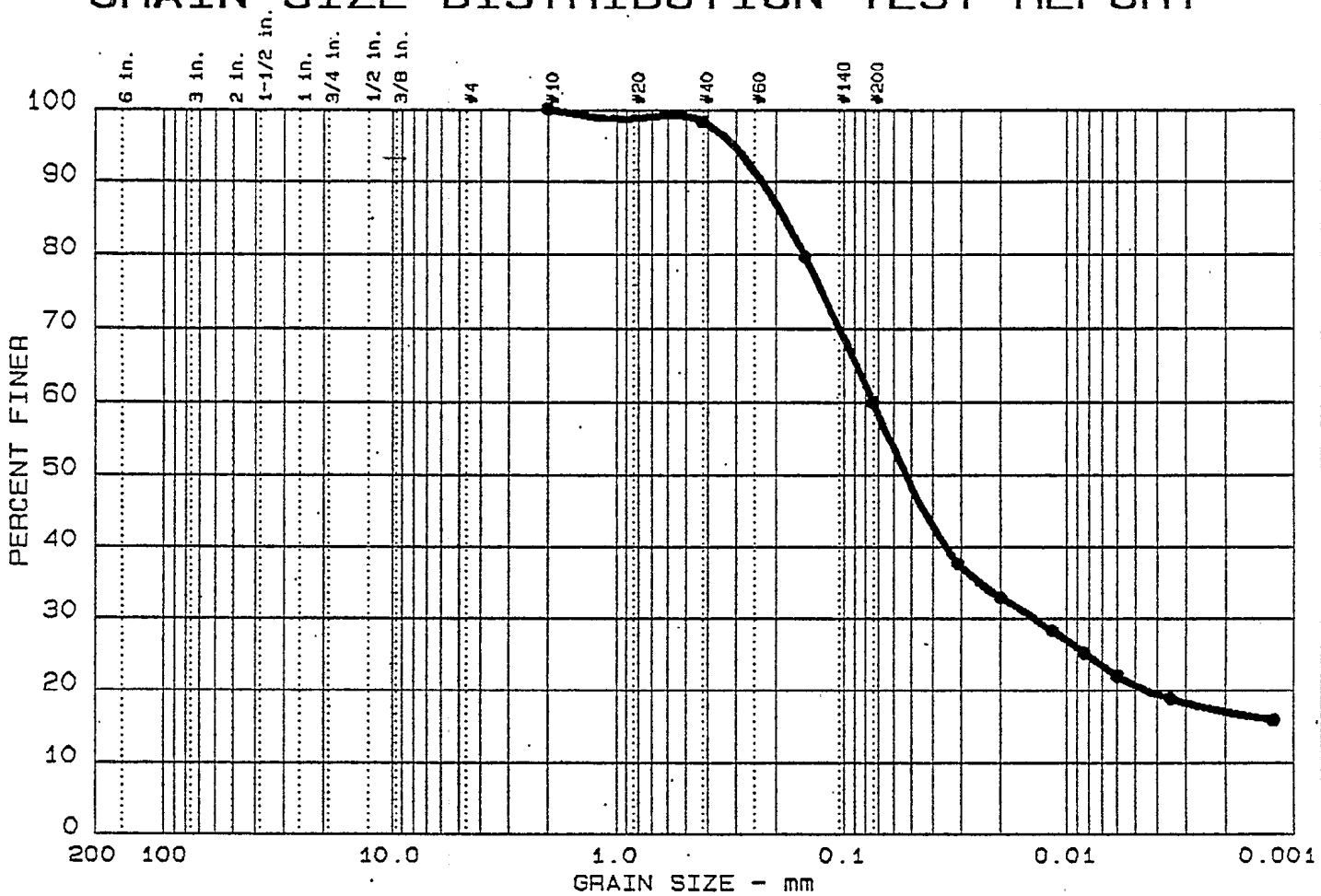
Remarks:
CLIENT: WADSWORTH/ALERT
LAB P.O. SR002232
SMPL.I.D. A-2F020039-003
67904-1-01

GRAIN SIZE DISTRIBUTION TEST REPORT

APPLIED CONSTRUCTION TECH., INC.

Figure No. 3

GRAIN SIZE DISTRIBUTION TEST REPORT



	%+75mm	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	0.0	40.0	39.3	20.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	33	15	0.18		0.05	0.014				

MATERIAL DESCRIPTION	USCS	AASHTO
● GRAYISH TAN SILTY CLAY	CL	A-6 (6)

Project No.:
Project: CLIENT CODE: 039984
● Location: RECEIVED ON 6/3/92

Date: 6/15/92

Remarks:
CLIENT: WADSWORTH/ALERT
LAB P.O. SR002232
SMPL.I.D. A-2F020039-004
67905-1-01

GRAIN SIZE DISTRIBUTION TEST REPORT

APPLIED CONSTRUCTION TECH., INC.

Figure No. 4

CLIENT CODE _____

QUOTE / SAR NUMBER _____

Chain-of Custody Record

WADSWORTH/ALERT LABORATORIES

4101 SHUFFEL DRIVE N.W. / NORTH CANTON, OHIO 44720

(216) 497-9396

№ 15374

Cooler 1 of 1

PROJ. NO.

PROJECT NAME/LOCATION: 19084-SRN

SAMPLERS: (Signature) Jeri R. Tragesser

STA. NO.	DATE	TIME	COMP.	GRAB.	STATION LOCATION	NO. OF CONTAINERS	PARAMETER	REMARKS
	5/28/92	0910		✓	GB-01	5		Selected Physical Parameters are:
	5/29/92	1042		✓	GB-02	4		
	5/28/92	1736		✓	GB-03	6		① grainsize by sieve + hydrometer (D422)
	5/27/92	1530		✓	GB-04	4		
								② Atterberg limits
								③ Moisture Content (D2216)
								④ Bulk Specific Gravity.
								Containers are ~ 8 to 12 oz each
					1 Temp Vial			

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Jeri R. Tragesser	5/1/92 1900	FEDERAL EXPRESS.			
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	
			6-2-92 1000	AIRBILL # 4347525486	

Distribution Original Accompanies Shipment. Copy returned with Report.

APPENDIX I

APPENDIX I
WATER LEVEL MEASUREMENTS AND PRECIPITATION INFORMATION

WATER LEVEL DATA

Camp Allen Landfill
Area A
Round 1 Water Levels

Well #	Date/	Time	G.W. Elevation (feet) (msl)
Deep Wells			
A-MW1B	5/17/92	1105	4.00
A-MW1C	5/20/92	0935	4.86
A-MW4B	5/20/92	0819	5.18
A-MW6B	5/17/92	0845	5.55
A-MW9B	5/16/92	1728	3.82
A-MW9C	5/16/92	1700	4.91
A-MW10B	5/17/92	1408	5.18
A-MW11B	5/17/92	1120	5.12
A-MW13B	5/20/92	0910	4.15
A-MW14B	5/20/92	0901	4.76
Shallow Wells			
A-MW4A	5/20/92	0823	6.02
A-MW5	5/17/92	0835	3.79
A-MW6A	5/17/92	0835	4.66
A-MW7	5/16/92	1645	4.05
A-MW8A	5/16/92	1800	4.16
A-MW9A	5/16/92	1720	5.44
A-MW10A	5/17/92	1406	4.43
A-MW11A	5/17/92	1118	5.68
A-MW12	5/17/92	1130	4.85
B-1W	5/16/92	1625	13.50
B-9W	5/17/92	1505	6.06
B-11W	5/17/92	1450	6.07
B-13W	5/17/92	1044	8.48
B-15WA	5/17/92	1022	4.95
B-16W	5/17/92	0955	5.79
B-17W	5/17/92	0933	6.44
B-20W	5/17/92	0913	9.71
GW-1	5/17/92	1107	5.31
GW-2	5/17/92	1435	7.63
GW-3	5/17/92	1140	5.83

Notes:

MSL - Mean Sea Level

Camp Allen Landfill

Area B

Round 1 Water Levels

Well #	Date/	Time	G.W. Elevation (feet) (msl)
Deep Wells			
B-MW2B	5/20/92	1048	6.10
B-MW3B	5/20/92	0811	6.33
B-MW5B	5/20/92	1029	7.95
B-MW8B	5/20/92	1018	5.35
B-MW9B	5/20/92	1012	5.33
B-MW11B	5/20/92	0758	5.15
Shallow Wells			
B-MW2A	5/20/92	1050	4.97
B-MW3A	5/20/92	0807	4.62
B-MW7	5/20/92	0951	5.77
B-MW8A	5/20/92	1019	6.10
B-MW9A	5/20/92	1011	5.88
B-MW10	5/20/92	1001	5.78
B-MW11A	5/20/92	0759	5.21
B-MW12	5/20/92	0756	5.19
B-MW13	5/20/92	0751	4.95
GW-4	5/20/92	1036	5.65
GW-5	5/20/92	1032	4.60
GW-6	5/20/92	1057	5.80

Notes:

MSL - Mean Sea Level

Camp Allen Landfill
Area A
Round 2 Water Levels

Well #	Date/	Time	G.W. Elevation (feet) (msl)
Deep Wells			
A-MW1B	6/8/92	1805	4.35
A-MW1C	6/8/92	1807	4.53
A-MW4B	6/8/92	1647	4.86
A-MW6B	6/8/92	1345	4.68
A-MW8B	6/8/92	1518	4.6
A-P8	6/8/92	1511	4.73
A-MW9B	6/8/92	1442	4.43
A-MW9C	6/8/92	1449	5.19
A-MW10B	6/8/92	1250	4.32
A-MW11B	6/8/92	1737	4.98
A-MW13B	6/8/92	1048	3.81
A-MW14B	6/8/92	1030	4.32
A-MW15B	6/8/92	1137	3.9
B-15WB	6/8/92	1745	4.51
Shallow Wells			
A-MW4A	6/8/92	1640	5.33
A-MW5	6/8/92	1332	3.59
A-MW6A	6/8/92	1350	4.5
A-MW7	6/8/92	1318	3.97
A-MW8A	6/8/92	1503	3.7
A-MW9A	6/8/92	1435	3.91
A-MW10A	6/8/92	1300	4.32
A-MW11A	6/8/92	1740	5.29
A-MW12	6/8/92	1800	4.64
B-?1W	6/8/92	1620	-8.48
B-?2W	6/8/92	1608	-6.74
B-?3W	6/8/92	1600	-9
B-1W	6/8/92	1632	-8.77
B-9W	6/8/92	1657	-9.48
B-11W	6/8/92	1702	-11.58
B-13W	6/8/92	1710	-9.55
B-15W	6/8/92	1740	-5.08
B-16W	6/8/92	1725	-9.74
B-17W	6/8/92	1825	-7.58
B-20W	6/8/92	1815	-5.62
B-20WSS	6/8/92	1820	-6.32
GW-1	6/8/92	1815	-9.16
GW-2	6/8/92	1727	-7.67
GW-3	6/8/92	1754	-8.7

Notes:
MSL - Mean Sea Level

Camp Allen Landfill
Area B
Round 2 Water Levels

Well #	Date/	Time	G.W. Elevation (feet) (msl)
Deep Wells			
BMW-2B	6/8/92	1120	-6.2
BMW-3B	6/8/92	1630	-4.88
BMW-5B	6/8/92	1300	-8.55
BMW-8B	6/8/92	1405	-8.5
BMW-9B	6/8/92	1445	-7.12
BMW-11B	6/8/92	1535	-4.5
Shallow Wells			
BMW-1	6/8/92	1030	-3.61
BMW-2	6/8/92	1145	-5.3
BMW-3A	6/8/92	1640	-3.88
BMW-7	6/8/92	1620	-7.3
BMW-8	6/8/92	1350	-8.52
BMW-9	6/8/92	1435	-6.94
BMW-10	6/8/92	1505	-4.12
BMW-11	6/8/92	1520	-4.54
BMW-12	6/8/92	1655	-4.4
BMW-13	6/8/92	1700	-5.08
GW-4	6/8/92	1330	-5.8
GW-5	6/8/92	1315	-5.36
GW-6	6/8/92	1100	-5.78

Notes:
MSL - Mean Sea Level

Camp Allen Landfill
Area A
Round 3 Water Levels

Well #	Date/	Time	G.W. Elevation (feet) (msl)
Deep Wells			
A-MW1B	6/14/92	1400	4.35
A-MW1C	6/14/92	833	4.53
A-MW4B	6/12/92	1430	4.86
A-MW6B	6/16/92	830	4.68
A-MW8B	6/17/92	920	4.83
A-MW9B	6/15/92	1120	4.43
A-MW9C	6/16/92	820	5.19
A-MW10B	6/18/92	1730	4.32
A-MW11B	6/13/92	835	4.98
A-MW13B	6/17/92	925	3.81
A-MW14B	6/17/92	942	4.32
A-MW15B	6/19/92	845	3.9
A-MW16B	6/19/92	745	9.58
A-MW17B	6/18/92	1210	9.05
B-15WB	6/15/92	830	4.51
Shallow Wells			
A-MW4A	6/13/92	805	5.33
A-MW5	6/14/92	1432	3.59
A-MW6A	6/16/92	1040	4.5
A-MW8A	6/17/92	1040	3.7
A-MW9A	6/15/92	925	3.91
A-MW10A	6/18/92	1610	4.32
A-MW11A	6/13/92	1304	5.29
A-MW12	6/13/92	1400	4.64
B-15WA	6/15/92	1600	4.91
B-17W	6/18/92	1215	5.72
B-1W	6/13/92	1105	4.73
B-20W	6/15/92	1655	9.57
B-20WSS	6/18/92	925	8.69
GW-1	6/14/92	1530	4.3
GW-2	6/13/92	915	7.41
GW-3	6/13/92	1246	5.58

Notes:

MSL - Mean Sea Level

These water levels were obtained prior to groundwater sampling.

Camp Allen Landfill
Area B
Round 3 Water Levels

Well #	Date/	Time	G.W. Elevation (feet) (msl)
Deep Wells			
BMW-2B	6/12/92	1405	4.84
BMW-3B	6/12/92	755	5.09
BMW-5B	6/12/92	1345	4.85
BMW-8B	6/11/92	830	5.03
BMW-9B	6/10/92	1442	5.05
BMW-11B	6/11/92	1359	5.01
Shallow Wells			
BMW-1	6/11/92	945	5.58
BMW-2A	6/12/92	1115	5.42
BMW-3A	6/12/92	950	5.42
BMW-7	6/10/92	1405	5.35
BMW-8A	6/10/92	1649	5.65
BMW-9A	6/10/92	1134	5.44
BMW-10	6/10/92	1531	5.39
BMW-11A	6/11/92	1515	5.01
BMW-12	6/11/92	1312	4.57
BMW-13	6/11/92	1422	4.67
B-MW14	6/14/92	1045	4.32
B-MW15	6/14/92	950	3.62
B-MW16	6/14/92	840	4.81
B-MW17	6/14/92	1300	4.84
GW-4	6/13/92	915	5.62
GW-5	6/12/92	1558	7.33
GW-6	6/12/92	810	5.43

Notes:

MSL - Mean Sea Level

These water levels were obtained prior to groundwater sampling.

Camp Allen Landfill

Area A

Slug Test Water Levels

Well #	Date/Time	G.W. Elevation (feet) (MSL)
A-MW1C	6/22/92 1000	5.58
A-MW8B	6/17/92 0920	4.92
A-P8	6/22/92 1518	4.6
A-MW9C	6/22/92 0820	5.15
A-MW13	6/17/92 0925	3.99
A-MW14	6/23/92 1124	4.43
A-MW15	6/19/92 0845	3.91
A-MW16	6/23/92 0745	3.56
A-MW17	6/23/92 1210	4.35
B-15WB	6/22/92 0830	4.62
B-20WSS	6/23/92 0925	3.14

Notes:

MSL - Mean Sea Level

Camp Allen Landfill
Area B
Slug Test Water Levels

Well #	Date/Time	G.W. Elevation (feet) (MSL)
BMW-8B	6/23/92 0830	5.15
BMW-9B	6/23/92 1442	5.11
BMW-11	6/23/92 1359	5.03
BMW-12	6/24/92 1312	5.09
BMW-13	6/23/92 1422	4.87
B-MW14	6/24/92 1045	4.7
B-MW15	6/24/92 0950	4.92
B-MW16	6/24/92 0840	5.11
B-MW17	6/24/92 1300	4.98

Notes:
MSL - Mean Sea Level

Camp Allen Landfill
Area A
Round 4 Water Levels

Well #	Date/	Time	G.W. Elevation (feet) (msl)
A-MW6A	6/23/92	817	4.46
A-MW6B	6/23/92	815	4.78
A-MW8A	6/23/92	726	3.26
A-MW8B	6/23/92	722	4.82
A-P8	6/23/92	723	4.56
A-MW9A	6/23/92	738	3.49
A-MW9B	6/23/92	735	4.54
A-MW9C	6/23/92	733	4.02
A-MW10A	6/23/92	1112	4.23
A-MW10B	6/23/92	1109	4.45
A-MW13B	6/23/92	943	3.85
A-MW14B	6/23/92	900	4.43
B-15W	6/23/92	754	4.87
B-15WB	6/23/92	752	3.75
B-17W	6/23/92	843	6.04
B-20W	6/23/92	830	7.59
B-20WSS	6/23/92	833	2.21

Notes:

MSL - Mean Sea Level

Water levels obtained prior to Slug Tests.

Camp Allen Landfill

Area A

Water Levels Prior to 25 Hr Pump Test

Well #	Date/	Time	G.W. Elevation (feet) (MSL)
A-MW6A	6/26/92	859	4.49
A-MW6B	6/26/92	858	4.71
A-P8	6/26/92	913	4.12
A-MW9A	6/26/92	912	3.37
A-MW9B	6/26/92	910	4.46
A-MW9C	6/26/92	909	4.97
B-15WA	6/26/92	833	4.8
B-15WB	6/26/92	832	3.95
B-17W	6/26/92	835	5.94
B-20W	6/26/92	907	7.03
B-20WSS	6/26/92	905	4.86

Notes:

MSL - Mean Sea Level

Camp Allen Landfill
Area A
Round 5 Water Levels

Well #	Date/ Time		G.W. Elevation (feet) (MSL)
Deep Wells			
A-MW1B	12/12/92	1440	5.64
A-MW1C	12/12/92	1444	5.54
A-MW4B	12/12/92	1350	6.14
A-MW6B	12/12/92	1517	5.86
A-MW8B	12/12/92	1548	5.90
A-P8	12/12/92	1552	5.65
A-MW9B	12/12/92	1600	5.61
A-MW9C	12/12/92	1605	6.22
A-MW10B	12/12/92	1655	5.53
A-MW11B	12/12/92	1335	6.09
A-MW13B	12/12/92	1635	4.86
A-MW14B	12/12/92	1644	5.49
A-MW15B	12/13/92	750	4.92
A-MW16B	12/13/92	743	4.71
A-MW17B	12/12/92	1451	5.58
B-15WB	12/12/92	1430	5.54
Shallow Wells			
A-MW4A	12/12/92	1353	7.37
A-MW5	12/12/92	1520	4.80
A-MW6A	12/12/92	1515	5.84
A-MW7	12/12/92	1730	4.93
A-MW8A	12/12/92	1545	5.60
A-MW9A	12/12/92	1555	5.45
A-MW10A	12/12/92	1700	5.34
A-MW11A	12/12/92	1330	6.05
A-MW12	12/12/92	1300	5.26
B-1W	12/12/92	1500	7.03
B-9W	12/12/92	1350	7.44
B-11W	12/12/92	1400	7.05
B-13W	12/12/92	1415	10.01
B-15WA	12/12/92	1425	6.69
B-16W	12/12/92	1420	6.62
B-17W	12/12/92	1422	7.28
B-20W	12/12/92	1538	11.27
B-20WSS	12/12/92	1542	8.07
GW-1	12/12/92	1442	5.57
GW-2	12/12/92	1340	7.56
GW-3	12/12/92	1255	6.21

Notes:

MSL - Mean Sea Level

Camp Allen Landfill

Area B

Round 5 Water Levels

Well #	Date/	Time	G.W. Elevation (feet) (MSL)
Deep Wells			
B-MW2B	12/12/92	905	6.30
B-MW3B	12/12/92	1052	6.23
B-MW5B	12/12/92	925	6.20
B-MW8B	12/12/92	910	6.18
B-MW9B	12/12/92	1010	6.14
B-MW11B	12/12/92	1035	6.13
Shallow Wells			
B-MW1	12/12/92	1125	7.29
B-MW2A	12/12/92	900	7.69
B-MW3A	12/12/92	1048	6.88
B-MW7	12/12/92	1320	6.64
B-MW8A	12/12/92	915	6.44
B-MW9A	12/12/92	955	6.38
B-MW10	12/12/92	1020	6.78
B-MW11A	12/12/92	1030	6.27
B-MW12	12/12/92	1115	6.29
B-MW13	12/12/92	1105	6.21
B-MW14	12/12/92	1135	6.14
B-MW15	12/12/92	1155	5.76
B-MW16	12/12/92	1200	6.04
B-MW17	12/12/92	1205	5.94
GW-4	12/12/92	850	6.86
GW-5	12/12/92	845	9.93
GW-6	12/12/92	805	9.81

Notes:

MSL - Mean Sea Level

Camp Allen Landfill
Area A
Round 6 Water Levels

Well #	Date/ Time		G.W. Elevation (feet) (MSL)
Shallow Wells			
A-MW4A	12/17/92	1041	7.31
A-MW5	12/17/92	1127	4.31
A-MW6A	12/17/92	1131	5.56
A-MW7	12/17/92	1120	4.43
A-MW8A	12/17/92	1058	5.46
A-MW9A	12/17/92	1105	5.50
A-MW10A	12/17/92	1021	5.27
A-MW11A	12/17/92	1054	6.01
A-MW12	12/17/92	1007	5.07
B-1W	12/17/92	1132	7.22
B-9W	12/17/92	1039	7.54
B-11W	12/17/92	1036	7.11
B-13W	12/17/92	1033	9.50
B-15WA	12/17/92	1025	6.48
B-16W	12/17/92	1031	7.04
B-17W	12/17/92	1028	7.03
B-20W	12/17/92	1114	11.07
B-20WSS	12/17/92	1116	8.01
GW-1	12/17/92	1014	5.13
GW-2	12/17/92	1048	7.65
GW-3	12/17/92	1003	6.19
Deep Wells			
A-MW1B	12/17/92	1015	5.32
A-MW1C	12/17/92	1013	5.55
A-MW4B	12/17/92	1043	6.06
A-MW6B	12/17/92	1129	6.80
A-MW8B	12/17/92	1100	5.83
A-P8	12/17/92	1102	5.56
A-MW9B	12/17/92	1107	5.55
A-MW9C	12/17/92	1109	6.11
A-MW10B	12/17/92	1023	5.45
A-MW11B	12/17/92	1052	6.01
A-MW13B	12/17/92	1012	4.80
A-MW14B	12/17/92	1017	5.40
A-MW15B	12/17/92	1052	4.64
A-MW16B	12/17/92	1048	4.30
A-MW17B	12/17/92	1041	5.29
A-MW18B	12/18/92	1055	5.23
A-MW19B	12/18/92	800	5.74
B-15WB	12/17/92	1146	4.52

Notes:
MSL - Mean Sea Level

Camp Allen Landfill
Area B
Round 6 Water Levels

Well #	Date/ Time		G.W. Elevation (feet) (MSL)
Shallow Wells			
B-MW1	12/17/92	939	6.75
B-MW2A	12/17/92	819	7.10
B-MW3A	12/17/92	902	6.62
B-MW7	12/17/92	953	6.53
B-MW8A	12/17/92	838	6.49
B-MW9A	12/17/92	845	6.49
B-MW10	12/17/92	852	6.67
B-MW11A	12/17/92	855	6.15
B-MW12	12/17/92	907	6.25
B-MW13	12/17/92	905	6.13
B-MW14	12/17/92	934	6.06
B-MW15	12/17/92	939	4.58
B-MW16	12/17/92	934	5.85
B-MW17	12/17/92	915	5.71
B-MW18A	12/17/92	813	7.05
B-MW19A	12/17/92	830	6.71
GW-4	12/17/92	824	6.61
GW-5	12/17/92	836	8.68
GW-6	12/17/92	810	7.22
Deep Wells			
B-MW2B	12/17/92	816	6.19
B-MW3B	12/17/92	901	6.18
B-MW5B	12/17/92	834	6.14
B-MW8B	12/17/92	841	6.15
B-MW9B	12/17/92	848	6.12
B-MW11B	12/17/92	857	6.09
B-MW19B	12/17/92	828	6.18

Notes:
MSL - Mean Sea Level

Camp Allen Landfill
Area A
Round 7 Water Levels

Well #	Date/	Time	G.W. Elevation (feet) (msl)
Shallow Wells			
A-MW4A	1/26/93	933	8.27
A-MW5	1/26/93	1216	4.54
A-MW6A	1/26/93	1213	6.04
A-MW7	1/26/93	1151	4.49
A-MW8A	1/26/93	1025	5.26
A-MW9A	1/26/93	1019	5.32
A-MW10A	1/26/93	1031	5.71
A-MW11A	1/26/93	926	6.45
A-MW12	1/26/93	918	5.23
B-1W	1/26/93	1157	7.98
B-2	1/26/93	1200	No Water
B-3	1/26/93	1203	8.24
B-4W	1/26/93	1205	8.89
B-5W	1/26/93	1210	No Access
B-6	1/26/93	1222	8.36
B-7W	1/26/93	1225	8.04
B-8	1/26/93	1045	No Water
B-9W	1/26/93	1029	8.39
B-10	1/26/93	1042	12.67
B-11W	1/26/93	1033	8.60
B-12	1/26/93	1038	11.54
B-13W	1/26/93	913	10.33
B-15WA	1/26/93	905	6.81
B-16W	1/26/93	911	8.06
B-17W	1/26/93	908	5.34
B-20W	1/26/93	1011	11.48
B-20WSS	1/26/93	1010	9.41
GW-1	1/26/93	859	5.67
GW-2	1/26/93	928	8.60
GW-3	1/26/93	922	6.53
Deep Wells			
A-MW1B	1/26/93	855	5.69
A-MW1C	1/26/93	901	5.98
A-MW4B	1/26/93	934	6.62
A-MW6B	1/26/93	1212	6.34
A-MW8B	1/26/93	1023	6.35
A-P8	1/26/93	1022	6.09
A-MW9B	1/26/93	1016	6.04
A-MW9C	1/26/93	1014	6.67
A-MW10B	1/26/93	1129	5.92
A-MW11B	1/26/93	924	6.49
A-MW13B	1/26/93	1140	5.28
A-MW14B	1/26/93	1124	5.56
A-MW15B	1/26/93	847	4.76
A-MW16B	1/26/93	843	4.32
A-MW17B	1/26/93	831	5.63
A-MW18B	1/26/93	834	5.66
A-MW19B	1/26/93	915	6.23
B-15WB	1/26/93	904	6.16

Notes:
MSL - Mean Sea Level

Camp Allen Landfill

Area B

Round 7 Water Levels

Well #	Date/	Time	G.W. Elevation (feet) (msl)
Shallow Wells			
B-MW1	1/26/93	744	7.12
B-MW2A	1/26/93	654	7.54
B-MW3A	1/26/93	731	5.90
B-MW7	1/26/93	812	7.05
B-MW8A	1/26/93	712	6.86
B-MW9A	1/26/93	714	6.88
B-MW10	1/26/93	722	6.99
B-MW11A	1/26/93	725	6.33
B-MW12	1/26/93	737	6.39
B-MW13	1/26/93	745	Buried
B-MW14	1/26/93	754	6.36
B-MW15	1/26/93	750	5.69
B-MW16	1/26/93	747	6.03
B-MW17	1/26/93	800	5.92
B-MW18A	1/26/93	703	7.60
B-MW19A	1/26/93	705	7.11
GW-4	1/26/93	651	6.86
GW-5	1/26/93	648	8.79
GW-6	1/26/93	700	7.83
Deep Wells			
B-MW2B	1/26/93	657	6.69
B-MW3B **	1/26/93	734	6.61
B-MW5B	1/26/93	646	6.56
B-MW8B	1/26/93	711	6.59
B-MW9B	1/26/93	718	6.56
B-MW11B	1/26/93	728	6.55
B-MW19B	1/26/93	706	6.64

Notes:

* - Buried by recent excavation

** - Standing water above flushmount cap

MSL - Mean Sea Level

Camp Allen Landfill RI/FS
Rainfall Gauge Readings

Date	Daily Rainfall (in)	Cumulative Rainfall (in)
4/28/92	0.00	0.00
4/29/92	0.00	0.00
4/30/92	0.00	0.00
5/01/92	0.13	0.13
5/02/92	0.00	0.13
5/03/92	0.00	0.13
5/04/92	0.00	0.13
5/05/92	0.03	0.16
5/06/92	0.33	0.49
5/11/92	1.48	1.97
5/12/92	0.00	1.97
5/13/92	0.00	1.97
5/14/92	0.00	1.97
5/15/92	0.00	1.97
5/16/92	0.00	1.97
5/17/92	0.06	2.03
5/18/92	0.00	2.03
5/19/92	0.07	2.10
5/20/92	0.10	2.20
5/26/92	0.07	2.27
5/27/92	0.63	2.90
5/28/92	0.00	2.90
5/29/92	0.00	2.90
5/30/92	0.35	3.25
6/01/92	0.93	4.18
6/02/92	0.00	4.18
6/03/92	0.00	4.18
6/08/92	1.18	5.36
6/09/92	0.00	5.36
6/10/92	0.93	6.29
6/11/92	0.00	6.29
6/12/92	0.00	6.29
6/13/92	0.00	6.29
6/14/92	0.00	6.29
6/15/92	0.00	6.29
6/16/92	0.00	6.29
6/17/92	0.00	6.29
6/18/92	0.00	6.29
6/19/92	0.00	6.29
6/22/92	0.78	7.07
6/23/92	0.00	7.07
6/24/92	0.00	7.07
6/25/92	0.00	7.07
6/26/92	0.00	7.07

Camp Allen Landfill RI/FS
Rainfall Gauge Readings

Date	Daily Rainfall (in)	Cumulative Rainfall (in)
4/28/92	0.00	0.00
4/29/92	0.00	0.00
4/30/92	0.00	0.00
5/01/92	0.13	0.13
5/02/92	0.00	0.13
5/03/92	0.00	0.13
5/04/92	0.00	0.13
5/05/92	0.03	0.16
5/06/92	0.33	0.49
5/11/92	1.48	1.97
5/12/92	0.00	1.97
5/13/92	0.00	1.97
5/14/92	0.00	1.97
5/15/92	0.00	1.97
5/16/92	0.00	1.97
5/17/92	0.06	2.03
5/18/92	0.00	2.03
5/19/92	0.07	2.10
5/20/92	0.10	2.20
5/26/92	0.07	2.27
5/27/92	0.63	2.90
5/28/92	0.00	2.90
5/29/92	0.00	2.90
5/30/92	0.35	3.25
6/01/92	0.93	4.18
6/02/92	0.00	4.18
6/03/92	0.00	4.18
6/08/92	1.18	5.36
6/09/92	0.00	5.36
6/10/92	0.93	6.29
6/11/92	0.00	6.29
6/12/92	0.00	6.29
6/13/92	0.00	6.29
6/14/92	0.00	6.29
6/15/92	0.00	6.29
6/16/92	0.00	6.29
6/17/92	0.00	6.29
6/18/92	0.00	6.29
6/19/92	0.00	6.29
6/22/92	0.78	7.07
6/23/92	0.00	7.07
6/24/92	0.00	7.07
6/25/92	0.00	7.07
6/26/92	0.00	7.07

Camp Allen Landfill RI/FS
Round 3 Rainfall Readings

Date	Daily Rainfall (in)	Cumulative Rainfall (in)
12/07/92	0.000	31.445
12/08/92	0.000	31.445
12/09/92	0.000	31.445
12/10/92	0.005	31.450
12/11/92	1.860	33.310
12/12/92	0.190	33.500
12/13/92	0.040	33.540
12/14/92	0.000	33.540
12/15/92	0.000	33.540
12/16/92	0.000	33.540
12/17/92	0.000	33.540
12/18/92	0.020	33.560
Total Rainfall (in.)		2.115

Camp Allen Landfill RI/FS

Rainfall Gauge Readings

Date	Daily Rainfall (in)	Cumulative Rainfall (in)
1/1/93	0.00	0.00
1/2/93	0.00	0.00
1/3/93	0.00	0.00
1/4/93	0.00	0.00
1/5/93	0.59	0.59
1/6/93	0.60	1.19
1/7/93	0.16	1.35
1/8/93	0.64	1.99
1/9/93	0.99	2.98
1/10/93	0.15	3.13
1/11/93	0.18	3.31
1/12/93	0.80	4.11
1/13/93	0.30	4.41
1/14/93	0.00	4.41
1/15/93	0.00	4.41
1/16/93	0.85	5.26
1/17/93	0.00	5.26
1/18/93	0.00	5.26
1/19/93	trace	5.26
1/20/93	0.00	5.26
1/21/93	0.29	5.55
1/22/93	0.11	5.66
1/23/93	0.00	5.66
1/24/93	0.16	5.82
1/25/93	0.00	5.82
1/26/93	0.00	5.82
1/27/93	0.00	5.82
1/28/93	0.00	5.82
1/29/93	0.00	5.82
1/30/93	0.00	5.82
1/31/93	0.00	5.82

APPENDIX J

APPENDIX J
SLUG TEST INFORMATION

APPENDIX J

SLUG TESTS

J.1 Introduction

In-situ hydraulic conductivity tests (falling and rising head slug tests) were performed at seven shallow monitoring wells and 13 deep monitoring wells at the Camp Allen Landfill between June 22 and 24, 1992. The purpose of these tests was to develop estimates of the hydrogeologic parameters of the site, specifically, hydraulic conductivity and storativity.

This appendix presents the results of the slug tests beginning with a brief discussion of the field and analytical procedures (Sections J.2 and J.3). The results of the slug tests conducted on the shallow monitoring wells are given in Section J.4. The results from the deep wells are presented in Section J.5. Supporting data and calculations are included as Attachments J-1 and J-2.

J.2 Field Procedures

Falling and rising head slug tests were conducted on the following newly installed monitoring wells at the Camp Allen Landfill:

Shallow Aquifer

Area A	Area B	
B-20WSS	B-MW12	B-MW15
	B-MW13	B-MW16
	B-MW14	B-MW17

Deep Aquifer (Yorktown)

Area A		Area B
A-MW1C	A-MW9C	B-MW8B
B-15WB	A-MW8B	B-MW9B
A-P8	A-MW13B	B-MW11B
A-MW14B	A-MW15B	
A-MW16B	A-MW17B	

The slug tests were conducted in general accordance with the Final Work Plan (Baker, April 23, 1992) by placement (for the falling head tests) or removal (rising head tests) of either

a three or six foot, 1.5 inch diameter teflon slug in the well. Water levels were measured with In-Situ Environmental, Inc. Hermit 2000 Data Logger equipped with a pressure transducer. Water levels were recorded prior to placement of the slug in the well until equilibrium was attained after removal of slug from the well. Data from the data loggers were downloaded onto computer disks for subsequent evaluation as discussed in Section J.3.

J.3 Data Evaluation

The slug test data were evaluated using the Geraghty & Miller AQTESOLV (Version 1.10) computer program. This program is designed to estimate aquifer parameters from either slug test or aquifer (pumping) test data.

For slug test data from the shallow monitoring wells, the version of the Bouwer and Rice method that was incorporated into the AQTESOLV program was used to calculate the hydraulic conductivity (K). A modified Bouwer and Rice method (1989) was used to calculate hydraulic conductivity for two of the shallow wells where the water table was within the screened zone of the well. The transmissivity for the shallow wells was calculated from the hydraulic conductivity using the following equation:

$$T = Kb$$

Where:

- T = transmissivity (gallons per day per foot or GPD/ft)
- K = hydraulic conductivity (GPD/ft^2)
- b = saturated thickness of the aquifer (estimated at 9 feet for Area A and 17 feet for Area B)

The AQTESOLV program also was used in the analysis of data collected from slug tests conducted on the deep monitoring wells. The version of the Cooper et al. method incorporated in the program was used to calculate transmissivity and storativity. Hydraulic conductivity was estimated using the above equation and an estimated saturated thickness of 88.6 feet.

For all wells that were tested, the calculated values of T, K, and/or S for the corresponding rising and falling head tests were averaged by well. These averages, by well, then were used to estimate aquifer-wide ranges and averages for T, K and/or S. The results of these calculations are presented in Sections J.4 and J.5.

For consistency, hydraulic conductivity is presented in units of gallons per day per square foot (GPD/ft^2); transmissivity is presented in units of gallons per day per foot (GPD/ft); storativity is dimensionless.

J.4 Shallow Monitoring Well Slug Test Results

Slug tests were performed in shallow monitoring wells at both Areas A and B of the Camp Allen Landfill. The following sections discuss the results of these tests by Area.

J.4.1 Shallow Monitoring Well Slug Test Results - Area A

A falling and rising head slug test was performed on the newly installed monitoring well B-20WSS on June 22, 1992. This well is screened in the upper (shallow) aquifer located in Area A of the Camp Allen Landfill. Evaluation of the falling head test results using the AQTESOLV program (Bouwer and Rice method) yielded a hydraulic conductivity (K) of 259 GPD/ft^2. For comparison with other slug test results presented in this Appendix and aquifer test results given in Appendix H, the transmissivity (T) was calculated from K using an estimated saturated thickness of 9.0 feet. This calculation yielded a transmissivity (T) of approximately 2300 GPD/ft. Evaluation of the rising head test resulted in a hydraulic conductivity of 187 GPD/ft^2 and a corresponding estimated transmissivity of 1700 GPD/ft. From these results the average transmissivity for this well is calculated to be approximately 2,000 GPD/ft. This value is typical of a silty sand to sand (Freeze and Cherry, 1979) as indicated by the boring logs for this well (refer to Appendix H for boring logs). These calculations are summarized in Table J-1 and presented in detail in Attachment J-1.

J.4.2 Shallow Monitoring Well Slug Test Results - Area B

Falling and rising head slug tests were performed on six shallow monitoring wells (B-MW12, B-MW13, B-MW14, B-MW15, B-MW16, and BMW-17) in Area B between June 22 and 24, 1992.

The AQTESOLV program was used as a means of estimating hydraulic conductivity for four of the six monitoring wells. The rising head test data for monitoring wells B-MW12 and B-MW13 was evaluated by hand using a version of the Bouwer and Rice method (1989) modified to account for a water table within the screened interval of the well. For comparison with other slug test results presented in this Appendix and aquifer test results given in

TABLE J-1

Slug Test Results
Shallow Unconfied Aquifer

WELL NO.	HYDRAULIC CONDUCTIVITY (K) (ft/min)	HYDRAULIC CONDUCTIVITY (K) (GPD/ft^2)	AVERAGE HYDRAULIC CONDUCTIVITY (GPD/ft^2)	TRANSMISSIVITY* (T) (GPD/ft)	AVERAGE TRANSMISSIVITY* (T) (GPD/ft)
Area A					
B-20WSSR *	1.73E-02	187	223	1700	2000
B-20WSSF *	2.40E-02	259		2300	
Area B					
B-MW12R **	6.74E-02	726	726	12300	12300
B-MW13R **	1.94E-02	209	209	3600	3600
B-MW14R *	1.84E-03	20	19	300	300
B-MW14F *	1.77E-03	19		300	
B-MW15R *	1.91E-04	2	2	30	30
B-MW15F *	2.15E-04	2		30	
B-MW16R *	1.92E-03	21	20	400	400
B-MW16F *	1.87E-03	20		400	
B-MW17R *	1.32E-02	142	74	2400	1240
B-MW17F *	4.91E-04	5		80	

Notes:

* Bouwer and Rice method using Aqtesolv.

** Bouwer and Rice method (modified).

The suffix R following the well number denotes a rising head test.

The suffix F following the well number denotes a falling head test.

The transmissivity is based on a saturated thickness of 9.0 feet for Area A and 17 feet for Area B and has been rounded to the nearest 10 or 100, as appropriate.

Appendix H, the transmissivity (T) was calculated from K using an estimated saturated thickness of 17 feet. The saturated thickness was estimated from the midpoint of the elevation of deeper wells located near the slug-tested wells. The results of these tests are summarized in Table J-1 and presented in detail in Attachment J-1.

The results of the rising and falling head slug tests were averaged by well as shown on Table J-1. The transmissivity ranged from 30 GPD/ft in monitoring well B-MW15 to 12300 GPD/ft in monitoring well B-MW12. The transmissivities appear to fall into two different ranges: less than 1000 and greater than 1000. For the lower transmissivity values, the average is about 200 GPD/ft. This is within a typical range for a sandy silt. For the higher transmissivity values, the average is about 5700 GPD/ft. This is more typical of a sand.

J.4.3 Summary of Shallow Monitoring Well Slug Test Results

As identified on Table J-1, there appears to be two ranges and two corresponding averages for the shallow aquifer transmissivity (Areas A and B combined). These are summarized below:

Transmissivity Range	Average Transmissivity
30 GPD/ft to 400 GPD/ft	200 GPD/ft
1,200 GPD/ft to 12,300 GPD/ft	4,800 GPD/ft

J.5 Deep Monitoring Well Slug Test Results

Slug tests were performed in deep monitoring wells at both Areas A and B of the Camp Allen Landfill. The following sections discuss the results of these tests by Area.

J.5.1 Deep Monitoring Well Slug Test Results - Area A

Falling and rising head slug tests were performed on ten deep monitoring wells (A-MW1C, A-MW9C, B-15WB, A-MW8B, A-P8, A-MW13B, A-MW14B, A-MW15B, A-MW16B, and A-MW17B) in Area A between June 22 and 24, 1992. The AQTESOLV program (employing the Cooper et al. method) was used as a means of estimating transmissivity and storativity (S). For comparison with other slug test results presented in this Appendix and aquifer test results given in Appendix M, the hydraulic conductivity was calculated from the transmissivity using an estimated saturated thickness of 88.6 feet. Time drawdown graphs, calculations, and AQTESOLV printouts are given in Attachment J-2. The results are summarized in Table J-2.

TABLE J-2

Slug Test Results
Yorktown Aquifer

WELL NO.	TRANSMISSIVITY (T) (ft^2/min)	(GPD/ft)	AVERAGE TRANSMISSIVITY (GPD/ft)	AVERAGE HYDRAULIC CONDUCTIVITY (GPD/ft^2)	STORATIVITY (S)	AVERAGE STORATIVITY
Area A						
A-MW1CR	1.09E-01	1,200	1,300	20	4.90E-06	5.84E-06
A-MW1CF	1.29E-01	1,400			6.78E-06	
A-MW8BR	1.62E+00	17,400	25,600	300	1.00E-08	1.00E-08
A-MW8BF	3.14E+00	33,800			1.00E-08	
A-P8R	1.32E+00	14,200	10,200	100	9.90E-09	9.95E-09
A-P8F	5.79E-01	6,200			1.00E-08	
A-MW9CR	8.52E-05	1	1	0.01	1.32E-03	1.32E-03
A-MW9CF	---	---			---	
A-MW13BR	3.53E-01	3,400	5,950	50	1.00E-08	1.00E-08
A-MW13BF	7.88E-01	8,500			1.00E-08	
A-MW14BR	6.74E-01	7,300	7,550	100	1.00E-08	1.00E-08
A-MW14BF	7.22E-01	7,800			1.00E-08	
A-MW15BR	1.02E+00	11,000	8,750	100	1.00E-08	6.89E-09
A-MW15BF	6.30E-01	6,500			3.77E-09	
A-MW17BR	---	---	4,200	50	---	1.18E-05
A-MW17BF	3.91E-01	4,200			1.18E-05	
B-15WBR	9.28E-04	10	6	0.05	2.08E-03	1.52E-03
B-15WBF	9.35E-05	1			9.50E-04	
Area B						
B-MW8BR	1.62E-01	1,700	1,650	20	1.97E-07	3.56E-06
B-MW8BF	1.46E-01	1,600			6.91E-06	
B-MW9BR	5.84E-02	600	3,450	50	8.61E-04	4.30E-04
B-MW9BF	5.86E-01	6,300			1.00E-08	
B-MW11BR	2.68E-01	2,900	5,500	50	1.00E-08	1.00E-08
B-MW11BF	7.53E-01	8,100			1.00E-08	

Notes:

Calculations performed using Aqtesolv's Cooper et. al. Method.

The suffix R following the well number denotes a rising head test.

The suffix F following the well number denotes a falling head test.

The hydraulic conductivity is based on a saturated thickness of 88.6 feet.

The T and K values have been rounded to the nearest multiple of 10, as appropriate.

Three of the wells, A-MW1C, A-MW9C and B-15WB were screened near the base of the Yorktown Aquifer. The other seven wells, A-MW8B, A-P8, A-MW13B, A-MW14B, A-MW15B, A-MW16B and A-MW17B were screened near the top of the Yorktown Aquifer.

The calculated transmissivities for two of the three wells screened near the base of the Yorktown Aquifer (A-MW9C and B-15WB) generally fall into the 1 GPD/ft to 5 GPD/ft range with an approximate average of 3 GPD/ft/ This is typical of a clay to silty clay. The transmissivity of A-MW1C was substantially greater, 1300 GPD/ft.

The transmissivities for the wells screened near the top of the Yorktown Aquifer generally fall into two ranges as shown on Table J-2. The lower T ranges from 4,200 GPD/ft for monitoring well A-MW17 to 8,750 GPD/ft for well A-MW15 with an average of 6,450 GPD/ft. The upper T range extends from 10,200 to 25,600 GPD/ft for wells A-P8 and A-MW8, respectively with an average of 17,900 GPD/ft. Both ranges are typical of a silty sand to sandy material.

The average storativities for these ten wells range over six orders of magnitude from 1.52×10^{-3} to 6.88×10^{-9} with an average of 2.86×10^{-4}. This average storativity is in the typical range of 5×10^{-3} to 5×10^{-5} (Freeze and Cheery, 1979) for confined or semi-confined aquifers.

J.5.2 Deep Monitoring Well Slug Test Results - Area B

Falling and rising head slug tests were performed on three deep monitoring wells in Area B between June 22 and 24, 1992. These wells include B-MW8, B-MW9 and B-MW11. The AQTESOLV program (employing the Cooper et al. method) was used as a means of estimating transmissivity and storativity. For comparison with other slug test results presented in this Appendix and aquifer test results given in Appendix M, the hydraulic conductivity (K) was calculated from the transmissivity (T) using an estimated saturated thickness of 88.6 feet. Time drawdown graphs, calculations, and Aqtesolv printouts are given in Attachment J-2. The results are summarized in Table J-2.

The calculated transmissivities for these three wells range from 1,650 GPD/ft to 5,500 GPD/ft with an average of 3,550 GPD/ft, typical of a silty sand to sand. The storativities for these wells range from 4.30×10^{-4} to 1.00×10^{-8}, with an average of 1.44×10^{-4}. This is within the

typical range for confined to semi-confined aquifers. These ranges are comparable to those calculated for the deep monitoring wells in Area A.

J.5.3 Summary of Deep Monitoring Well Slug Test Results

As identified on Table J-2, there appears to be three ranges for the deep aquifer transmissivity. These ranges are summarized below:

Transmissivity Range	Average Transmissivity
1 to 5 GPD/ft	3 GPD/ft
1,300 to 8,750 GPD/ft	4,900 GPD/ft*
10,200 to 25,660 GPD/ft	17,900 GPD/ft

* Includes both Areas A and B

J.6 References

Remedial Investigation/Feasibility Study for Camp Allen Landfill (Areas A and B), Norfolk Naval Base, Norfolk, Virginia, Final Work Plan, Baker Environmental, Inc. (April 1992).

Bouwer, H., 1989. "The Bouwer and Rice Slug Test -- An Update," Ground Water, Vol. 27, No. 3, pp. 304-309 (also see Discussion: Vol. 27, No. 5, p. 175).

AQTESOLV, Geraghty & Miller Modeling Group, Version 1.10.

Attachment J-1

Slug Test Results and Supporting Calculations for the Shallow Aquifer

Slug Test Results
Shallow Unconfied Aquifer

WELL NO.	HYDRAULIC CONDUCTIVITY (K) (ft/min)	HYDRAULIC CONDUCTIVITY (K) (GPD/ft^2)	AVERAGE HYDRAULIC CONDUCTIVITY (GPD/ft^2)	TRANSMISSIVITY* (T) (GPD/ft)	AVERAGE TRANSMISSIVITY* (T) (GPD/ft)
Area A					
B-20WSSR *	1.73E-02	187	223	1700	2000
B-20WSSF *	2.40E-02	259		2300	
Area B					
B-MW12R **	6.74E-02	726	726	12300	12300
B-MW13R **	1.94E-02	209	209	3600	3600
B-MW14R *	1.84E-03	20	19	300	300
B-MW14F *	1.77E-03	19		300	
B-MW15R *	1.91E-04	2	2	30	30
B-MW15F *	2.15E-04	2		30	
B-MW16R *	1.92E-03	21	20	400	400
B-MW16F *	1.87E-03	20		400	
B-MW17R *	1.32E-02	142	74	2400	1240
B-MW17F *	4.91E-04	5		80	

Notes:

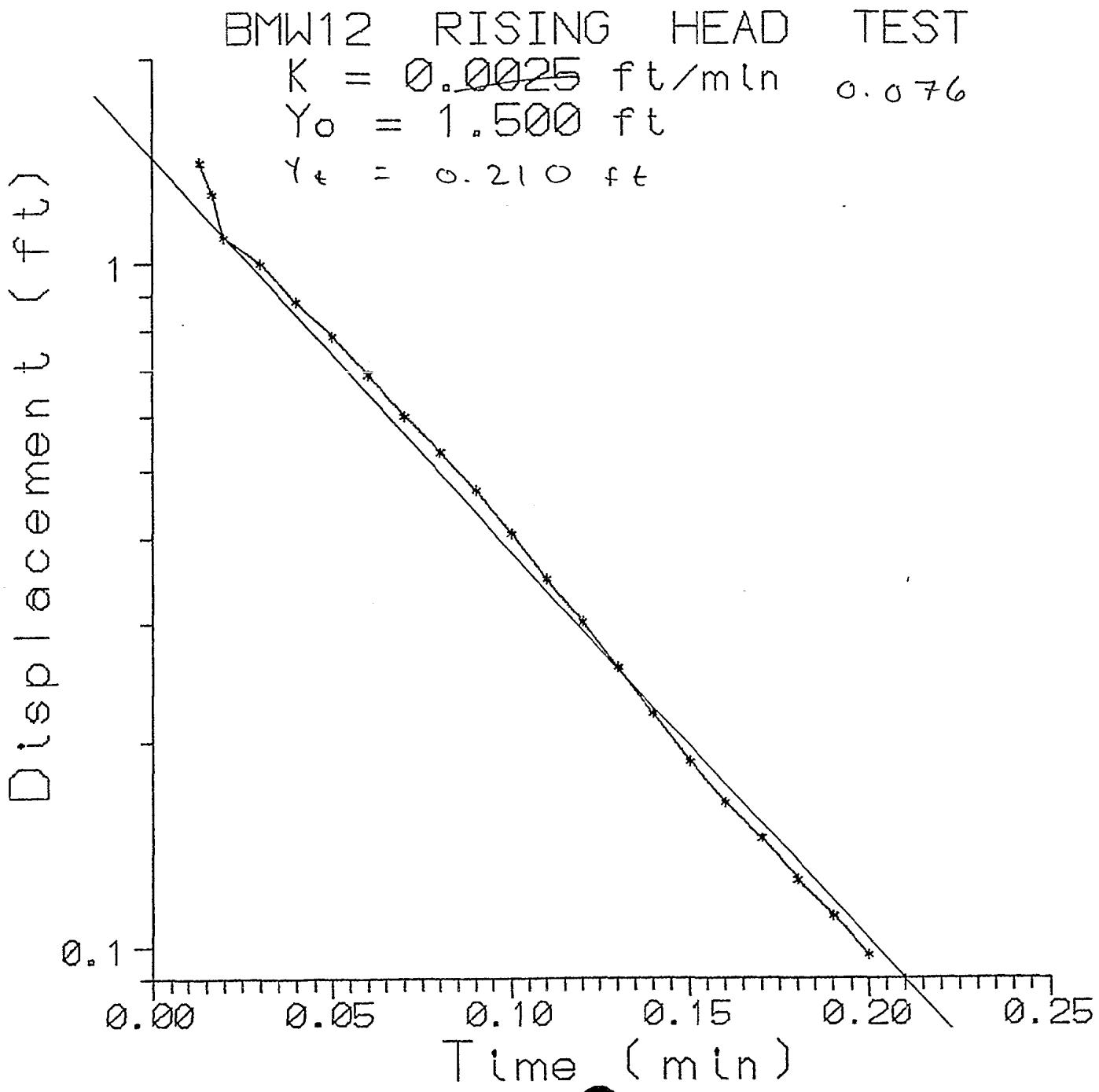
* Bouwer and Rice method using Aqtesolv.

** Bouwer and Rice method (modified).

The suffix R following the well number denotes a rising head test.

The suffix F following the well number denotes a falling head test.

The transmissivity is based on a saturated thickness of 9.0 feet for Area A and 17 feet for Area B and has been rounded to the nearest 10 or 100, as appropriate.


BMW12 RISING HEAD TEST
K = 0.0025 ft/min
0.076
Yo = 1.500 ft
Yt = 0.210 ft
Displacement (ft)
1
0.1
0.00
0.05
0.10
0.15
0.20
0.25
Time (min)

[illegible]12 RISING HEAD TEST
[illegible]ugt1
1
0.0833333
0.25
slugt2
9.48
9.76
9.48
tsdata
0.0133 11.409 1
0.0166 11.266 1
0.02 11.095 1
0.0233 11.109 1
0.0266 11.038 1
0.03 11 1
0.0333 10.962 1
0.0366 10.924 1
0.04 10.881 1
0.0433 10.848 1
0.0466 10.815 1
0.05 10.786 1
0.0533 10.748 1
0.0566 10.724 1
0.06 10.691 1
[illegible]0633 10.662 1
[illegible]666 10.634 1
0.07 10.601 1
0.0733 10.582 1
0.0766 10.558 1
0.08 10.534 1
0.0833 10.51 1
0.0866 10.491 1
0.09 10.468 1
0.0933 10.444 1
0.0966 10.425 1
0.1 10.406 1
0.1033 10.387 1
0.1066 10.368 1
0.11 10.349 1
0.1133 10.33 1
0.1166 10.315 1
0.12 10.301 1
0.1233 10.282 1
0.1266 10.273 1
0.13 10.258 1
0.1333 10.244 1
0.1366 10.23 1
0.14 10.22 1
0.1433 10.211 1
0.1466 10.197 1
[illegible]5 10.187 1
[illegible]1533 10.178 1
0.1566 10.173 1
0.16 10.163 1
0.1633 10.159 1
0.1666 10.149 1
0.17 10.144 1
0.1733 10.135 1

0.18	10.126	1
0.1833	10.121	1
0.1866	10.116	1
0.19	10.111	1
0.1933	10.106	1
0.1966	10.102	1
0.2	10.097	1

S.O. No. 19084-SL-SRN

Subject: B-MW12 RISING HEAD SLUG TEST CALCULATIONS

BOUWER AND RICE METHOD

CAMP ALLEN LANDFILL

Sheet No. 1 of 1

Drawing No. —

Computed by MEK Checked By _____ Date 21 JULY 92

Baker

$$r_{eq} = \left[(1-n)\,r_c^2 + n\,r_w^2\right]^{1/2}$$

$$= \left[(1-0.3)(0.0833\ ft)^2 + (0.3)(0.333\ ft)^2\right]^{1/2}$$

$$= \left[0.0049\ ft^2 + 0.0333\ ft^2\right]^{1/2}$$

$$r_{eq} = .1954\ ft$$

$$L_e/r_w = \frac{9.48\ ft}{0.33\ ft}$$

$$= 28.73$$

$$\ln \frac{R_e}{r_w} = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{C}{L_e/r_w}\right]^{-1}$$

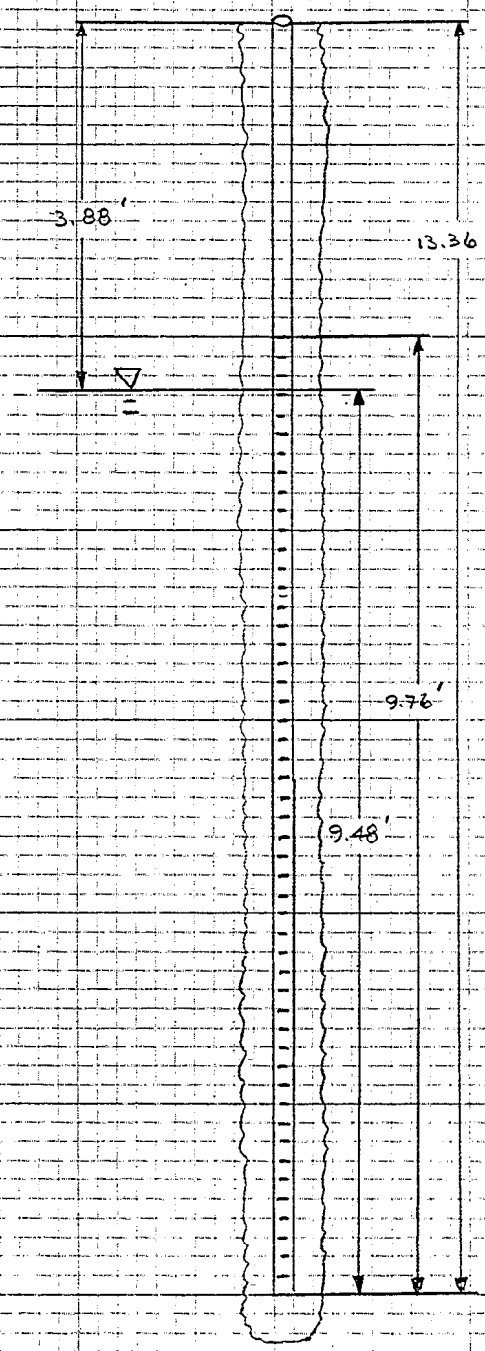
$$= \left[\frac{1.1}{\ln(9.48/0.33)} + \frac{2}{28.73}\right]^{-1}$$

$$\ln \frac{R_e}{r_w} = 2.5$$

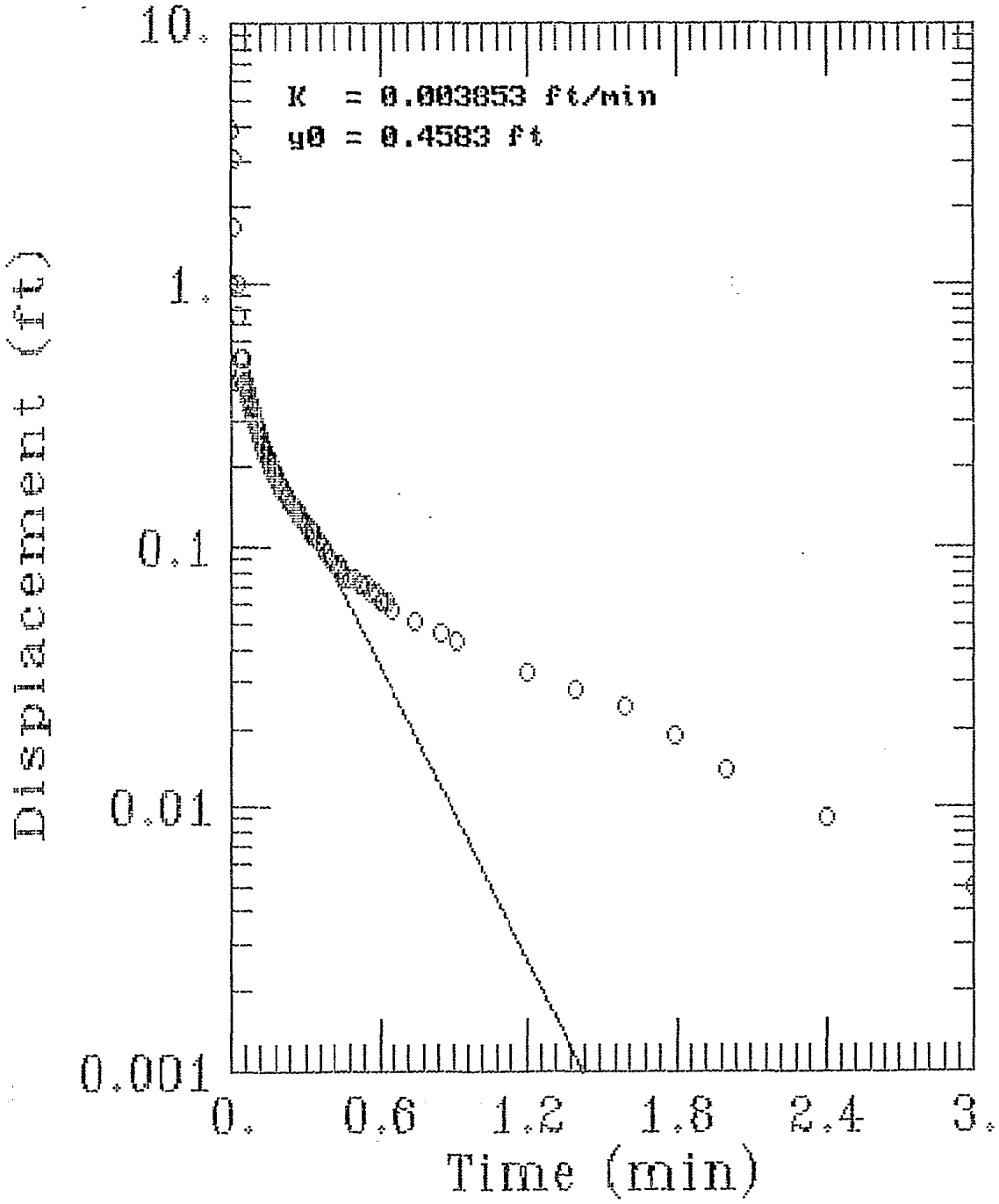
$$K = \frac{r_c^2 \ln(R_e/r_w)}{2 L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

$$= \frac{(0.1954\ ft)^2 (2.5)}{2(9.48\ ft)} \frac{1}{0.21\ min} \ln \frac{1.5\ ft}{0.09\ ft}$$

$$K = 0.067\ ft/min$$



BMW12 FALLING HEAD TEST



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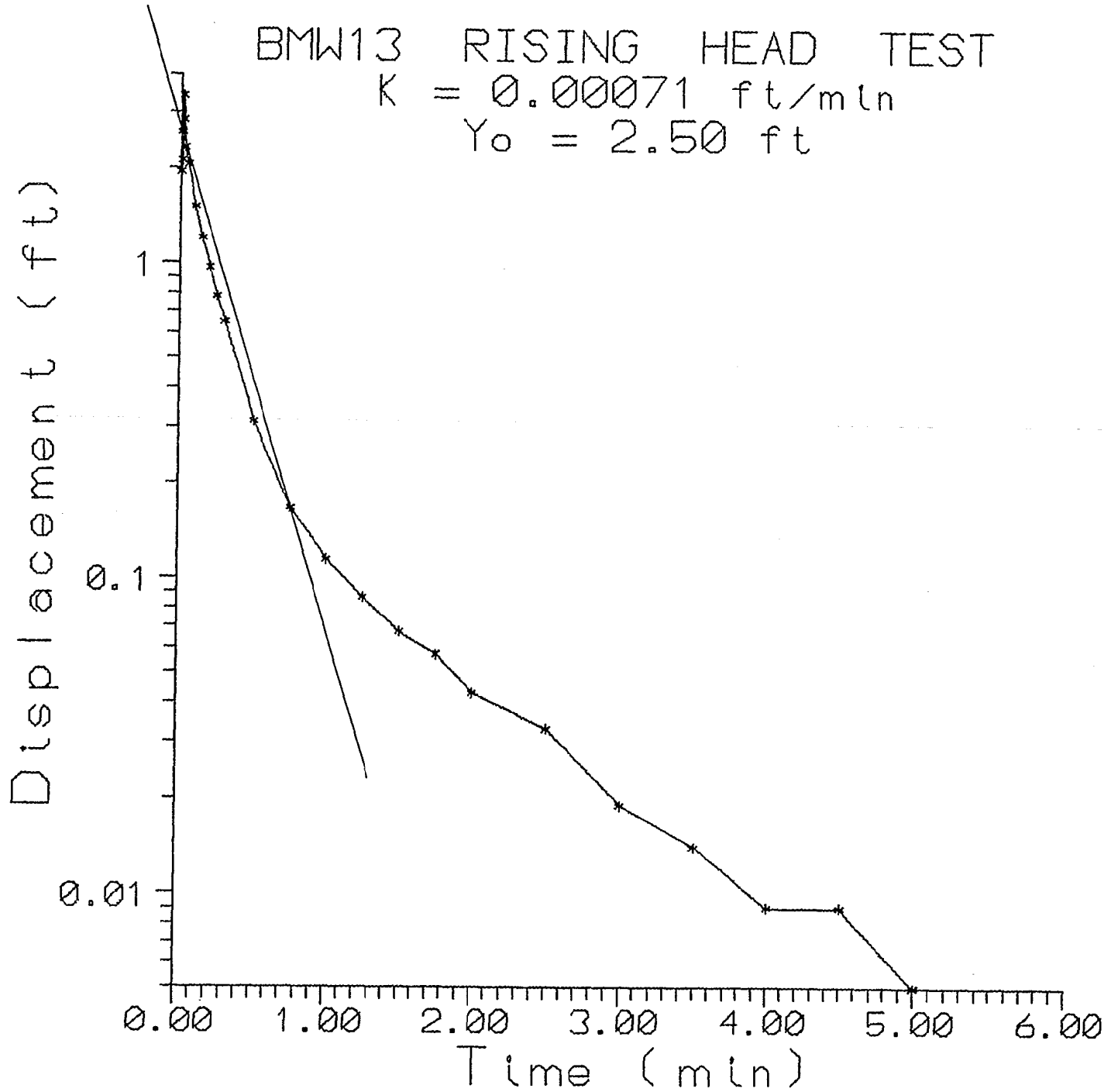

BMW13 RISING HEAD TEST
K = 0.00071 ft/min
Yo = 2.50 ft
Displacement (ft)
1
0.1
0.01
0.00
1.00
2.00
3.00
4.00
5.00
6.00
Time (min)

BMW13 RISING HEAD TEST
slugt1
3.39
0.083333
0.25
slugt2
8.75
9.76
8.75
tsdata
0.0033 1.948 0
0.0066 2.614 0
0.01 2.114 0
0.0133 3.395 0
0.0166 2.029 0
0.02 2.848 0
0.0233 2.343 0
0.0266 2.51 0
0.03 2.324 0
0.0333 2.338 0
0.05 2.062 0
0.0666 1.848 0
0.0833 1.657 0
0.1 1.505 0
0.1166 1.386 0
0.1333 1.29 0
0.15 1.195 0
0.1666 1.114 0
0.1833 1.033 0
0.2 0.962 0
0.2166 0.895 0
0.2333 0.833 0
0.25 0.781 0
0.2666 0.733 0
0.2833 0.69 0
0.3 0.648 0
0.3166 0.609 0
0.3333 0.576 0
0.4166 0.414 0
0.5 0.314 0
0.5833 0.243 0
0.6666 0.2 0
0.75 0.167 0
0.8333 0.143 0
0.9166 0.124 0
1 0.114 0
1.0833 0.1 1
1.1666 0.09 1
1.25 0.086 1
1.3333 0.076 1
1.4166 0.071 1
1.5 0.067 1
1.5833 0.062 1
1.6666 0.057 1
1.75 0.057 1
1.8333 0.052 1
1.9166 0.048 1
2 0.043 1

3.5	0.014	1
4	0.009	1
4.5	0.009	1
5	0.005	1
5.5	0.005	1
6	0.005	1
[illegible]	0.005	1
7	0.005	1
9	0.005	1
10	0.005	1

S.O. No. 19084-51-SRN

Subject: BMW13 RISING HEAD SLUG TEST

BOUWER AND RICE METHOD — Sheet No. 1 of 1

CAMP ALLEN LANDFILL — Drawing No. —

Computed by MEK — Checked By _____ — Date 21 JULY 92

Baker

$C = 1.8$ $\qquad t = 0.75$ min

$L_e = 8.75$ ft $\qquad y_t = 0.167$ ft

$r_w = 0.33$ ft

$r_c = 0.0833$ ft

$$r_{eq} = \left[(1-n)r_c^2 + n r_w^2\right]^{1/2}$$

$$= \left[(1-0.3)(0.0833)^2 + (0.3)(0.333\ ft)^2\right]^{1/2}$$

$$= \underline{0.195\ ft}$$

$$L_e/r_w = \frac{8.75}{0.33}$$

$$= \underline{26.52\ ft}$$

$$\ln\frac{R_e}{r_w} = \left[\frac{1.1}{\ln(L_e/r_w)} + \frac{C}{L_e/r_w}\right]^{-1}$$

$$= \left[\frac{1.1}{\ln(8.75/0.33)} + \frac{1.8}{26.52}\right]^{-1}$$

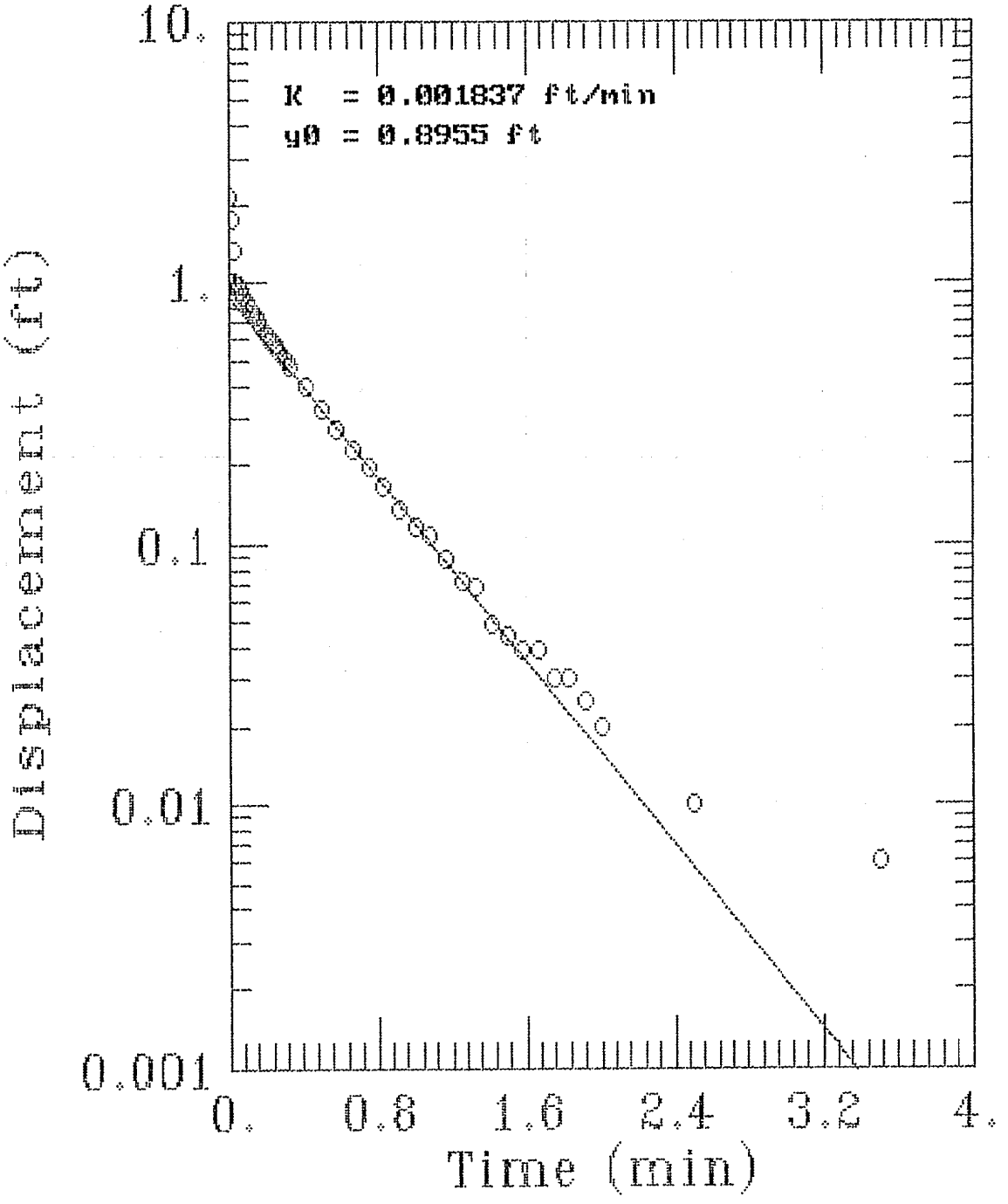
$$\underline{\ln\frac{R_e}{r_w} = 2.48}$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e} \cdot \frac{1}{t} \ln\frac{y_o}{y_t}$$

$$= \frac{(0.195\ ft)^2\ 2.48}{2(8.75\ ft)} \cdot \frac{1}{0.75\ min} \ln\frac{2.5}{0.167}$$

$$\underline{K = 0.0194\ ft/min}$$

BMW14 RISING HEAD TEST



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

A Q T E S O L V

A Program for

Automatic Estimation of Aquifer Coefficients

From Aquifer Test Data

By:

Glenn M. Duffield
and
James O. Rumbaugh, III

Geraghty & Miller Modeling Group
1895 Preston White Drive, Suite 301
Reston, VA 22091

(703) 476 - 0335

A Q T E S O L V is a user-friendly program designed to analyze data from aquifer tests automatically. Aquifer coefficients for a variety of aquifer test conditions can be estimated by A Q T E S O L V, including the following:

- o confined aquifers, unconfined aquifers, and leaky aquifers
- o pumping tests, injection tests, recovery tests, and slug tests

Features:

- o Interactive, menu-driven program design
- o Nonlinear least-squares estimation of aquifer coefficients
- o Statistical analysis of results
- o Complete graphical display of results

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A Q T E S O L V   R E S U L T S

Version 1.10

07/20/92 14:21:22

TEST DESCRIPTION

Data set............. A:BMW14R.DAT
Data set title....... BMW14 RISING HEAD TEST

Knowns and Constants:
    No. of data points...................... 44
    Radius of well casing................... 0.08333
    Radius of well.......................... 0.3333
    Aquifer saturated thickness............. 10.02
    Well screen length...................... 9.76
    Static height of water in well.......... 10.02
    Log(Re/Rw).............................. 2.566
    A, B, C................................. 0.000, 0.000, 1.946

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
K =	1.8366E-003	+/-	2.7317E-005
y0 =	8.9548E-001	+/-	1.7769E-002

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
    Number of residuals................. 21
    Number of estimated parameters...... 2
    Degrees of freedom.................. 19
    Residual mean....................... 0.001276
    Residual standard deviation......... 0.005139
    Residual variance................... 2.641E-005

Model Residuals:

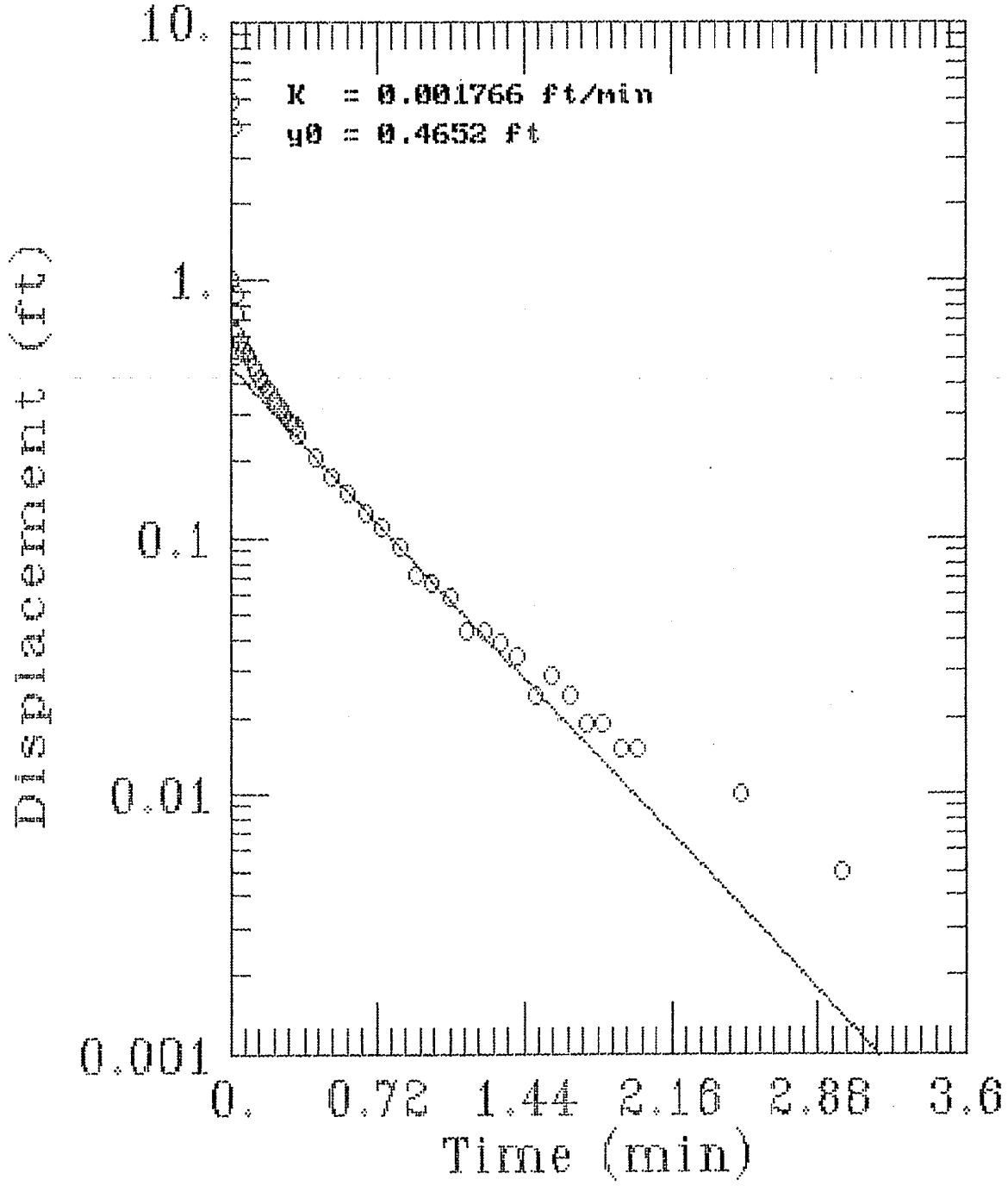
0.4166	0.397	0.38731	0.0096867	1.
0.5	0.325	0.32749	-0.0024866	1.
0.5833	0.273	0.27696	-0.0039568	1.
0.6666	0.23	0.23422	-0.0042235	1.
0.75	0.197	0.19804	-0.0010439	1.
0.8333	0.163	0.16749	-0.0044866	1.
0.9166	0.135	0.14164	-0.0066441	1.
1	0.115	0.11976	-0.0047649	1.
1.0833	0.106	0.10129	0.0047143	1.
1.1666	0.087	0.085658	0.0013423	1.
1.25	0.072	0.072427	-0.0004265	1.
1.3333	0.068	0.061251	0.0067486	1.
1.4166	0.049	0.051801	-0.0028006	1.
1.5	0.044	0.043799	0.00020087	1.
1.5833	0.039	0.037041	0.0019589	1.
1.6666	0.039	0.031326	0.0076742	1.
1.75	0.03	0.026487	0.003513	1.
1.8333	0.03	0.0224	0.0075998	1.
1.9166	0.025	0.018944	0.0060561	1.
2	0.02	0.016018	0.0039823	1.
2.5	0.01	0.0058578	0.0041422	1.

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

	Estimate
K =	1.8366E-003
yO =	

BMW14 FALLING HEAD TEST



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<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>

A Q T E S O L V   R E S U L T S
Version 1.10

'20/92 14:03:21

==

TEST DESCRIPTION

ta set............. A:BMW14F.DAT
ta set title...... BMW14 FALLING HEAD TEST

owns and Constants:
 No. of data points.................... 46
 Radius of well casing................. 0.08333
 Radius of well........................ 0.3333
 Aquifer saturated thickness........... 10.02
 Well screen length.................... 9.76
 Static height of water in well........ 10.02
 Log(Re/Rw)............................ 2.566
 A, B, C............................... 0.000, 0.000, 1.946

==

ANALYTICAL METHOD

uwer-Rice (Unconfined Aquifer Slug Test)

==

RESULTS FROM STATISTICAL CURVE MATCHING

ATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
K =	1.7664E-003	+/-	3.7493E-005
y0 =	4.6520E-001	+/-	1.1466E-002

ALYSIS OF MODEL RESIDUALS

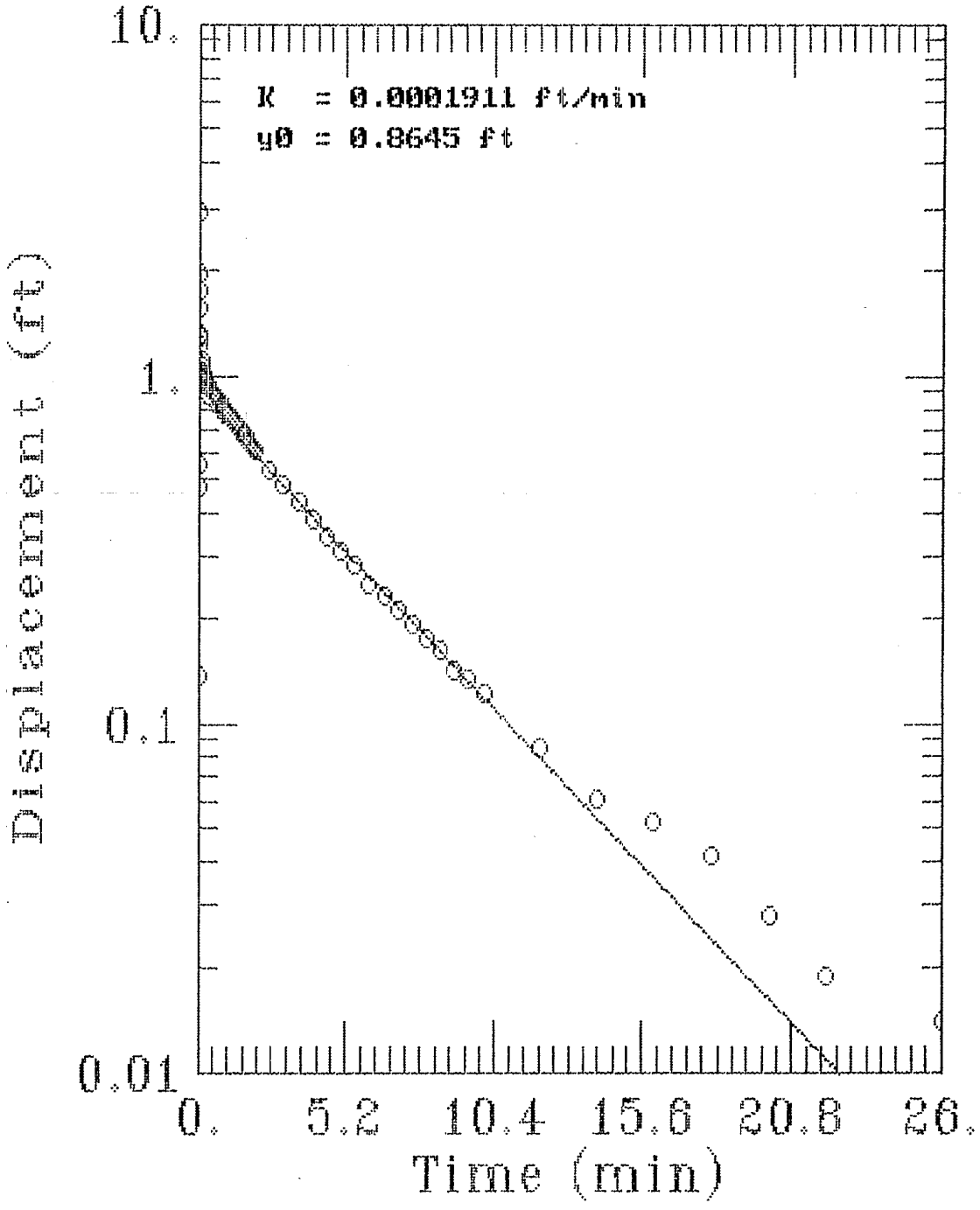
sidual = calculated - observed
ighted residual = residual * weight

ighted Residual Statistics:
 Number of residuals................ 23
 Number of estimated parameters..... 2
 Degrees of freedom................. 21
 Residual mean...................... 0.001357
 Residual standard deviation........ 0.004718
 Residual variance.................. 2.226E-005

del Residuals:

0.3333	0.253	0.2441	0.0089028	1
0.4166	0.206	0.20776	-0.0017623	1
0.5	0.172	0.1768	-0.004801	1
0.5833	0.148	0.15048	-0.0024807	1
0.6666	0.124	0.12808	-0.0040821	1
0.75	0.11	0.109	0.0010051	1
0.8333	0.091003	0.092771	-0.0017676	1
0.9166	0.072002	0.078961	-0.006959	1
1	0.067001	0.067194	-0.00019299	1
1.0833	0.058003	0.057192	0.00081049	1
1.1666	0.043003	0.048679	-0.0056755	1
1.25	0.043003	0.041424	0.0015787	1
1.3333	0.039002	0.035258	0.0037434	1
1.4166	0.034	0.03001	0.0039908	1
1.5	0.024002	0.025538	-0.0015354	1
1.5833	0.029003	0.021736	0.007267	1
1.6666	0.024002	0.018501	0.0055016	1
1.75	0.019001	0.015744	0.0032575	1
1.8333	0.019001	0.0134	0.005601	1
1.9166	0.015003	0.011405	0.0035979	1
2	0.015003	0.0097057	0.0052975	1
2.5	0.010002	0.0036887	0.0063134	1
3	0.0050011	0.0014019	0.0035992	1

BMW15 RISING HEAD TEST



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Modeling Group

A Q T E S O L V

A Program for

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- o Complete graphical display of results

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>

A Q T E S O L V   R E S U L T S
Version 1.10

07/20/92 13:25:3

TEST DESCRIPTION

```
Data set............. A:BMW15R.DAT
Data set title...... BMW15 RISING HEAD TEST

Knowns and Constants:
   No. of data points..................... 71
   Radius of well casing.................. 0.08333
   Radius of well......................... 0.3333
   Aquifer saturated thickness............ 12.5
   Well screen length..................... 9.76
   Static height of water in well......... 12.5
   Log(Re/Rw)............................. 2.703
   A, B, C................................  0.000,  0.000,  1.946
```

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

```
          Estimate           Std. Error
   K  =   1.9109E-004 +/-    3.2785E-006
   y0 =   8.6453E-001 +/-    1.4436E-002
```

ANALYSIS OF MODEL RESIDUALS

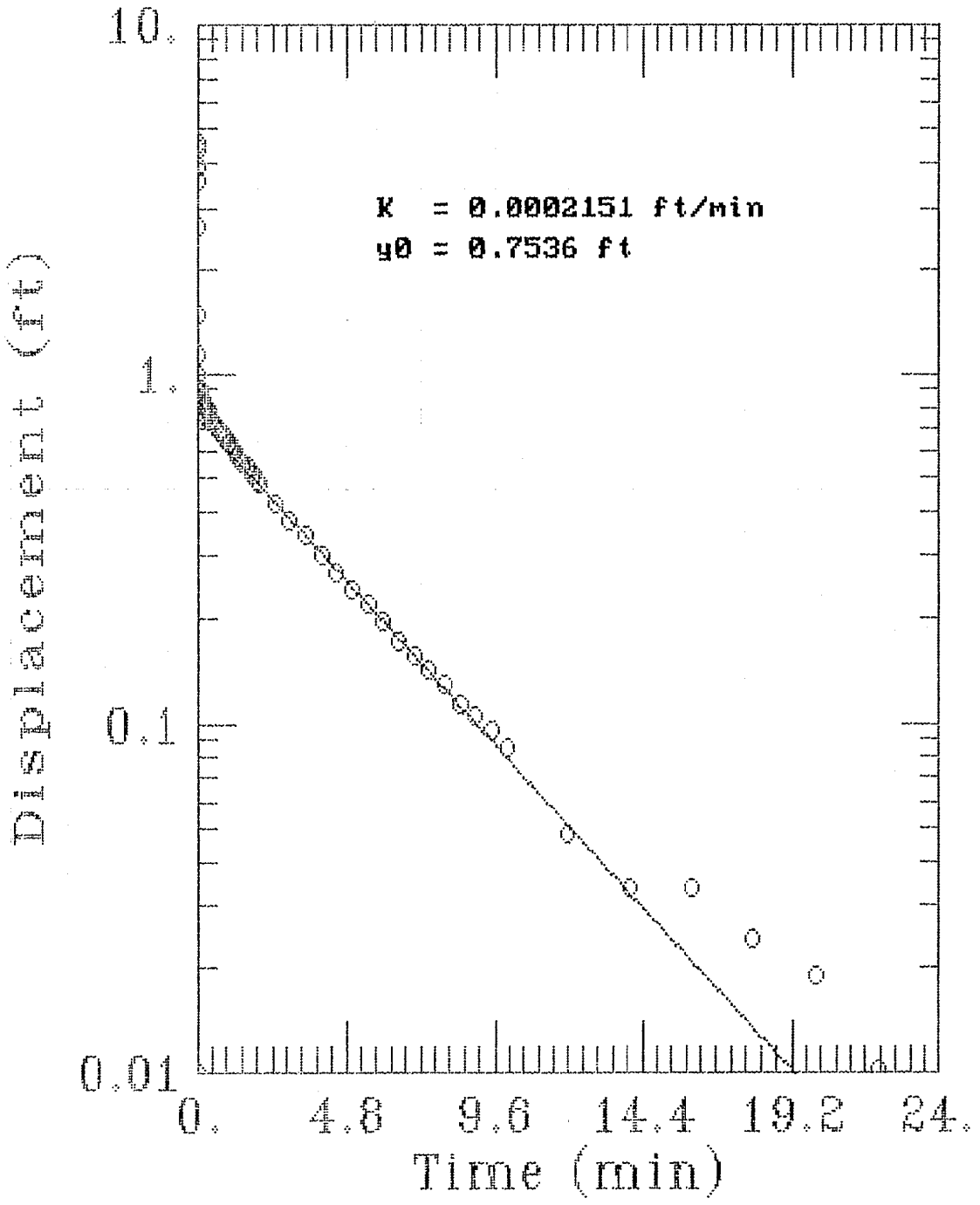
residual = calculated - observed
weighted residual = residual * weight

```
Weighted Residual Statistics:
   Number of residuals................. 23
   Number of estimated parameters..... 2
   Degrees of freedom................. 21
   Residual mean...................... 0.002493
   Residual standard deviation........ 0.008273
   Residual variance.................. 6.844E-005
```

Model Residuals:

2.5	0.536	0.52605	0.0099542	1.
3	0.484	0.47629	0.0077095	1.
3.5	0.432	0.43124	0.00075864	1.
4	0.389	0.39045	-0.0014528	1.
4.5	0.346	0.35352	-0.0075223	1.
5	0.313	0.32008	-0.0070849	1.
5.5	0.285	0.28981	-0.0048101	1.
6	0.251	0.2624	-0.011399	1.
6.5	0.232	0.23758	-0.0055801	1.
7	0.213	0.21511	-0.0021089	1.
7.5	0.194	0.19476	-0.00076312	1.
8	0.175	0.17634	-0.0013417	1.
8.5	0.161	0.15966	0.0013373	1.
9	0.142	0.14456	-0.0025612	1.
9.5	0.133	0.13089	0.002112	1.
10	0.123	0.11851	0.0044918	1.
12	0.085	0.079642	0.0053581	1.
14	0.061	0.053522	0.0074777	1.
16	0.052	0.035969	0.016031	1.
18	0.042	0.024172	0.017828	1.
20	0.028	0.016245	0.011755	1.
22	0.019	0.010917	0.0080829	1.
26	0.014	0.0049305	0.0090695	1.

BMW15 FALLING HEAD TEST



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

A Q T E S O L V

A Program for

Automatic Estimation of Aquifer Coefficients

From Aquifer Test Data

By:

Glenn M. Duffield
and
James O. Rumbaugh, III

Geraghty & Miller Modeling Group
1895 Preston White Drive, Suite 301
Reston, VA 22091

(703) 476 - 0335

A Q T E S O L V is a user-friendly program designed to analyze data from aquifer tests automatically. Aquifer coefficients for a variety of aquifer test conditions can be estimated by A Q T E S O L V, including the following:

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- o pumping tests, injection tests, recovery tests, and slug tests

Features:

- o Interactive, menu-driven program design
- o Nonlinear least-squares estimation of aquifer coefficients
- o Statistical analysis of results
- o Complete graphical display of results

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A Q T E S O L V   R E S U L T S

Version 1.10

07/20/92 13:18:3

TEST DESCRIPTION

Data set............. A:BMW15F.DAT
Data set title...... BMW15 FALLING HEAD TEST

Knowns and Constants:
- No. of data points.................... 68
- Radius of well casing................. 0.08333
- Radius of well........................ 0.3333
- Aquifer saturated thickness........... 12.5
- Well screen length.................... 9.76
- Static height of water in well........ 12.5
- Log(Re/Rw)............................ 2.703
- A, B, C............................... 0.000, 0.000, 1.946

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
K =	2.1512E-004	+/-	2.4193E-006
y0 =	7.5365E-001	+/-	7.0228E-003

ANALYSIS OF MODEL RESIDUALS

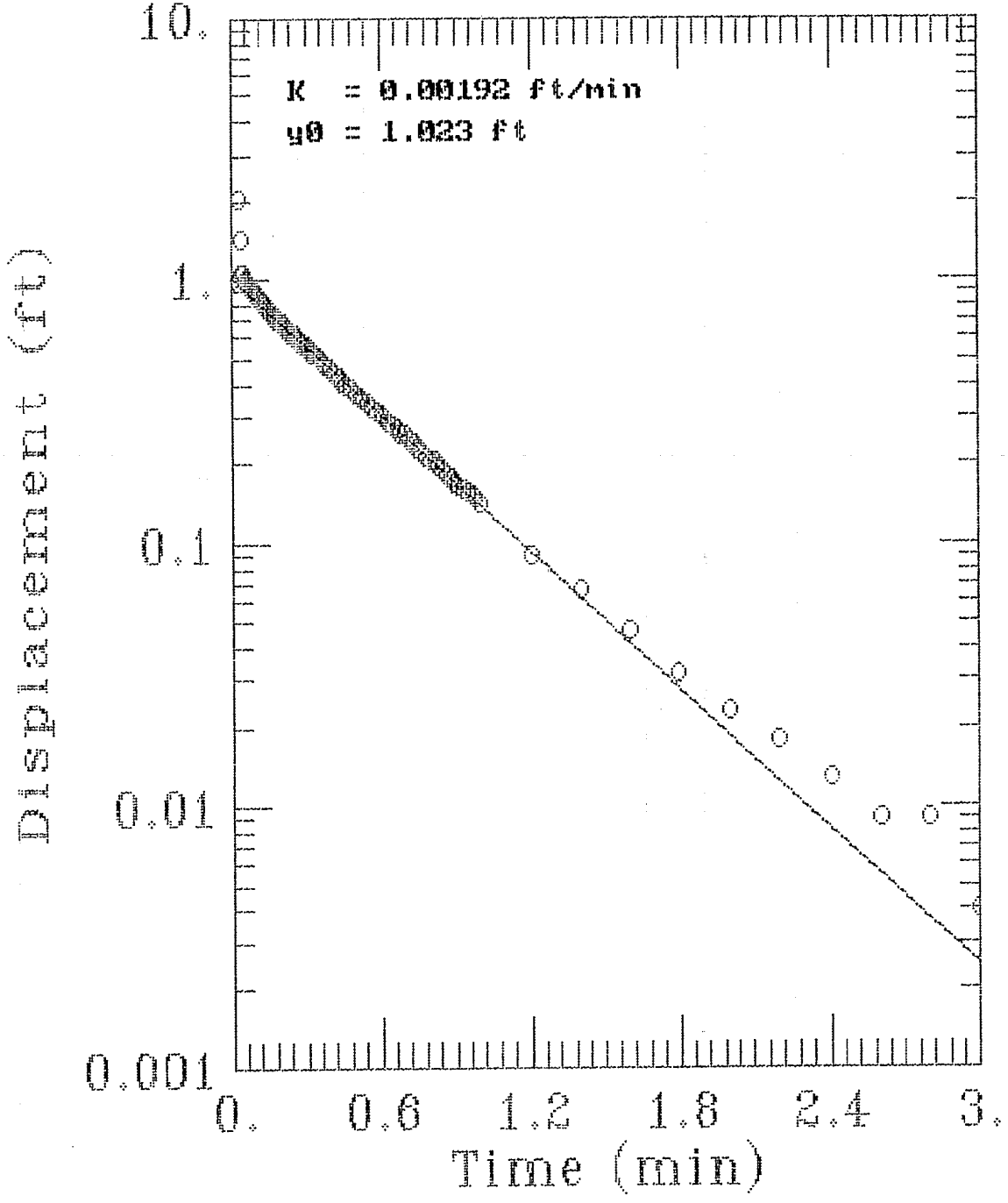
residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
- Number of residuals................. 25
- Number of estimated parameters..... 2
- Degrees of freedom.................. 23
- Residual mean....................... 0.001536
- Residual standard deviation........ 0.005818
- Residual variance.................. 3.385E-005

Model Residuals:

1.8333	0.509	0.5001	0.0089046	1.
1.9166	0.494	0.49086	0.0031376	1.
2	0.485	0.48179	0.0032109	1.
2.5	0.428	0.4308	-0.0028033	1.
3	0.38	0.38521	-0.0052131	1.
3.5	0.342	0.34445	-0.0024476	1.
4	0.3	0.308	-0.0079961	1.
4.5	0.271	0.2754	-0.0044021	1.
5	0.243	0.24626	-0.0032574	1.
5.5	0.219	0.2202	-0.001197	1.
6	0.195	0.19689	-0.0018944	1.
6.5	0.171	0.17606	-0.0050579	1.
7	0.157	0.15743	-0.00042636	1.
7.5	0.143	0.14077	0.0022334	1.
8	0.129	0.12587	0.0031302	1.
8.5	0.114	0.11255	0.0014495	1.
9	0.105	0.10064	0.0043611	1.
9.5	0.094999	0.089989	0.0050107	1.
10	0.086	0.080466	0.005534	1.
12	0.047999	0.05144	-0.0034402	1.
14	0.033999	0.032684	0.0011153	1.
16	0.033999	0.021022	0.012977	1.
18	0.024	0.013439	0.010561	1.
20	0.019	0.0085911	0.010409	1.
22	0.01			

BMW16 RISING HEAD TEST



AQTESOLV

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<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

A Q T E S O L V   R E S U L T S

Version 1.10

07/20/92 18:04:47

TEST DESCRIPTION

```
Data set............. A:BMW16R.DAT
Data set title...... BMW16 RISING HEAD TEST

Knowns and Constants:
   No. of data points...................... 137
   Radius of well casing................... 0.08333
   Radius of well.......................... 0.3333
   Aquifer saturated thickness............. 12.26
   Well screen length...................... 9.76
   Static height of water in well.......... 12.26
   Log(Re/Rw).............................. 2.691
   A, B, C.................................  0.000,  0.000,  1.946
```

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

```
          Estimate          Std. Error
   K  =   1.9196E-003 +/-   5.6882E-006
   y0 =   1.0230E+000 +/-   2.1018E-003
```

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

```
Weighted Residual Statistics:
   Number of residuals................ 91
   Number of estimated parameters..... 2
   Degrees of freedom................. 89
   Residual mean...................... 0.0005146
   Residual standard deviation........ 0.003599
   Residual variance.................. 1.295E-005
```

Model Residuals:

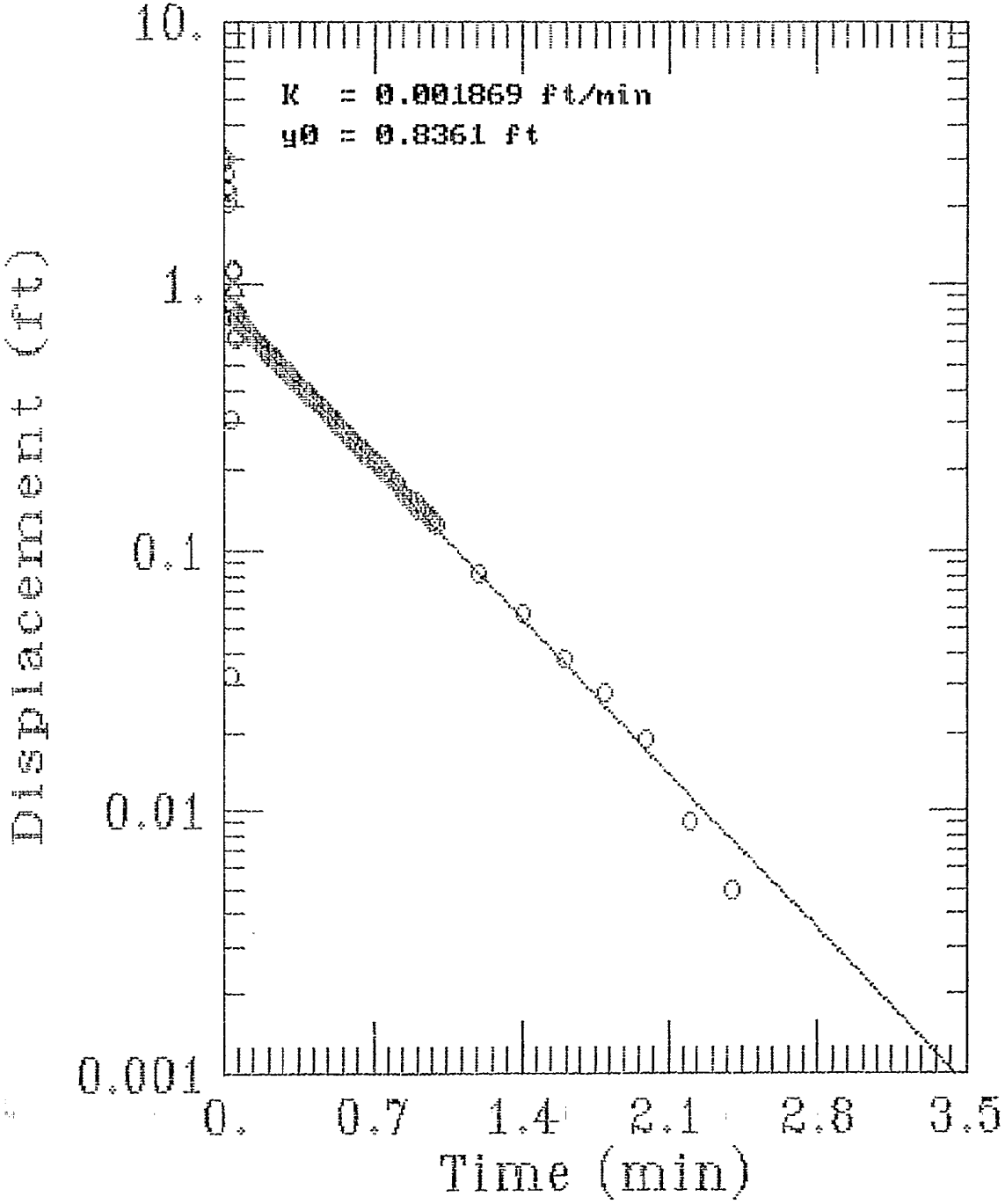
0.2	0.694	0.68505	0.0089523	1.
0.2033	0.689	0.68053	0.0084701	1.
0.2066	0.684	0.67604	0.0079582	1.
0.21	0.679	0.67145	0.0075513	1.
0.2133	0.67	0.66702	0.0029795	1.
0.2166	0.665	0.66262	0.0023785	1.
0.22	0.66	0.65812	0.0018804	1.
0.2233	0.656	0.65378	0.0022207	1.
0.2266	0.651	0.64947	0.0015324	1.
0.23	0.646	0.64506	0.00094496	1.
0.2333	0.641	0.6408	0.00019908	1.
0.2366	0.637	0.63657	0.00042514	1.
0.24	0.632	0.63225	-0.00024988	1.
0.2433	0.627	0.62808	-0.0010802	1.
0.2466	0.627	0.62394	0.003062	1.
0.25	0.622	0.6197	0.0023011	1.
0.2533	0.618	0.61561	0.002388	1.
0.2566	0.613	0.61155	0.0014479	1.
0.26	0.608	0.6074	0.00060289	1.
0.2633	0.603	0.60339	-0.00039134	1.
0.2666	0.598	0.59941	-0.001412	1.
0.27	0.594	0.59534	-0.0013395	1.
0.2733	0.589	0.59141	-0.0024133	1.
0.2766	0.584	0.58751	-0.0035129	1.
0.28	0.579	0.58352	-0.0045213	1.
0.2833	0.579	0.57967	-0.00067295	1.
0.2866	0.575	0.57585	-0.00085002	1.
0.29	0.57	0.57194	-0.0019376	1.
0.2933	0.565	0.56817	-0.0031657	1.
0.2966	0.565	0.56442	0.00058133	1.
0.3	0.56	0.56058	-0.00058393	1.
0.3033	0.556	0.55689	-0.0008869	1.
0.3066	0.551	0.55321	-0.0022142	1.
0.31	0.546	0.54946	-0.0034556	1.
0.3133	0.546	0.54583	0.00016802	1.
0.3166	0.541	0.54223	-0.0012322	1.
0.32	0.537	0.53855	-0.0015482	1.
0.3233	0.532	0.535	-0.0029965	1.
0.3266	0.527	0.53147	-0.0044682	1.
0.33	0.527	0.52786	-0.00085737	1.
0.3333	0.522	0.52438	-0.0023762	1.
0.35	0.503	0.50711	-0.0041081	1.
0.3666	0.489	0.49051	-0.001507	1.
0.3833	0.47	0.47435	-0.0043543	1.
0.4	0.456	0.45873	-0.0027335	1.
0.4166	0.437	0.44372	-0.0067161	1.
0.4333	0.422	0.4291	-0.0071042	1.
0.45	0.408	0.41497	-0.0069735	1.
0.4666	0.394	0.40139	-0.0073886	1.
0.4833	0.384	0.38817	-0.0041706	1.
0.5	0.37	0.37539	-0.0053879	1.
0.5166	0.361	0.3631	-0.0020989	1.
0.5333	0.346	0.35114	-0.0051418	1.
0.55	0.337	0.33958	-0.0025785	1.
0.5666	0.327	0.32846	-0.0014618	1.
0.5833	0.318	0.31765	0.00035466	1.
0.6	0.308	0.30719	0.00081494	1.
0.6166	0.299	0.29713	0.0018712	1.
0.6333	0.289	0.28734	0.0016558	1.
0.65	0.28	0.27788	0.0021183	1.
0.6666	0.27	0.26878	0.0012152	1.
0.6833	0.261	0.25993	0.0010665	1.
0.7	0.256	0.25137	0.0046263	1.
0.7166	0.246	0.24314	0.0028554	1.

0.75	0.227	0.22739	-0.00039443	1
0.7666	0.223	0.21995	0.0030497	1
0.7833	0.213	0.21271	0.00029284	1
0.8	0.208	0.2057	0.0022974	1
0.8166	0.204	0.19897	0.0050315	1
0.8333	0.194	0.19242	0.0015836	1
0.85	0.189	0.18608	0.00292	1
0.8666	0.18	0.17999	1.1681E-005	1
0.8833	0.175	0.17406	0.00093882	1
0.9	0.17	0.16833	0.0016708	1
0.9166	0.166	0.16282	0.0031813	1
0.9333	0.161	0.15746	0.003543	1
0.95	0.156	0.15227	0.0037282	1
0.9666	0.151	0.14729	0.0037131	1
0.9833	0.147	0.14244	0.0045634	1
1	0.142	0.13775	0.0042539	1
1.2	0.089	0.09224	-0.0032399	1
1.4	0.066	0.061767	0.0042327	1
1.6	0.047	0.041362	0.0056383	1
1.8	0.032	0.027697	0.0043027	1
2	0.023	0.018547	0.0044528	1
2.2	0.018	0.01242	0.0055801	1
2.4	0.013	0.0083168	0.0046832	1
2.6	0.009	0.0055692	0.0034308	1
2.8	0.009	0.0037294	0.0052706	1
3	0.004	0.0024973	0.0015027	1

RESULTS FROM VISUAL CURVE MATCHING

UAL MATCH PARAMETER E

BMW16 FALLING HEAD TEST



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A Q T E S O L V   R E S U L T S
Version 1.10

07/20/92 17:51:15

TEST DESCRIPTION

Data set.............. a:bmw16f.dat
Data set title...... BMW16 FALLING HEAD TEST

Knowns and Constants:
    No. of data points................... 145
    Radius of well casing................. 0.08333
    Radius of well........................ 0.3333
    Aquifer saturated thickness........... 12.26
    Well screen length.................... 9.76
    Static height of water in well........ 12.26
    Log(Re/Rw)............................ 2.691
    A, B, C............................... 0.000, 0.000, 1.946

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
K =	1.8687E-003	+/-	9.2597E-006
y0 =	8.3609E-001	+/-	2.0374E-003

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

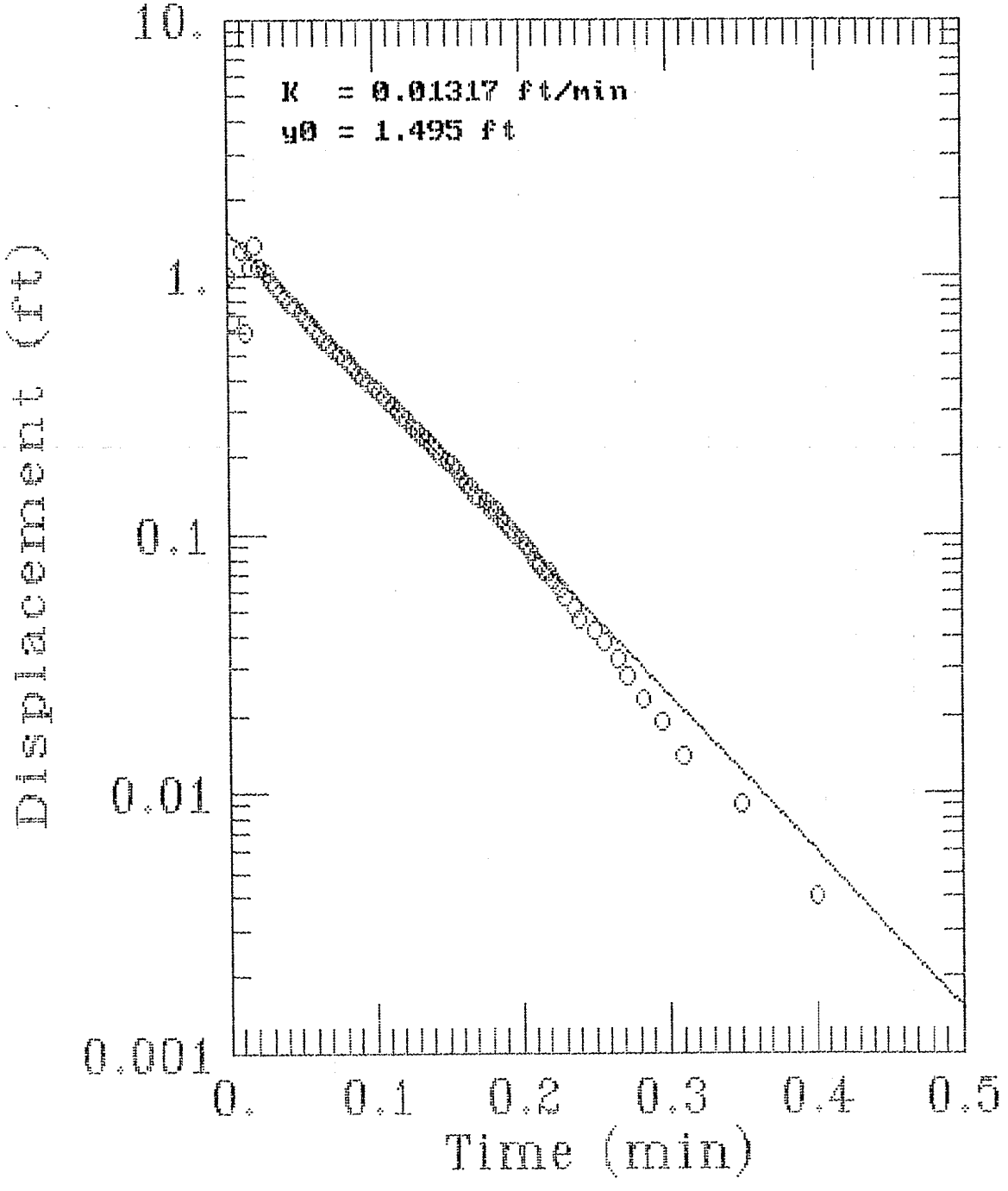
Weighted Residual Statistics:
    Number of residuals................. 127
    Number of estimated parameters..... 2
    Degrees of freedom.................. 125
    Residual mean....................... 0.0003092
    Residual standard deviation........ 0.007159
    Residual variance................... 5.126E-005

Model Residuals:

0.07	0.77	0.72931	0.040695	1.
0.0733	0.775	0.72462	0.050378	1.
0.0766	0.747	0.71997	0.02703	1.
0.08	0.718	0.71521	0.0027932	1.
0.0833	0.709	0.71062	-0.0016146	1.
0.0866	0.709	0.70605	0.0029481	1.
0.09	0.704	0.70138	0.0026185	1.
0.0933	0.699	0.69688	0.002121	1.
0.0966	0.699	0.6924	0.0065955	1.
0.1	0.69	0.68782	0.0021766	1.
0.1033	0.68	0.68341	-0.003408	1.
0.1066	0.675	0.67902	-0.00402	1.
0.11	0.67	0.67453	-0.0045284	1.
0.1133	0.666	0.6702	-0.0041974	1.
0.1166	0.661	0.66589	-0.0048941	1.
0.12	0.656	0.66149	-0.0054894	1.
0.1233	0.651	0.65724	-0.0062421	1.
0.1266	0.647	0.65302	-0.006022	1.
0.13	0.647	0.6487	-0.0017025	1.
0.1333	0.642	0.64454	-0.0025373	1.
0.1366	0.637	0.6404	-0.0033988	1.
0.14	0.632	0.63616	-0.0041627	1.
0.1433	0.628	0.63208	-0.004078	1.
0.1466	0.623	0.62802	-0.0050195	1.
0.15	0.618	0.62387	-0.0058653	1.
0.1533	0.613	0.61986	-0.0068596	1.
0.1566	0.613	0.61588	-0.0028796	1.
0.16	0.609	0.61181	-0.0028057	1.
0.1633	0.604	0.60786	-0.0038774	1.
0.1666	0.599	0.60397	-0.0049743	1.
0.17	0.594	0.59998	-0.0059792	1.
0.1733	0.594	0.59613	-0.0021268	1.
0.1766	0.59	0.5923	-0.0022992	1.
0.18	0.585	0.58838	-0.0033812	1.
0.1833	0.58	0.5846	-0.0046034	1.
0.1866	0.575	0.58085	-0.0058497	1.
0.19	0.575	0.57701	-0.0020075	1.
0.1933	0.571	0.5733	-0.0023027	1.
0.1966	0.566	0.56962	-0.0036216	1.
0.2	0.561	0.56585	-0.0048537	1.
0.2033	0.556	0.56222	-0.0062204	1.
0.2066	0.556	0.55861	-0.0026105	1.
0.21	0.552	0.55492	-0.0029154	1.
0.2133	0.547	0.55135	-0.0043524	1.
0.2166	0.542	0.54781	-0.0058123	1.
0.22	0.542	0.54419	-0.0021886	1.
0.2233	0.537	0.54069	-0.0036945	1.
0.2266	0.537	0.53722	-0.00022275	1.
0.23	0.533	0.53367	-0.00066915	1.
0.2333	0.528	0.53024	-0.0022426	1.
0.2366	0.523	0.52684	-0.003838	1.
0.24	0.518	0.52335	-0.005352	1.
0.2433	0.518	0.51999	-0.0019917	1.
0.2466	0.513	0.51665	-0.0036529	1.
0.25	0.513	0.51324	-0.00023535	1.
0.2533	0.509	0.50994	-0.00094095	1.
0.2566	0.504	0.50667	-0.0026667	1.
0.26	0.499	0.50332	-0.0043142	1.
0.2633	0.499	0.50008	-0.0010825	1.
0.2666	0.494	0.49687	-0.0028716	1.
0.27	0.49	0.49359	-0.0035859	1.
0.2733	0.49	0.49042	-0.00041664	1.
0.2766	0.485	0.48727	-0.0022668	1.
0.28	0.485	0.48404	0.00095641	1.

0.2866	0.475	0.47785	-0.0028486	1.
0.29	0.475	0.47469	0.00031224	1.
0.2933	0.471	0.47164	-0.00063986	1.
0.2966	0.471	0.46861	0.0023885	1.
0.3	0.466	0.46551	0.00048921	1.
0.3033	0.461	0.46252	-0.0015218	1.
0.3066	0.461	0.45955	0.001448	1.
0.31	0.456	0.45651	-0.0005132	1.
0.3133	0.452	0.45358	-0.001581	1.
0.3166	0.452	0.45067	0.0013314	1.
0.32	0.447	0.44769	-0.00068756	1.
0.3233	0.447	0.44481	0.002187	1.
0.3266	0.442	0.44196	4.2053E-005	1.
0.33	0.442	0.43903	0.0029655	1.
0.3333	0.437	0.43622	0.00078447	1.
0.35	0.418	0.42223	-0.004225	1.
0.3666	0.409	0.40876	0.00023701	1.
0.3833	0.395	0.39565	-0.00065194	1.
0.4	0.38	0.38296	-0.0029634	1.
0.4166	0.371	0.37075	0.00024685	1.
0.4333	0.357	0.35886	-0.0018622	1.
0.45	0.347	0.34735	-0.00035257	1.
0.4666	0.337	0.33628	0.00072226	1.
0.4833	0.323	0.32549	-0.0024925	1.
0.5	0.314	0.31505	-0.0010531	1.
0.5166	0.304	0.30501	-0.0010081	1.
0.5333	0.295	0.29523	-0.00022575	1.
0.55	0.285	0.28576	-0.00075712	1.
0.5666	0.276	0.27665	-0.00064618	1.
0.5833	0.271	0.26777	0.0032266	1.
0.6	0.261	0.25919	0.0018157	1.
0.6166	0.252	0.25092	0.0010785	1.
0.6333	0.247	0.24287	0.0041261	1.
0.65	0.238	0.23508	0.0029157	1.
0.6666	0.228	0.22759	0.00041102	1.
0.6833	0.223	0.22029	0.0027114	1.
0.7	0.219	0.21322	0.0057756	1.
0.7166	0.209	0.20643	0.002575	1.
0.7333	0.204	0.19981	0.0041955	1.
0.75	0.195	0.1934	0.0016028	1.
0.7666	0.19	0.18723	0.00277	1.
0.7833	0.185	0.18123	0.003774	1.
0.8	0.181	0.17541	0.0055863	1.
0.8166	0.176	0.16982	0.0061801	1.
0.8333	0.166	0.16437	0.0016257	1.
0.85	0.161	0.1591	0.0018976	1.
0.8666	0.157	0.15403	0.0029714	1.
0.8833	0.152	0.14909	0.0029105	1.
0.9	0.152	0.14431	0.0076921	1.
0.9166	0.142	0.13971	0.0022932	1.
0.9333	0.142	0.13523	0.0067739	1.
0.95	0.138	0.13089	0.007112	1.
0.9666	0.133	0.12672	0.0062842	1.
0.9833	0.128	0.12265	0.0053483	1.
1	0.123	0.11872	0.004282	1.
1.2	0.081	0.080347	0.0006533	1.
1.4	0.057	0.054378	0.0026223	1.
1.6	0.038	0.036802	0.0011977	1.
1.8	0.028	0.024907	0.0030925	1.
2	0.019	0.016857	0.002143	1.
2.2	0.0089998	0.011409	-0.0024089	1.
2.4	0.0050001	0.0077213	-0.0027211	1.

BMW17 RISING HEAD TEST



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

A Q T E S O L V

A Program for

Automatic Estimation of Aquifer Coefficients

From Aquifer Test Data

By:

Glenn M. Duffield
and
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A Q T E S O L V   R E S U L T S

Version 1.10

07/20/92 18:25:16

TEST DESCRIPTION

```
Data set............. A:BMW17R.DAT
Data set title...... BMW17 RISING HEAD TEST

Knowns and Constants:
   No. of data points.................... 79
   Radius of well casing................. 0.08333
   Radius of well........................ 0.3333
   Aquifer saturated thickness........... 12.1
   Well screen length.................... 9.76
   Static height of water in well........ 12.1
   Log(Re/Rw)............................ 2.683
   A, B, C...............................  0.000,  0.000,  1.946
```

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

```
          Estimate           Std. Error
   K  =   1.3171E-002 +/-    8.8168E-005
   y0 =   1.4954E+000 +/-    1.8472E-002
```

ANALYSIS OF MODEL RESIDUALS

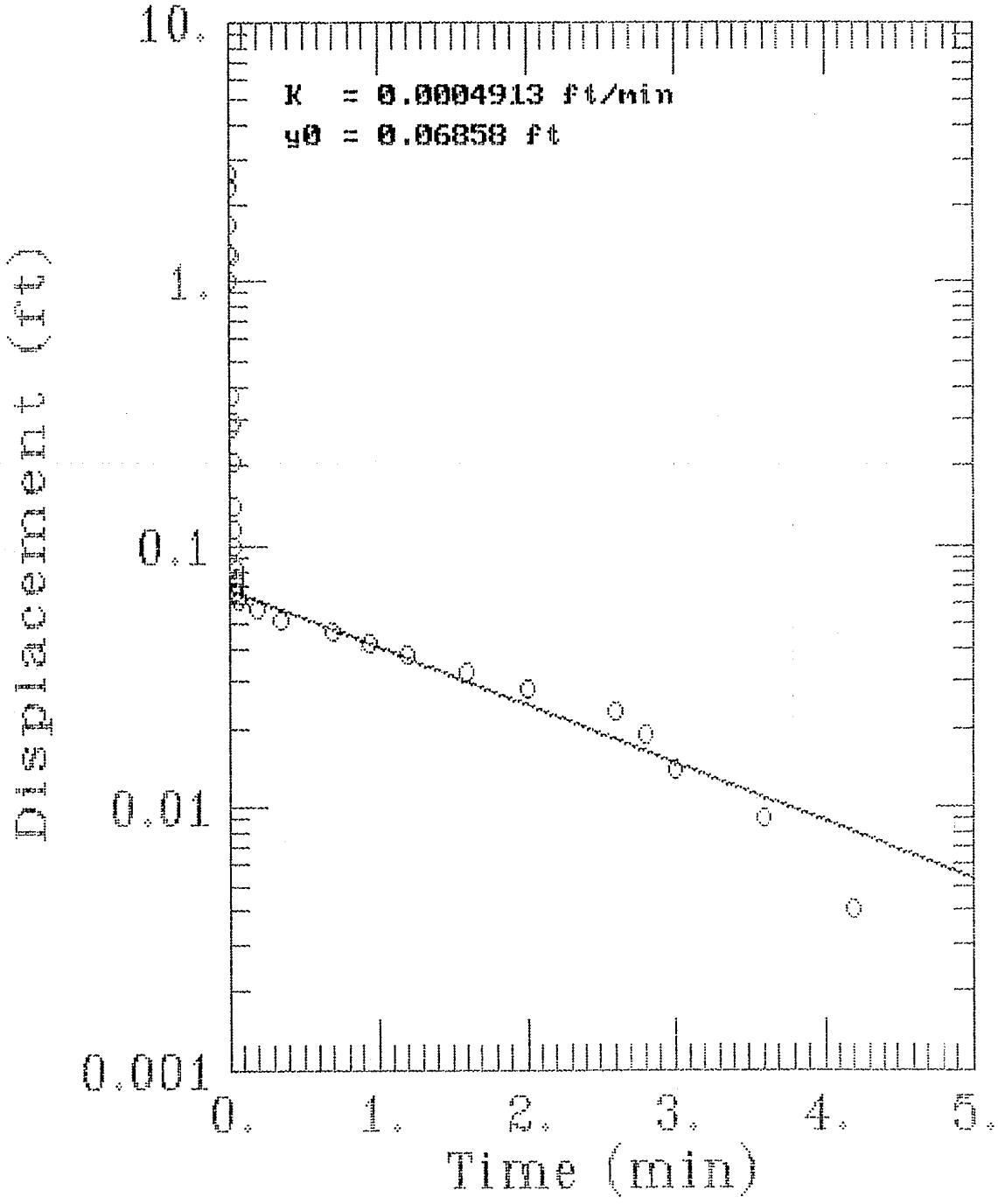
```
residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
   Number of residuals................ 43
   Number of estimated parameters..... 2
   Degrees of freedom................. 41
   Residual mean...................... -0.0003969
   Residual standard deviation........ 0.003412
   Residual variance.................. 1.164E-005
```

Model Residuals:

0.1	0.37	0.37624	-0.0062386	1.
0.1033	0.356	0.35949	-0.00349	1.
0.1066	0.342	0.34349	-0.0014869	1.
0.11	0.323	0.32774	-0.0047437	1.
0.1133	0.313	0.31315	-0.00015386	1.
0.1166	0.299	0.29921	-0.00021351	1.
0.12	0.285	0.2855	-0.00049948	1.
0.1233	0.275	0.27279	0.0022098	1.
0.1266	0.261	0.26065	0.00035334	1.
0.13	0.251	0.2487	0.0022997	1.
0.1333	0.242	0.23763	0.0043709	1.
0.1366	0.232	0.22705	0.0049492	1.
0.14	0.223	0.21664	0.0063557	1.
0.1433	0.213	0.207	0.0059998	1.
0.1466	0.199	0.19779	0.0012147	1.
0.15	0.19	0.18872	0.0012799	1.
0.1533	0.185	0.18032	0.0046809	1.
0.1566	0.175	0.17229	0.002708	1.
0.16	0.166	0.1644	0.0016048	1.
0.1633	0.156	0.15708	-0.001077	1.
0.1666	0.152	0.15008	0.0019154	1.
0.17	0.142	0.14321	-0.0012057	1.
0.1733	0.137	0.13683	0.00016929	1.
0.1766	0.133	0.13074	0.0022604	1.
0.18	0.123	0.12475	-0.0017473	1.
0.1833	0.123	0.11919	0.003806	1.
0.1866	0.114	0.11389	0.000112	1.
0.19	0.109	0.10867	0.0003319	1.
0.1933	0.104	0.10383	0.00016937	1.
0.1966	0.099	0.099209	-0.00020851	1.
0.2	0.095	0.094661	0.00033857	1.
0.2033	0.09	0.090447	-0.00044748	1.
0.2066	0.085	0.086421	-0.0014211	1.
0.21	0.08	0.08246	-0.0024601	1.
0.2133	0.076	0.078789	-0.0027893	1.
0.2166	0.071	0.075282	-0.004282	1.
0.22	0.071	0.071832	-0.00083151	1.
0.2233	0.066	0.068634	-0.0026339	1.
0.2266	0.061	0.065579	-0.0045786	1.
0.23	0.057	0.062573	-0.0055729	1.
0.2366	0.052	0.057126	-0.0051259	1.
0.24	0.047	0.054508	-0.0075076	1.
0.25	0.042	0.047482	-0.0054819	1.

RESULTS FROM VISUAL CURVE MATCHING

BMW17 FALLING HEAD TEST



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A Q T E S O L V   R E S U L T S

Version 1.10

07/20/92   18:18:32

===

TEST DESCRIPTION

Data set........... A:BMW17F.DAT
Data set title...... BMW17 FALLING HEAD TEST

Knowns and Constants:
    No. of data points..................... 29
    Radius of well casing.................. 0.08333
    Radius of well......................... 0.3333
    Aquifer saturated thickness........... 12.26
    Well screen length..................... 9.76
    Static height of water in well........ 12.26
    Log(Re/Rw)............................. 2.691
    A, B, C................................ 0.000, 0.000, 1.946

===

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

===

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES ---

	Estimate		Std. Error
K =	4.9126E-004	+/-	6.7995E-005
y0 =	6.8585E-002	+/-	2.4072E-003

ANALYSIS OF MODEL RESIDUALS

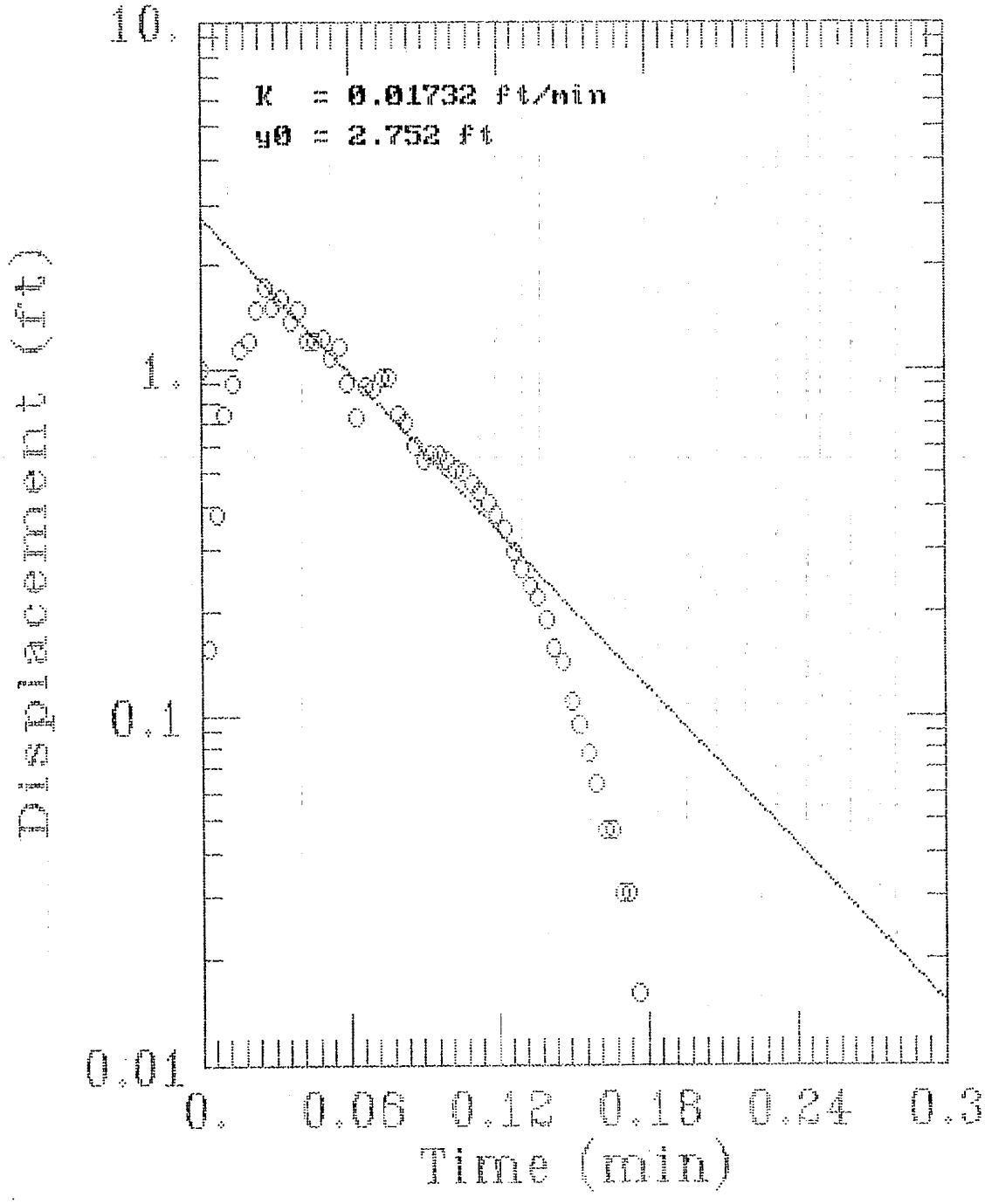
residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
    Number of residuals................. 10
    Number of estimated parameters..... 2
    Degrees of freedom.................. 8
    Residual mean....................... 5.298E-005
    Residual standard deviation........ 0.004922
    Residual variance................... 2.422E-005

Model Residuals:

0.0533	0.076	0.066734	0.0092657	1
0.0566	0.071	0.066622	0.0043786	1
0.06	0.066	0.066505	-0.00050541	1
0.07	0.061	0.066165	-0.0051651	1
0.2	0.057	0.061895	-0.0048951	1
0.35	0.052	0.05731	-0.0053098	1
0.7	0.047	0.047888	-0.00088859	1
0.95	0.042	0.042123	-0.00012307	1
1.2	0.038	0.037051	0.00094869	1
1.6	0.033	0.030176	0.0028239	1

20MWSS MSING HEAD TEST



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A Q T E S O L V   R E S U L T S

Version 1.10

07/21/92   08:12:35

===

TEST DESCRIPTION

Data set............. a:20mwsr1.dat
Data set title...... 20MWSS RISING HEAD TEST

Knowns and Constants:
    No. of data points.................... 53
    Radius of well casing................. 0.08333
    Radius of well........................ 0.3333
    Aquifer saturated thickness........... 14.79
    Well screen length.................... 9.76
    Static height of water in well........ 14.79
    Log(Re/Rw)............................ 2.805
    A, B, C............................... 0.000, 0.000, 1.946

===

ANALYTICAL METHOD

Bouwer-Rice (Unconfined Aquifer Slug Test)

===

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
K =	1.7316E-002	+/-	6.3056E-004
y0 =	2.7519E+000	+/-	1.0256E-001

ANALYSIS OF MODEL RESIDUALS

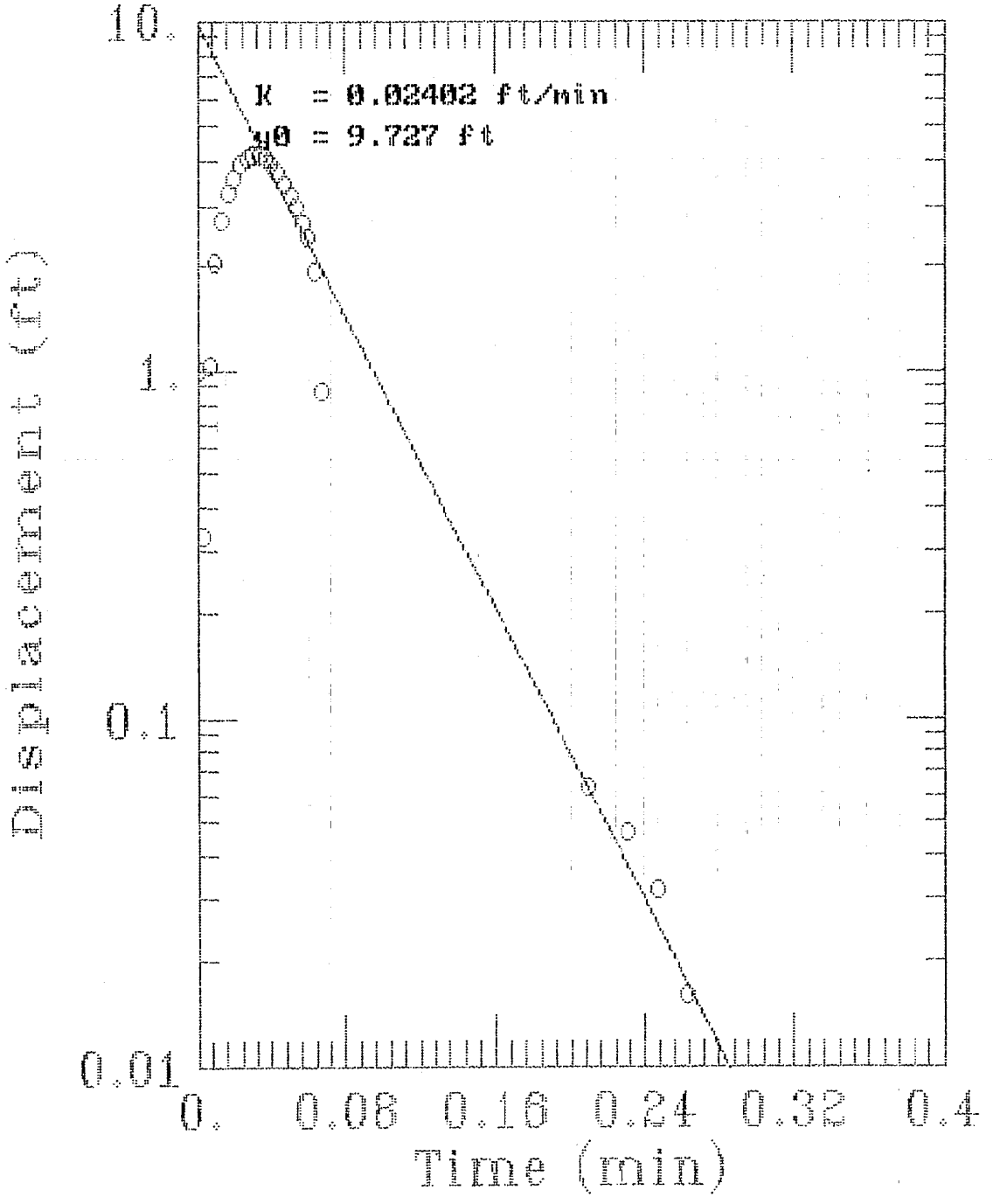
residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
    Number of residuals................. 46
    Number of estimated parameters...... 2
    Degrees of freedom.................. 44
    Residual mean....................... -0.01221
    Residual standard deviation......... 0.08718
    Residual variance................... 0.007601

Model Residuals:

0.0266	1.708	1.7345	-0.026519	1
0.03	1.505	1.6351	-0.13015	1
0.0333	1.583	1.5441	0.038855	1
0.0366	1.379	1.4582	-0.079207	1
0.04	1.473	1.3747	0.098335	1
0.0433	1.207	1.2982	-0.09116	1
0.0466	1.207	1.2259	-0.018913	1
0.05	1.222	1.1557	0.066321	1
0.0533	1.081	1.0914	-0.010361	1
0.0566	1.16	1.0306	0.12938	1
0.06	0.909	0.97158	-0.062578	1
0.0633	0.721	0.91751	-0.19651	1
0.0666	0.893	0.86644	0.026557	1
0.07	0.878	0.8168	0.061196	1
0.0733	0.94	0.77135	0.16865	1
0.0766	0.94	0.72842	0.21158	1
0.08	0.736	0.68669	0.049314	1
0.0833	0.69	0.64847	0.041531	1
0.0866	0.596	0.61238	-0.016379	1
0.09	0.548	0.5773	-0.029296	1
0.0933	0.564	0.54517	0.018833	1
0.0966	0.564	0.51483	0.049174	1
0.1	0.548	0.48533	0.062668	1
0.1033	0.517	0.45832	0.058679	1
0.1066	0.501	0.43281	0.068186	1
0.11	0.47	0.40802	0.061983	1
0.1133	0.439	0.38531	0.05369	1
0.1166	0.407	0.36387	0.043134	1
0.12	0.376	0.34302	0.03298	1
0.1233	0.345	0.32393	0.021071	1
0.1266	0.298	0.3059	-0.0079015	1
0.13	0.266	0.28838	-0.022376	1
0.1333	0.235	0.27233	-0.037327	1
0.1366	0.219	0.25717	-0.038171	1
0.14	0.188	0.24244	-0.054437	1
0.1433	0.157	0.22894	-0.071945	1
0.1466	0.141	0.2162	-0.075203	1
0.15	0.11	0.20382	-0.093817	1
0.1533	0.094	0.19247	-0.098474	1
0.1566	0.078	0.18176	-0.10376	1
0.16	0.063	0.17135	-0.10835	1
0.1633	0.047	0.16181	-0.11481	1
0.1666	0.047	0.15281	-0.10581	1
0.17	0.031	0.14405	-0.11305	1
0.1733	0.031	0.13604	-0.10504	1
0				

20MWSS FALLING HEAD TEST



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<<

0.03	4.216	4.7244	-0.5084	1.
0.0333	4.216	4.3636	-0.14764	1.
0.0366	4.138	4.0304	0.10758	1.
0.04	3.966	3.7137	0.25231	1.
0.0433	3.746	3.4301	0.3159	1.
0.0466	3.464	3.1682	0.29583	1.
0.05	3.213	2.9192	0.2938	1.
0.0533	2.947	2.6963	0.25071	1.
0.0566	2.665	2.4904	0.17461	1.
0.06	2.398	2.2947	0.10331	1.
0.0633	1.913	2.1195	-0.20646	1.
0.0666	0.878	1.9576	-1.0796	1.
0.21	0.063	0.06203	0.00096933	1.
0.23	0.046997	0.038328	0.0086686	1.
0.2466	0.031998	0.025703	0.0062947	1.
0.2633	0.015999	0.017195	-0.0011961	1.

Attachment J-2
Slug Test Results and Supporting Calculations for the Deep Aquifer

Slug Test Results
Yorktown Aquifer

WELL NO.	TRANSMISSIVITY (T) (ft^2/min)	(GPD/ft)	AVERAGE TRANSMISSIVITY (GPD/ft)	AVERAGE HYDRAULIC CONDUCTIVITY (GPD/ft^2)	STORATIVITY (S)	AVERAGE STORATIVITY
Area A						
A-MW1CR	1.09E-01	1,200	1,300	20	4.90E-06	5.84E-06
A-MW1CF	1.29E-01	1,400			6.78E-06	
A-MW8BR	1.62E+00	17,400	25,600	300	1.00E-08	1.00E-08
A-MW8BF	3.14E+00	33,800			1.00E-08	
A-P8R	1.32E+00	14,200	10,200	100	9.90E-09	9.95E-09
A-P8F	5.79E-01	6,200			1.00E-08	
A-MW9CR	8.52E-05	1	1	0.01	1.32E-03	1.32E-03
A-MW9CF	---	---			---	
A-MW13BR	3.53E-01	3,400	5,950	50	1.00E-08	1.00E-08
A-MW13BF	7.88E-01	8,500			1.00E-08	
A-MW14BR	6.74E-01	7,300	7,550	100	1.00E-08	1.00E-08
A-MW14BF	7.22E-01	7,800			1.00E-08	
A-MW15BR	1.02E+00	11,000	8,750	100	1.00E-08	6.89E-09
A-MW15BF	6.30E-01	6,500			3.77E-09	
A-MW17BR	---	---	4,200	50	---	1.18E-05
A-MW17BF	3.91E-01	4,200			1.18E-05	
B-15WBR	9.28E-04	10	6	0.05	2.08E-03	1.52E-03
B-15WBF	9.35E-05	1			9.50E-04	
Area B						
B-MW8BR	1.62E-01	1,700	1,650	20	1.97E-07	3.56E-06
B-MW8BF	1.46E-01	1,600			6.91E-06	
B-MW9BR	5.84E-02	600	3,450	50	8.61E-04	4.30E-04
B-MW9BF	5.86E-01	6,300			1.00E-08	
B-MW11BR	2.68E-01	2,900	5,500	50	1.00E-08	1.00E-08
B-MW11BF	7.53E-01	8,100			1.00E-08	

Notes:

Calculations performed using Aqtesolv's Cooper et. al. Method.

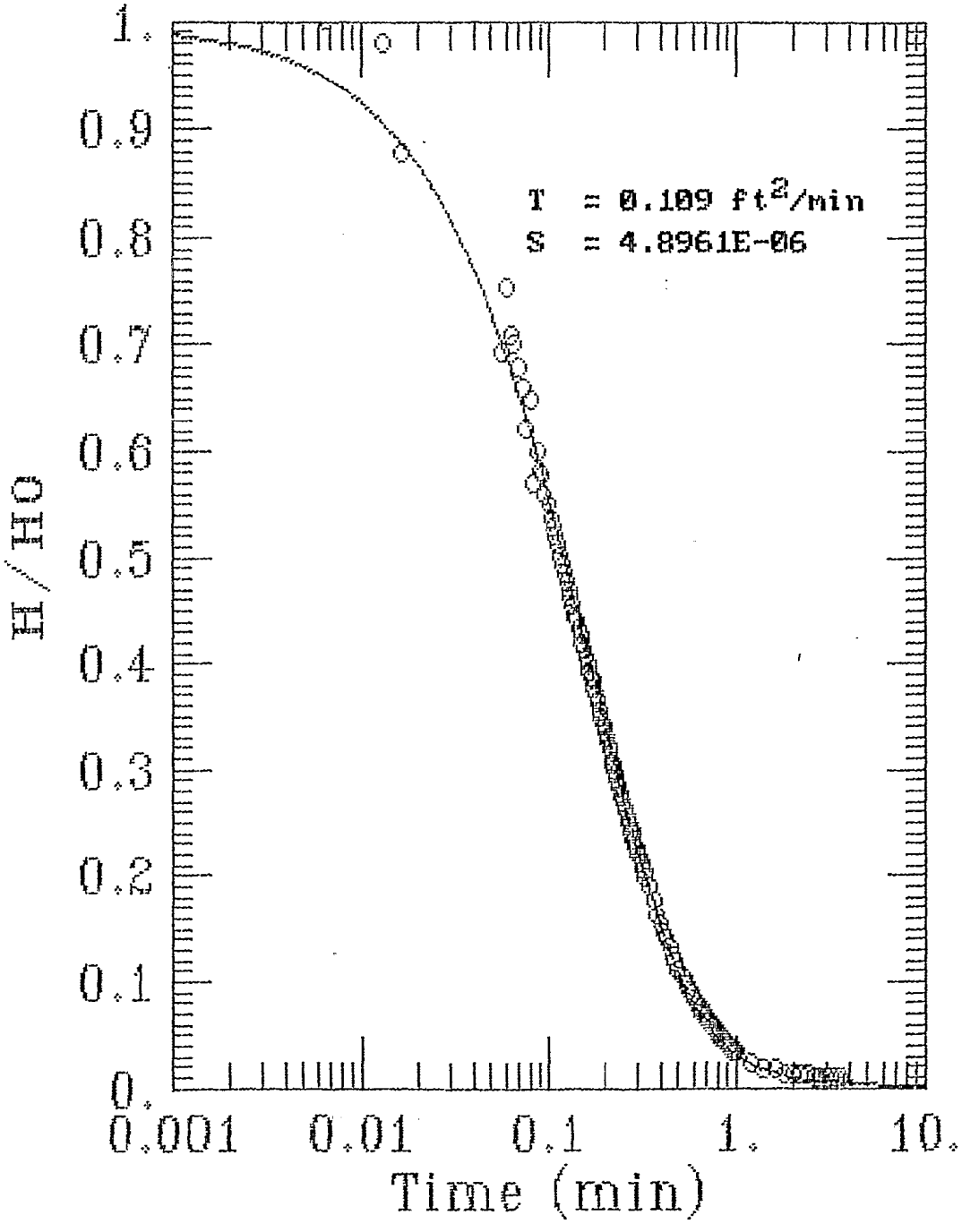
The suffix R following the well number denotes a rising head test.

The suffix F following the well number denotes a falling head test.

The hydraulic conductivity is based on a saturated thickness of 88.6 feet.

The T and K values have been rounded to the nearest multiple of 10, as appropriate.

AMW1C RISING HEAD TEST



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A Q T E S O L V   R E S U L T S
Version 1.10

07/22/92 13:57:34

==

TEST DESCRIPTION

Data set............ A:AMW1CR.DAT
Data set title...... AMW1C RISING HEAD TEST

Knowns and Constants:
No. of data points................... 141
Pumping rate......................... 1
Radius (distance) to obs. well....... 0.08333

==

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

==

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

		Estimate		Std. Error
T	=	1.0904E-001	+/-	4.9780E-003
S	=	4.8961E-006	+/-	2.4373E-006

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
Number of residuals................ 141
Number of estimated parameters..... 2
Degrees of freedom................. 139
Residual mean...................... 0.00708
Residual standard deviation........ 0.04513
Residual variance.................. 0.002037

Model Residuals:

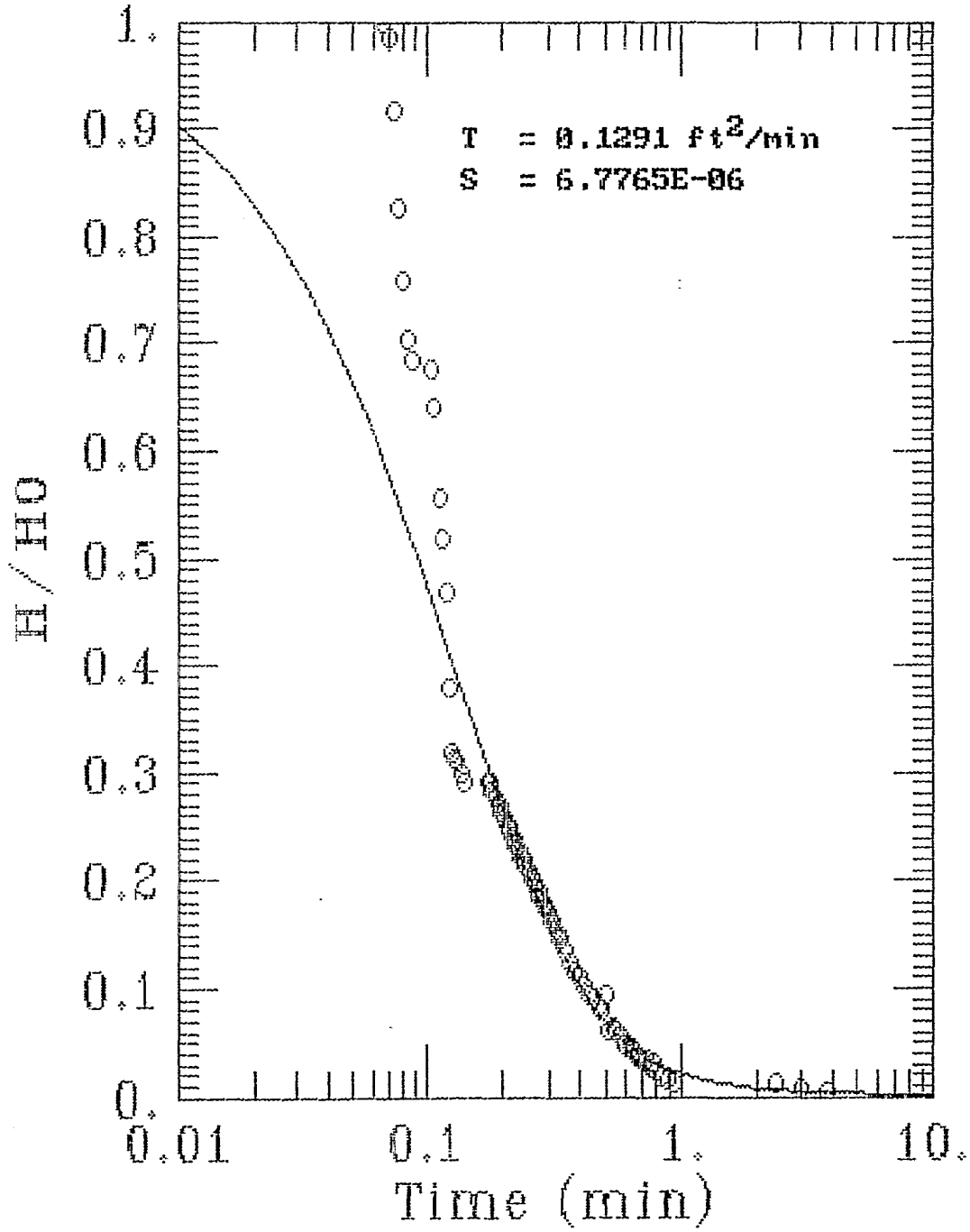
Time	Observed	Calculated	Residual	Weight
0.0066	3.555	3.364	0.19104	1
0.0133	3.476	3.2146	0.26144	1
0.0166	3.116	3.1467	-0.030743	1

0.06	2.678	2.4417	0.2363	1
0.0633	2.521	2.398	0.12303	1
0.0666	2.49	2.3553	0.1347	1
0.07	2.411	2.3124	0.098588	1
0.0733	2.349	2.2718	0.077215	1
0.0766	2.208	2.2321	-0.024108	1
0.08	2.302	2.1922	0.10981	1
0.0833	2.021	2.1543	-0.13334	1
0.0866	2.13	2.1173	0.012659	1
0.09	2.067	2.0801	-0.013089	1
0.0933	2.051	2.0447	0.0062548	1
0.0966	1.989	2.0102	-0.021176	1
0.1	1.958	1.9753	-0.017345	1
0.1033	1.911	1.9423	-0.031277	1
0.1066	1.879	1.9099	-0.030917	1
0.11	1.848	1.8773	-0.029293	1
0.1133	1.817	1.8463	-0.029305	1
0.1166	1.785	1.816	-0.030965	1
0.12	1.754	1.7854	-0.031365	1
0.1233	1.723	1.7563	-0.033286	1
0.1266	1.692	1.7278	-0.035802	1
0.13	1.66	1.6991	-0.039062	1
0.1333	1.644	1.6717	-0.027741	1
0.1366	1.613	1.645	-0.031969	1
0.14	1.582	1.6179	-0.035946	1
0.1433	1.566	1.5922	0.026247	1
0.1466	1.535	1.5671	-0.032057	1
0.15	1.519	1.5416	-0.022623	1
0.1533	1.488	1.5174	-0.029427	1
0.1566	1.472	1.4937	-0.021703	1
0.16	1.441	1.4697	-0.028742	1
0.1633	1.425	1.4469	-0.021941	1
0.1666	1.394	1.4246	-0.030578	1
0.17	1.378	1.402	-0.023986	1
0.1733	1.362	1.3805	-0.018482	1
0.1766	1.331	1.3594	-0.028385	1
0.18	1.316	1.3381	-0.022067	1
0.1833	1.3	1.3178	-0.01777	1
0.1866	1.284	1.2979	-0.013854	1
0.19	1.253	1.2777	-0.024722	1
0.1933	1.238	1.2586	-0.020552	1
0.1966	1.222	1.2397	-0.017737	1
0.2	1.206	1.2207	-0.014714	1
0.2033	1.19	1.2026	-0.012595	1
0.2066	1.174	1.1848	-0.010809	1
0.21	1.159	1.1668	-0.0078222	1
0.2133	1.144	1.1497	-0.005687	1
0.2166	1.128	1.1329	-0.0048622	1
0.22	1.096	1.1158	-0.019845	1
0.2233	1.081	1.0996	-0.018631	1
0.2266	1.081	1.0837	-0.0027067	1
0.23	1.065	1.0676	-0.0025979	1
0.2333	1.05	1.0522	-0.0022456	1
0.2366	1.034	1.0372	-0.0031659	1
0.24	1.018	1.0219	-0.0039085	1
0.2433	1.002	1.0074	-0.0053651	1
0.2466	0.987	0.99308	-0.0060775	1
0.25	0.971	0.97862	-0.0076189	1
0.2533	0.956	0.96483	-0.0088346	1
0.2566	0.956	0.95129	0.0047094	1
0.26	0.94	0.93758	0.0024177	1
0.2633	0.924	0.92451	-0.0005112	1
0.2666	0.908	0.91167	-0.0036659	1
0.27	0.893	0.89866	-0.0056627	1
0.2733	0.893	0.88626	0.0067381	1

0.28	0.862	[illegible]	[illegible]	1.
0.2833	0.862	0.84996	0.012037	1.
0.2866	0.846	0.83839	0.0076069	1.
0.29	0.83	0.82668	0.0033229	1.
0.2933	0.814	0.8155	-0.0015006	1.
0.2966	0.814	0.80451	0.0094876	1.
0.3	0.799	0.79338	0.0056159	1.
0.3033	0.783	0.78277	0.00023328	1.
0.3066	0.783	0.77233	0.010673	1.
0.31	0.768	0.76175	0.0062478	1.
0.3133	0.768	0.75166	0.016338	1.
0.3166	0.752	0.74174	0.010261	1.
0.32	0.736	0.73169	0.0043139	1.
0.3233	0.736	0.72209	0.013907	1.
0.3266	0.721	0.71266	0.0083432	1.
0.33	0.721	0.7031	0.017903	1.
0.3333	0.705	0.69397	0.011028	1.
0.35	0.673	0.65002	0.022979	1.
0.3666	0.627	0.60977	0.017229	1.
0.3833	0.579	0.57243	0.006575	1.
0.4	0.548	0.53796	0.010043	1.
0.4166	0.517	0.5063	0.010704	1.
0.4333	0.501	0.47684	0.024165	1.
0.45	0.47	0.44957	0.020434	1.
0.4666	0.439	0.42445	0.01455	1.
0.4833	0.423	0.40101	0.021986	1.
0.5	0.391	0.37926	0.011735	1.
0.5166	0.376	0.35918	0.016821	1.
0.5333	0.361	0.34039	0.020611	1.
0.55	0.345	0.32291	0.022094	1.
0.5666	0.329	0.30672	0.02228	1.
0.5833	0.313	0.29154	0.02146	1.
0.6	0.297	0.27738	0.019618	1.
0.6166	0.282	0.26424	0.017759	1.
0.6333	0.267	0.25189	0.015112	1.
0.65	0.267	0.24034	0.026661	1.
0.6666	0.251	0.22959	0.021406	1.
0.6833	0.235	0.21947	0.01553	1.
0.7	0.235	0.20998	0.025018	1.
0.7166	0.219	0.20114	0.017864	1.
0.7333	0.204	0.19278	0.01122	1.
0.75	0.204	0.18493	0.019068	1.
0.7666	0.204	0.1776	0.026402	1.
0.7833	0.189	0.17066	0.018345	1.
0.8	0.189	0.16412	0.02488	1.
0.8166	0.173	0.158	0.015002	1.
0.8333	0.173	0.15219	0.020809	1.
0.85	0.157	0.14671	0.010287	1.
0.8666	0.157	0.14157	0.01543	1.
0.8833	0.157	0.13668	0.020319	1.
0.9	0.141	0.13206	0.0089416	1.
0.9166	0.141	0.12771	0.01329	1.
0.9333	0.141	0.12357	0.017433	1.
0.95	0.125	0.11964	0.0053577	1.
0.9666	0.125	0.11594	0.0090576	1.
0.9833	0.125	0.11241	0.01259	1.
1	0.125	0.10906	0.015944	1.
1.2	0.079	0.079392	-0.00039176	1.
1.4	0.063	0.061843	0.0011571	1.
1.6	0.063	0.050569	0.012431	1.
1.8	0.047	0.042805	0.0041954	1.
2	0.047	0.037146	0.0098545	1.
2.2	0.047	0.032832	0.014168	1.
2.4	0.047	0.029428	0.017572	1.
2.6	0.031	0.026666	0.0043336	1.

3	0.031	0.022449	0.008606	1
3.2	0.031	0.020801	0.010199	1
3.4	0.031	0.019375	0.011625	

AMW1C FALLING HEAD TEST



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

A Q T E S O L V

A Program for

Automatic Estimation of Aquifer Coefficients

From Aquifer Test Data

By:

Glenn M. Duffield
and
James O. Rumbaugh, III

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A Q T E S O L V   R E S U L T S
Version 1.10

07/23/92 09:20:09

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TEST DESCRIPTION

Data set........... amw1cf.dat
Data set title..... AMW1C FALLING HEAD TEST

Knowns and Constants:
No. of data points.................. 100
Pumping rate........................ 1
Radius (distance) to obs. well...... 0.08333

==

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

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RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

		Estimate		Std. Error
T	=	1.2913E-001	+/-	2.1200E-002
S	=	6.7765E-006	+/-	1.1907E-005

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
Number of residuals............... 92
Number of estimated parameters.... 2
Degrees of freedom................ 90
Residual mean..................... 0.0002595
Residual standard deviation....... 0.1353
Residual variance................. 0.01829

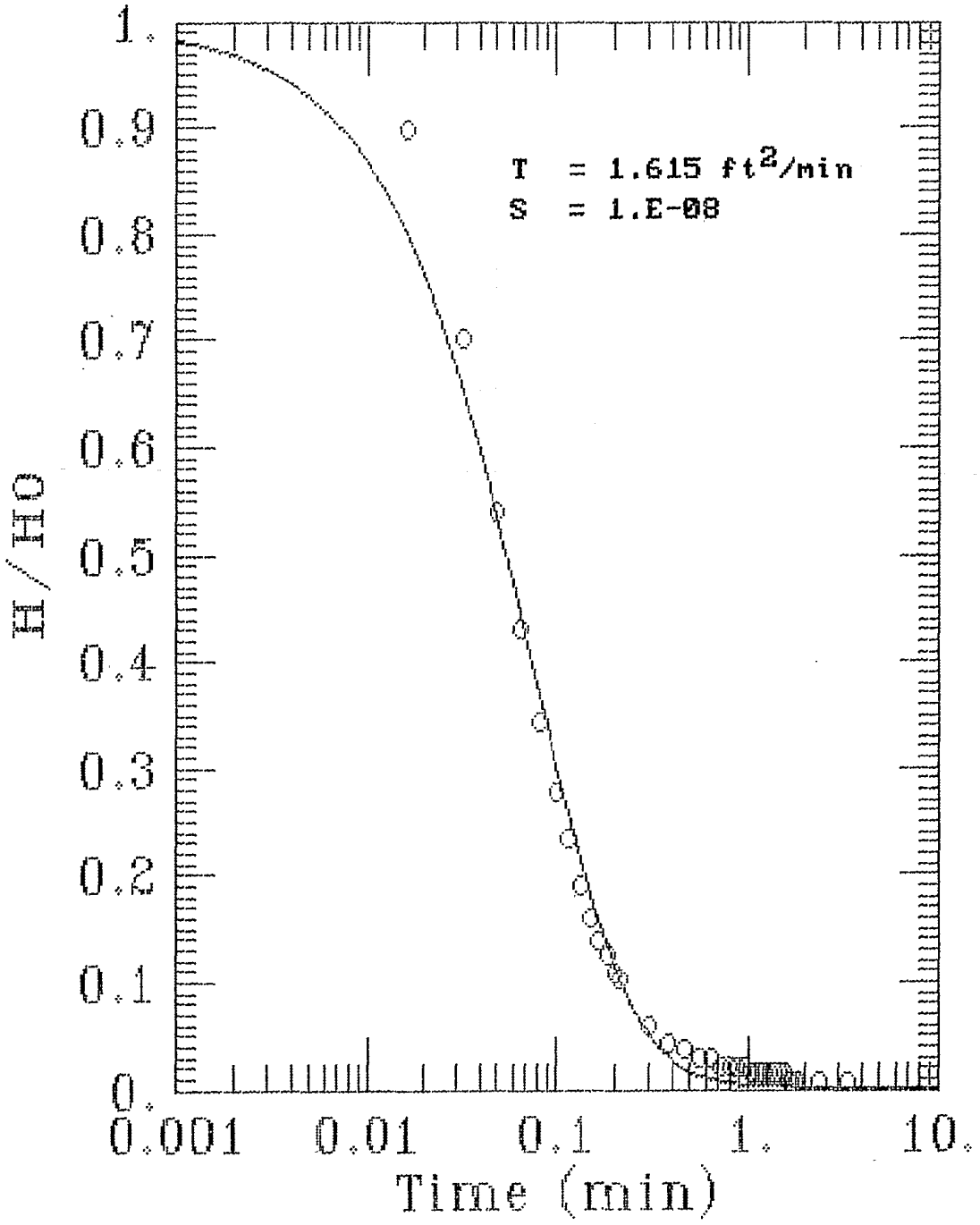
Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.1066	2.646	1.899	0.74703	1
0.1133	2.302	1.8217	0.48027	1
0.1166	2.145	1.7852	0.35984	1

0.1233	1.565	1.7137	-0.14873	1
0.1266	1.315	1.6799	-0.36488	1
0.13	1.299	1.6459	-0.34688	1
0.1333	1.284	1.6137	-0.32971	1
0.1366	1.237	1.5823	-0.34534	1
0.14	1.206	1.5508	-0.34481	1
0.1733	1.206	1.2802	-0.07424	1
0.1766	1.206	1.2568	-0.050785	1
0.18	1.174	1.2332	-0.059182	1
0.1833	1.159	1.2108	-0.051806	1
0.1866	1.143	1.1889	-0.045938	1
0.19	1.127	1.1669	-0.039926	1
0.1933	1.111	1.1461	-0.035051	1
0.1966	1.096	1.1256	-0.029645	1
0.2	1.08	1.1051	-0.025098	1
0.2033	1.064	1.0856	-0.021606	1
0.2066	1.049	1.0665	-0.017547	1
0.21	1.034	1.0474	-0.01335	1
0.2133	1.018	1.0291	-0.011134	1
0.2166	1.002	1.0113	-0.009318	1
0.22	0.986	0.99337	-0.0073685	1
0.2233	0.97	0.97633	-0.0063316	1
0.2266	0.955	0.95966	-0.0046638	1
0.23	0.939	0.94287	-0.003867	1
0.2333	0.924	0.92692	-0.0029201	1
0.2366	0.924	0.91131	0.012685	1
0.24	0.908	0.89558	0.012415	1
0.2433	0.892	0.88065	0.011353	1
0.2466	0.876	0.86603	0.0099745	1
0.25	0.861	0.85128	0.0097163	1
0.2533	0.861	0.83728	0.023719	1
0.2566	0.846	0.82357	0.022428	1
0.26	0.83	0.80975	0.020254	1
0.2633	0.814	0.79661	0.017389	1
0.2666	0.798	0.78375	0.014252	1
0.27	0.798	0.77077	0.027227	1
0.2733	0.782	0.75844	0.023558	1
0.2766	0.767	0.74637	0.020635	1
0.28	0.752	0.73418	0.01782	1
0.2833	0.752	0.7226	0.029402	1
0.2866	0.736	0.71125	0.024748	1
0.29	0.736	0.6998	0.036199	1
0.2933	0.72	0.68891	0.031085	1
0.2966	0.704	0.67825	0.025752	1
0.3	0.704	0.66748	0.03652	1
0.3033	0.689	0.65724	0.031758	1
0.3066	0.673	0.64721	0.025793	1
0.31	0.673	0.63708	0.035924	1
0.3133	0.658	0.62744	0.030559	1
0.3166	0.642	0.618	0.024005	1
0.32	0.642	0.60846	0.033543	1
0.3233	0.626	0.59938	0.026616	1
0.3266	0.626	0.59049	0.035512	1
0.33	0.61	0.5815	0.028497	1
0.3333	0.61	0.57295	0.037046	1
0.35	0.564	0.53215	0.031852	1
0.3666	0.516	0.49533	0.020668	1
0.3833	0.485	0.46166	0.023338	1
0.4	0.454	0.43102	0.022983	1
0.4166	0.422	0.40324	0.018758	1
0.4333	0.391	0.37773	0.013272	1
0.45	0.376	0.3544	0.021596	1
0.4666	0.344	0.33318	0.010825	1
0.4833	0.329	0.31359	0.015408	1
0.5	0.391	0.29562	0.095384	1

0.5333	0.266	0.26397	0.0020287	1
0.55	0.25	0.24995	5.1671E-005	1
0.5666	0.235	0.23708	-0.0020825	1
0.5833	0.219	0.22512	-0.0061203	1
0.6	0.203	0.21405	-0.011054	1
0.6166	0.188	0.20386	-0.015862	1
0.6333	0.188	0.19435	-0.0063501	1
0.65	0.172	0.18552	-0.013518	1
0.6666	0.157	0.17735	-0.020354	1
0.6833	0.157	0.16971	-0.012708	1
0.7	0.141	0.16258	-0.021582	1
0.7166	0.125	0.15597	-0.030972	1
0.7333	0.141	0.14976	-0.0087597	1
0.75	0.109	0.14395	-0.03495	1
0.7666	0.125	0.13854	-0.013542	1
0.7833	0.094	0.13344	-0.039442	1
0.8333	0.078	0.11996	-0.04196	1
0.8833	0.062	0.10871	-0.046712	1
0.9333	0.047	0.099239	-0.052239	1
2.4	0.047	0.027455	0.019545	1
3	0.031			

AMW8B RISING HEAD TEST



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A Q T E S O L V   R E S U L T S

Version 1.10

07/23/92 11:51:15

TEST DESCRIPTION

Data set.............. A:AMW8BR.DAT
Data set title...... AMW8B RISING HEAD TEST

Knowns and Constants:
No. of data points...................... 35
Pumping rate............................ 1
Radius (distance) to obs. well....... 0.1667

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

		Estimate		Std. Error
T	=	1.6160E+000	+/-	5.6313E-001
S	=	1.0000E-008	+/-	6.4569E-008

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

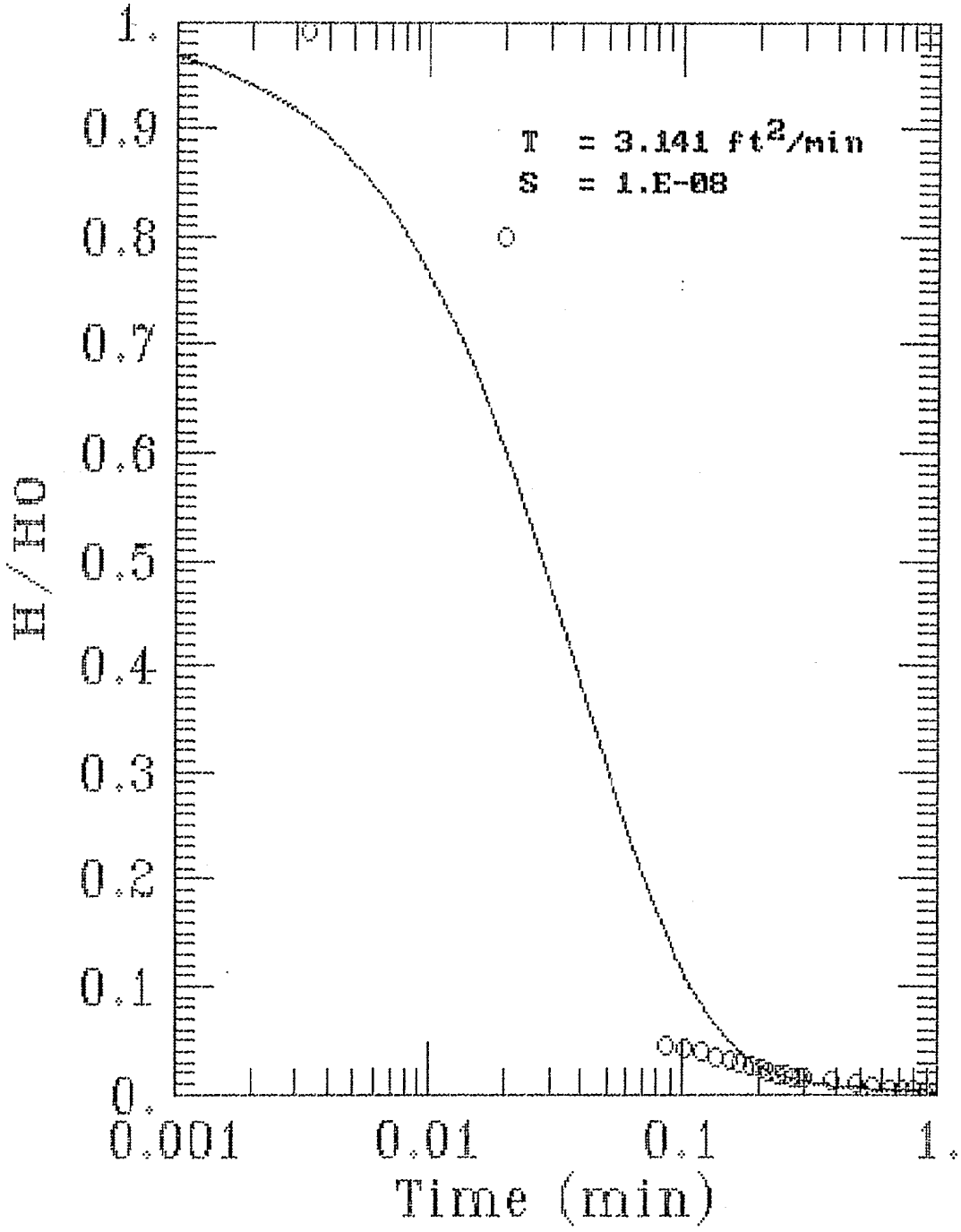
Weighted Residual Statistics:
Number of residuals.................. 35
Number of estimated parameters..... 2
Degrees of freedom................... 33
Residual mean........................ 0.01675
Residual standard deviation......... 0.05191
Residual variance.................... 0.002695

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0167	1.937	1.7166	0.22043	1
0.0334	1.512	1.3944	0.11765	1
0.05	1.165	1.1437	0.021307	1

0.0834	0.74	0.78167	-0.041667	1.
0.1	0.598	0.65194	-0.053935	1.
0.1167	0.504	0.54574	-0.041735	1.
0.1334	0.409	0.45898	-0.049979	1.
0.15	0.346	0.3882	-0.042202	1.
0.1667	0.299	0.32954	-0.030539	1.
0.1834	0.267	0.28106	-0.014062	1.
0.2	0.236	0.24108	-0.0050825	1.
0.2167	0.22	0.2076	0.012403	1.
0.3	0.126	0.10606	0.019935	1.
0.3834	0.094	0.061429	0.032571	1.
0.4667	0.078	0.040101	0.037899	1.
0.55	0.063	0.028933	0.034067	1.
0.6334	0.063	0.022516	0.040484	1.
0.7167	0.047	0.018496	0.028504	1.
0.8	0.047	0.015763	0.031237	1.
0.8834	0.047	0.013774	0.033226	1.
0.9667	0.047	0.012254	0.034746	1.
1.05	0.031	0.011045	0.019955	1.
1.1334	0.031	0.010052	0.020948	1.
1.2167	0.031	0.0092223	0.021778	1.
1.3	0.031	0.0085162	0.022484	1.
1.3834	0.031	0.007907	0.023093	1.
1.4667	0.031	0.0073774	0.023623	1.
1.55	0.031	0.0069124	0.024088	1.
1.6334	0.015	0.0065007	0.0084993	1.
1.7167	0.015	0.0061347	0.0088653	1.
1.8	0.015	0.0058071	0.0091929	1.
1.8834	0.015	0.005512	0.009488	1.
2.3834	0.015	0.0042252	0.010775	1.
3.3834	0.015	0.0028904	0.01211	1.

AMW8B FALLING HEAD TEST



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A Q T E S O L V   R E S U L T S

Version 1.10

07/23/92 11:58:35

TEST DESCRIPTION

Data set............ A:AMW8BF.DAT
Data set title...... AMW8B FALLING HEAD TEST

Knowns and Constants:
No. of data points................... 24
Pumping rate......................... 1
Radius (distance) to obs. well....... 0.1667

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

		Estimate		Std. Error
T	=	3.1772E+000	+/-	2.6037E+000
S	=	1.0000E-008	+/-	1.5858E-007

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
Number of residuals................. 24
Number of estimated parameters..... 2
Degrees of freedom................. 22
Residual mean...................... 0.006452
Residual standard deviation........ 0.3623
Residual variance.................. 0.1313

del Residuals:

Time	Observed	Calculated	Residual	Weight
0.0033	6.647	6.1044	0.54256	1
0.02	5.371	4.0363	1.3347	1
0.0866	0.299	0.99002	-0.69102	1

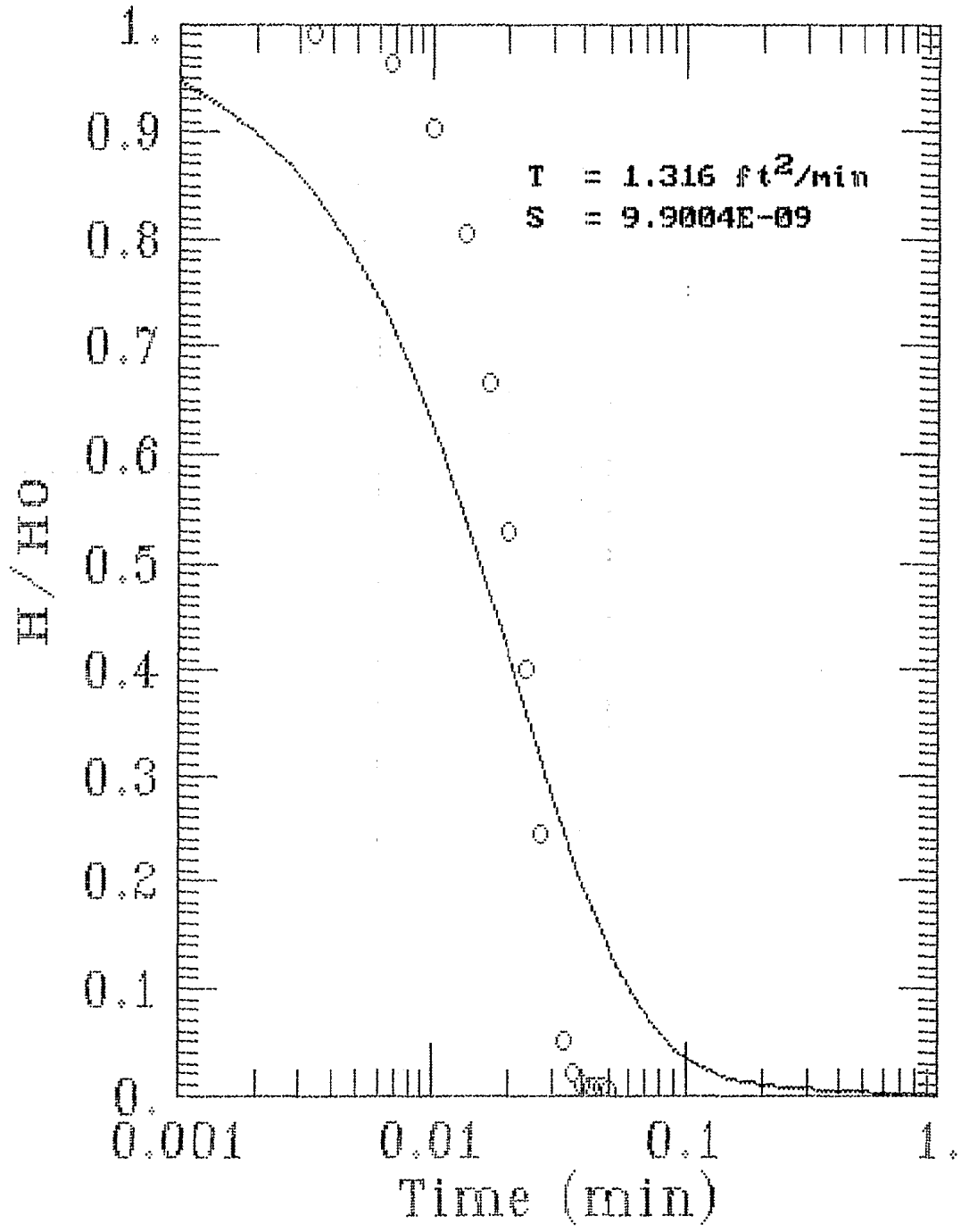
0.12	0.267	0.34888	-0.27988	1
0.1366	0.236	0.41866	-0.18266	1
0.1533	0.204	0.32643	-0.12243	1
0.17	0.189	0.25957	-0.070573	1
0.1866	0.173	0.21073	-0.037734	1
0.2033	0.157	0.17414	-0.017139	1
0.22	0.141	0.14654	-0.0055361	1
0.2366	0.125	0.12554	-0.00053613	1
0.2533	0.125	0.10914	0.015863	1
0.27	0.11	0.096236	0.013764	1
0.2866	0.093998	0.085997	0.0080013	1
0.3033	0.093998	0.077653	0.016345	1
0.3866	0.077999	0.052715	0.025284	1
0.47	0.063	0.040377	0.022623	1
0.5533	0.047001	0.032869	0.014132	1
0.6366	0.030998	0.027713	0.003285	1
0.72	0.030998	0.023923	0.0070754	1
0.8033	0.030998	0.021024	0.0099737	1
0.8866	0.014999	0.018739	-0.0037403	1
0.97	0.014999	0.016894	-0.0018954	1

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

		Estimate
T	=	3.1411E+000
S	=	1.0000E-008

AP8 RISING HEAD TEST



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

A Q T E S O L V

A Program for

Automatic Estimation of Aquifer Coefficients

From Aquifer Test Data

By:

Glenn M. Duffield
and
James O. Rumbaugh, III

Geraghty & Miller Modeling Group
1895 Preston White Drive, Suite 301
Reston, VA 22091

(703) 476 - 0335

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- Complete graphical display of results

A Q T E S O L V   R E S U L T S
Version 1.10

07/23/92 12:46:39

TEST DESCRIPTION

Data set........... A:AP8R.DAT
Data set title...... AP8 RISING HEAD TEST

Knowns and Constants:
- No. of data points..................... 14
- Pumping rate........................... 1
- Radius (distance) to obs. well........ 0.08333

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
T =	1.3329E+000	+/-	4.1740E+000
S =	1.0000E-008	+/-	5.2533E-007

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
- Number of residuals................ 14
- Number of estimated parameters..... 2
- Degrees of freedom................. 12
- Residual mean...................... 0.07636
- Residual standard deviation........ 1.177
- Residual variance.................. 1.386

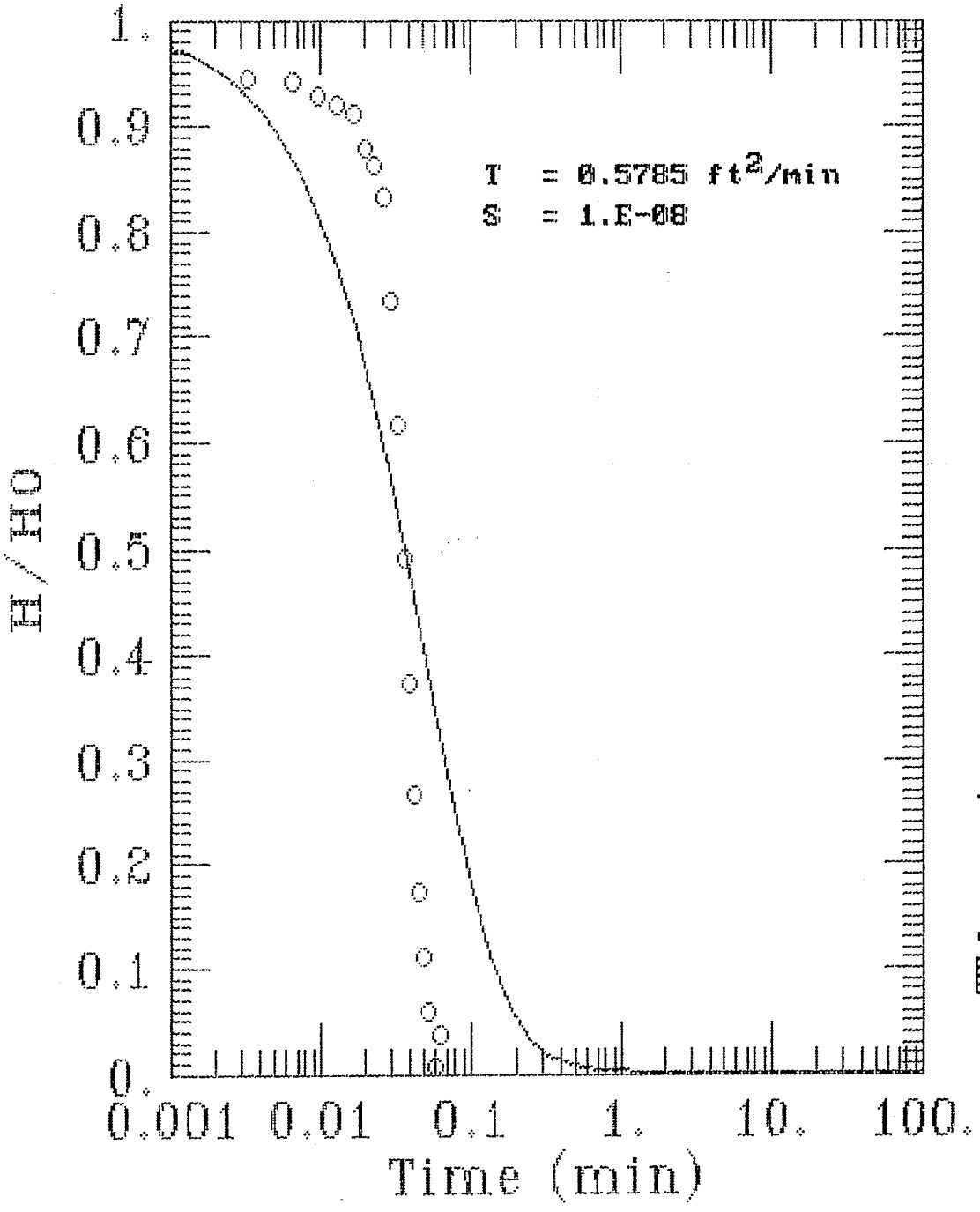
Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0034	5.955	5.0531	0.90187	1
0.0067	5.782	4.3459	1.4361	1
0.01	5.42	3.7604	1.6596	1

0.0167	3.991	2.636	1.145	1
0.02	3.174	2.4827	0.69125	1
0.0234	2.404	2.1695	0.23447	1
0.0267	1.461	1.9085	-0.4475	1
0.0334	0.298	1.4826	-1.1846	1
0.0367	0.125	1.3142	-1.1892	1
0.04	0.062	1.1677	-1.1057	1
0.0434	0.047	1.0364	-0.98942	1
0.0467	0.047	0.92544	-0.87844	1
0.05	0.031	0.82836	-0.79736	1

==========

AP8 FALLING HEAD TEST



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A Q T E S O L V   R E S U L T S

Version 1.10

07/23/92 12:22:56

TEST DESCRIPTION

Data set............. A:AP8F.DAT
Data set title...... AP8 FALLING HEAD TEST

Knowns and Constants:
No. of data points.................... 18
Pumping rate.......................... 1
Radius (distance) to obs. well....... 0.08333

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

		Estimate		Std. Error
T	=	6.7429E-001	+/-	2.7615E+000
S	=	1.0000E-008	+/-	6.8983E-007

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
Number of residuals................ 18
Number of estimated parameters..... 2
Degrees of freedom................. 16
Residual mean...................... 0.1611
Residual standard deviation........ 1.264
Residual variance.................. 1.598

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0033	5.641	5.4815	0.15948	1
0.0066	5.626	5.0725	0.55346	1
0.01	5.547	4.6965	0.85047	1

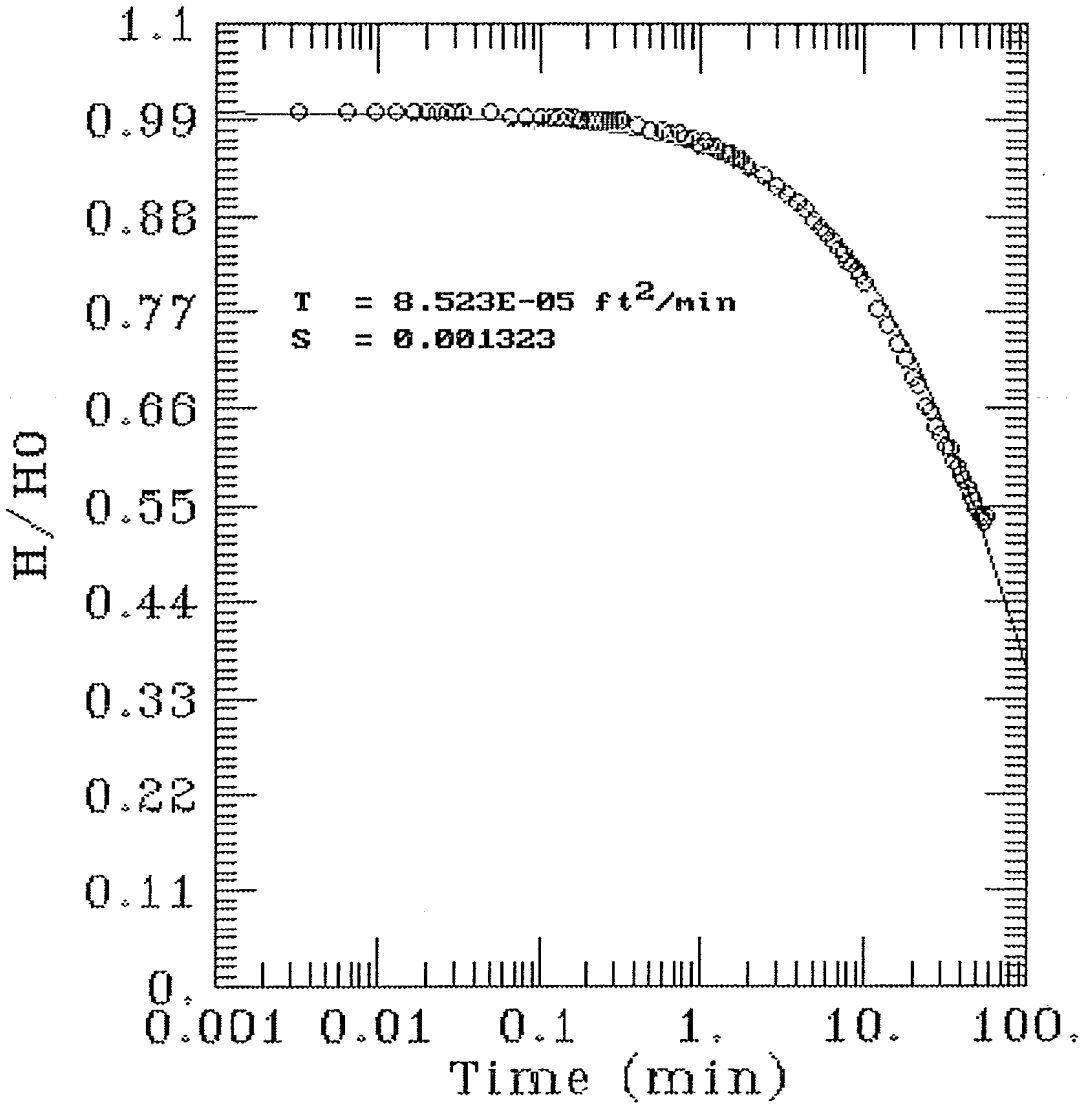
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.02	5.248	3.7808	1.4672	1.
0.0233	5.154	3.5275	1.6265	1.
0.0266	4.966	3.2942	1.6718	1.
0.03	4.384	3.0726	1.3114	1.
0.0333	3.677	2.8739	0.80306	1.
0.0366	2.938	2.6901	0.24792	1.
0.04	2.232	2.5147	-0.28275	1.
0.0433	1.587	2.3571	-0.77008	1.
0.0466	1.037	2.2107	-1.1737	1.
0.05	0.66	2.0708	-1.4108	1.
0.0533	0.346	1.9446	-1.5986	1.
0.06	0.047	1.7147	-1.6677	1.
0.0633	0.22	1.6131	-1.3931	1.

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

		Estimate
T	=	5.7848E-001

AMW9C RISING HEAD TEST



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A Q T E S O L V   R E S U L T S
Version 1.10

07/24/92 08:02:18

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TEST DESCRIPTION

Data set........... A:AMW9CR.DAT
Data set title..... AMW9C RISING HEAD TEST

Knowns and Constants:
No. of data points.................. 88
Pumping rate........................ 1
Radius (distance) to obs. well...... 0.08333

==

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

==

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
T =	8.5230E-005	+/-	4.1199E-006
S =	1.3233E-003	+/-	1.8823E-004

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
Number of residuals............... 88
Number of estimated parameters.... 2
Degrees of freedom................ 86
Residual mean..................... 0.01216
Residual standard deviation....... 0.03797
Residual variance................. 0.001441

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0033	3.216	3.2092	0.0068387	1
0.0066	3.216	3.2063	0.0097393	1
0.01	3.216	3.2039	0.012054	1
0.0133	3.216	3.202	0.013962	1

0.0166	3.216	3.2003	0.015658	1
0.02	3.216	3.1988	0.017248	1
0.0233	3.216	3.1973	0.018675	1
0.0266	3.216	3.196	0.020012	1
0.03	3.216	3.1947	0.021312	1
0.0333	3.216	3.1935	0.02251	1
0.05	3.216	3.1881	0.02789	1
0.0666	3.2	3.1835	0.016482	1
0.0833	3.2	3.1794	0.020613	1
0.1	3.2	3.1756	0.024397	1
0.1166	3.2	3.1721	0.027897	1
0.1333	3.2	3.1688	0.031209	1
0.15	3.2	3.1657	0.034348	1
0.1666	3.2	3.1627	0.037327	1
0.1833	3.184	3.1598	0.024201	1
0.2	3.184	3.157	0.02697	1
0.2166	3.184	3.1544	0.029628	1
0.2333	3.184	3.1518	0.032218	1
0.25	3.184	3.1493	0.034712	1
0.2666	3.184	3.1469	0.037144	1
0.2833	3.184	3.1445	0.039531	1
0.3	3.184	3.142	0.041952	1
0.3166	3.184	3.1398	0.044221	1
0.3333	3.184	3.1375	0.046454	1
0.4166	3.168	3.1269	0.041109	1
0.5	3.153	3.1173	0.035703	1
0.5833	3.153	3.1082	0.044753	1
0.6666	3.137	3.0996	0.037374	1
0.75	3.137	3.0914	0.045603	1
0.8333	3.121	3.0835	0.037482	1
0.9166	3.121	3.0759	0.045071	1
1	3.09	3.0686	0.021405	1
1.0833	3.106	3.0615	0.044494	1
1.1666	3.09	3.0546	0.035364	1
1.25	3.09	3.0479	0.042082	1
1.3333	3.074	3.0413	0.032715	1
1.4166	3.074	3.0347	0.039291	1
1.5	3.059	3.0281	0.030893	1
1.5833	3.059	3.0221	0.03694	1
1.6666	3.043	3.0164	0.026568	1
1.75	3.043	3.0113	0.031699	1
1.8333	3.043	3.0063	0.036696	1
1.9166	3.027	3.0001	0.026873	1
2	3.011	2.9932	0.017751	1
2.5	2.981	2.9646	0.016425	1
3	2.949	2.9319	0.017062	1
3.5	2.917	2.9031	0.013902	1
4	2.886	2.8765	0.0094654	1
4.5	2.855	2.8511	0.0039003	1
5	2.824	2.8267	-0.0027037	1
5.5	2.792	2.8032	-0.011214	1
6	2.776	2.7805	-0.0045267	1
6.5	2.745	2.7586	-0.013557	1
7	2.714	2.7372	-0.023236	1
7.5	2.698	2.7165	-0.018507	1
8	2.666	2.6963	-0.03032	1
8.5	2.651	2.6766	-0.025634	1
9	2.635	2.6574	-0.022412	1
9.5	2.619	2.6386	-0.019625	1
10	2.588	2.6202	-0.032243	1

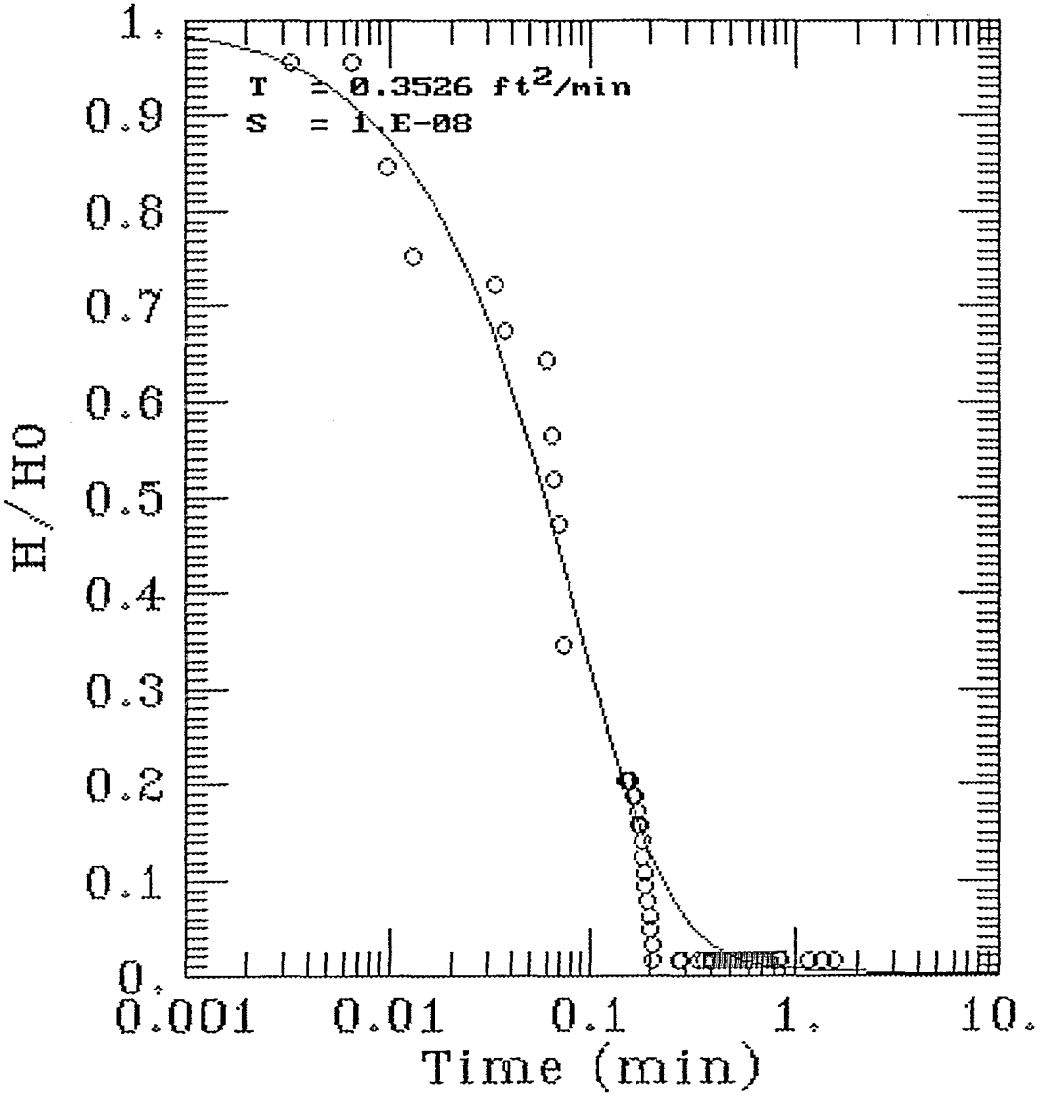
12	2.494	2.5503	-0.05632	1
14	2.431	2.4853	-0.054327	1
16	2.368	2.4244	-0.056432	1
18	2.306	2.367	-0.061036	1
20	2.243	2.3127	-0.069685	1
22	2.212	2.261	-0.049027	1
24	2.133	2.2118	-0.078777	1
26	2.118	2.1647	-0.046703	1
28	2.055	2.1196	-0.06461	1
30	2.024	2.0763	-0.052334	1
32	1.992	2.0347	-0.042733	1
34	1.977	1.9947	-0.017684	1
36	1.93	1.9561	-0.02608	1
38	1.914	1.9188	-0.0048248	1
40	1.882	1.8828	-0.00083436	1
42	1.866	1.848	0.017967	1
44	1.836	1.8144	0.021649	1
46	1.804	1.7817	0.022273	1
48	1.788	1.7501	0.037894	1
50	1.757	1.7194	0.037566	1
52	1.741	1.6897	0.051334	1
54	1.725	1.6608	0.064244	1
56	1.71	1.6327	0.077334	1
58	1.725	1.6054	0.11964	1

==========

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH P

AMW13B RISING HEAD TEST



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A Q T E S O L V   R E S U L T S
Version 1.10

07/23/92 17:50:16

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TEST DESCRIPTION

Data set........... A:AMW13BR.DAT
Data set title..... AMW13B RISING HEAD TEST

Knowns and Constants:
 No. of data points................... 60
 Pumping rate......................... 1
 Radius (distance) to obs. well...... 0.08333

==

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

==

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
T =	3.5256E-001	+/-	1.2019E-001
S =	1.0000E-008	+/-	5.9248E-008

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
 Number of residuals................ 60
 Number of estimated parameters.... 2
 Degrees of freedom................ 58
 Residual mean..................... -0.002591
 Residual standard deviation....... 0.0418
 Residual variance................. 0.001747

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0033	0.957	0.95242	0.0045827	1
0.0066	0.957	0.91148	0.045521	1
0.01	0.847	0.87258	-0.025578	1
0.0133	0.753	0.83727	-0.084266	1

0.0333	0.722	0.65977	0.062227	1
0.0366	0.675	0.63522	0.039781	1
0.06	0.643	0.48924	0.15376	1
0.0633	0.565	0.47201	0.092994	1
0.0666	0.518	0.45547	0.062525	1
0.07	0.471	0.43914	0.031856	1
0.0733	0.345	0.42394	-0.07894	1
0.1533	0.204	0.1908	0.013197	1
0.1566	0.204	0.18503	0.018975	1
0.16	0.204	0.17929	0.024713	1
0.1633	0.188	0.17392	0.014082	1
0.1666	0.188	0.16874	0.019262	1
0.17	0.188	0.16359	0.024408	1
0.1733	0.172	0.15877	0.013226	1
0.1766	0.157	0.15412	0.0028751	1
0.18	0.157	0.1495	0.0074963	1
0.1833	0.141	0.14518	-0.0041762	1
0.1866	0.125	0.141	-0.015998	1
0.19	0.109	0.13684	-0.027843	1
0.1933	0.094	0.13295	-0.038951	1
0.1966	0.078	0.12919	-0.051192	1
0.2	0.062	0.12545	-0.063452	1
0.2033	0.047	0.12195	-0.074948	1
0.2066	0.031	0.11856	-0.087561	1
0.21	0.015	0.11519	-0.10019	1
0.28	0.015	0.066298	-0.051298	1
0.2833	0.015	0.06472	-0.04972	1
0.3533	0.015	0.040484	-0.025484	1
0.37	0.015	0.036621	-0.021621	1
0.4033	0.015	0.030375	-0.015375	1
0.42	0.015	0.027832	-0.012832	1
0.4366	0.015	0.025618	-0.010618	1
0.4533	0.015	0.023662	-0.0086617	1
0.47	0.015	0.021938	-0.0069385	1
0.4866	0.015	0.020424	-0.0054242	1
0.5033	0.015	0.019073	-0.004073	1
0.52	0.015	0.017871	-0.0028711	1
0.5366	0.015	0.016805	-0.0018046	1
0.5533	0.015	0.015844	-0.00084367	1
0.57	0.015	0.014981	1.9451E-005	1
0.5866	0.015	0.014207	0.00079281	1
0.6033	0.015	0.013504	0.0014963	1
0.62	0.015	0.012866	0.0021344	1
0.6366	0.015	0.012289	0.0027115	1
0.6533	0.015	0.011759	0.0032414	1
0.67	0.015	0.011274	0.0037264	1
0.6866	0.015	0.010831	0.0041691	1
0.7033	0.015	0.010421	0.0045792	1
0.72	0.015	0.010042	0.0049578	1
0.7366	0.015	0.0096937	0.0053063	1
0.7533	0.015	0.0093682	0.0056318	1
0.77	0.015	0.0090653	0.0059347	1
0.8533	0.015	0.0078215	0.0071785	1
1.17	0.015	0.0051982	0.0098018	1
1.37	0.015	0.0042936	0.010706	1
1.57	0.015	0.0036523	0.011348	1

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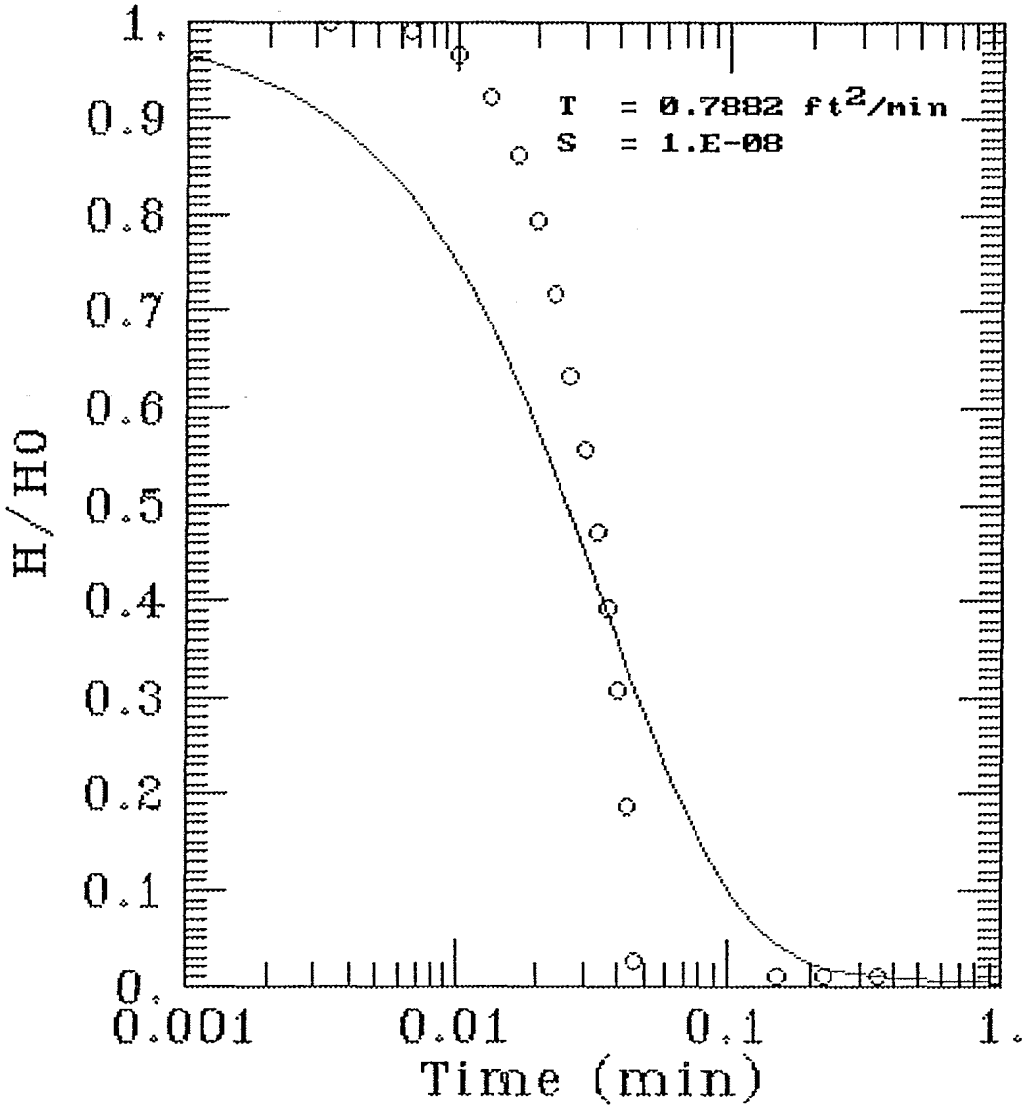
RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

AMW13B FALLING HEAD TEST



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A Q T E S O L V   R E S U L T S

Version 1.10

07/23/92 17:35:30

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TEST DESCRIPTION

Data set........... A:AMW13BF.DAT
Data set title..... AMW13B FALLING HEAD TEST

Knowns and Constants:
   No. of data points.................. 17
   Pumping rate........................ 1
   Radius (distance) to obs. well...... 0.08333

==

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

==

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
T =	7.8815E-001	+/-	2.4039E+000
S =	1.0000E-008	+/-	4.9423E-007

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
   Number of residuals................ 17
   Number of estimated parameters.... 2
   Degrees of freedom................ 15
   Residual mean..................... 0.1218
   Residual standard deviation....... 0.3044
   Residual variance................. 0.09265

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0033	1.837	1.6576	0.17942	1
0.0066	1.822	1.5107	0.31133	1
0.01	1.774	1.3779	0.39609	1
0.0133	1.696	1.2632	0.43281	1

0.0166	1.586	1.1601	0.42589	1
0.02	1.461	1.0644	0.39663	1
0.0233	1.319	0.98032	0.33868	1
0.0266	1.162	0.90399	0.25801	1
0.03	1.021	0.83252	0.18848	1
0.0333	0.864	0.76936	0.094637	1
0.0366	0.722	0.7117	0.010296	1
0.04	0.565	0.65747	-0.092467	1
0.0433	0.345	0.60935	-0.26435	1
0.0466	0.047	0.56527	-0.51827	1
0.15	0.016	0.083255	-0.067255	1
0.2233	0.016	0.03562	-0.01962	1
0.3533	0.016	0.016041	-4.0615E-005	1

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

		Estimate
T	=	7.8815E-001
S	=	1.0000E-008

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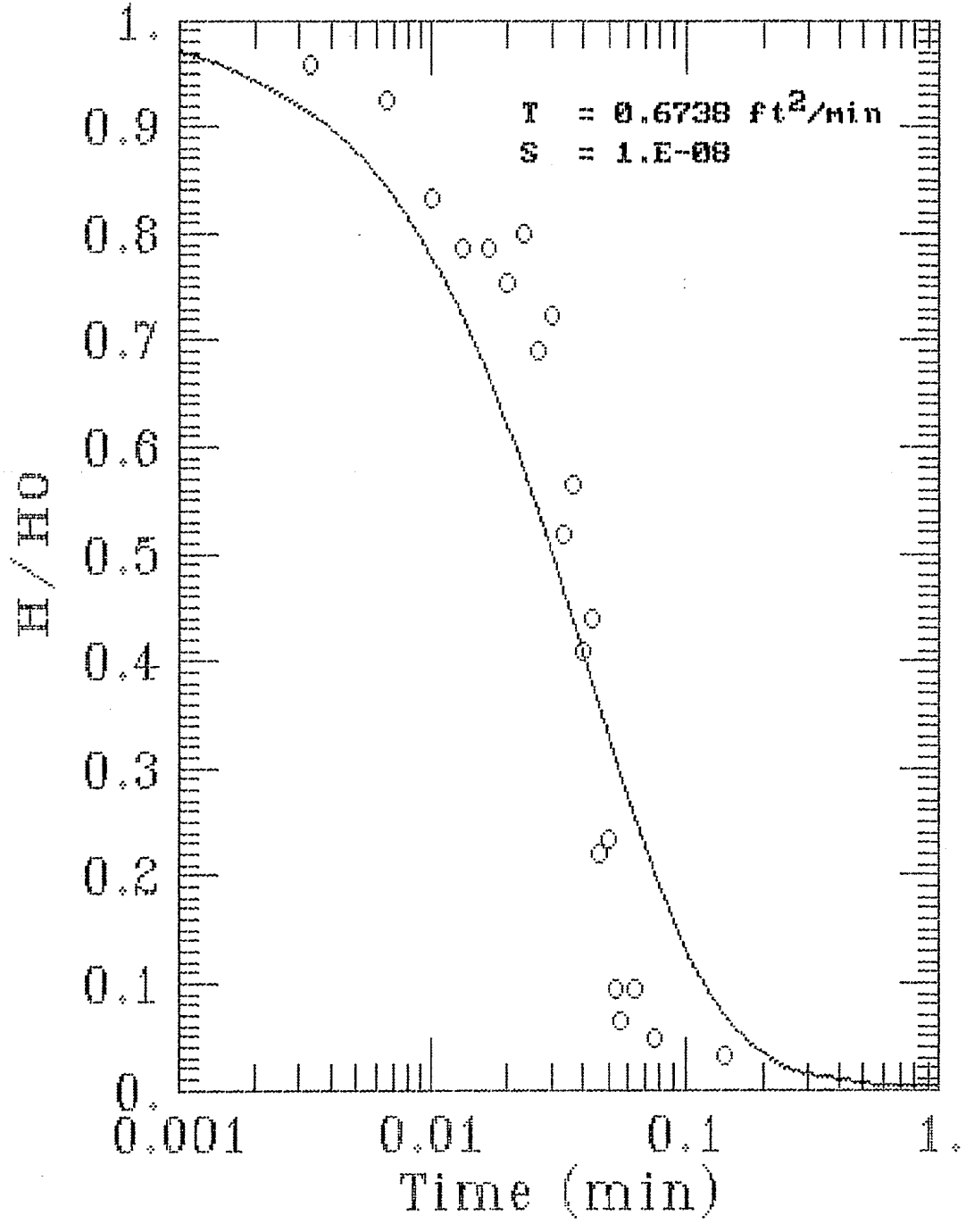
AMW14B RISING HEAD TEST



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

A Q T E S O L V

A Program for

Automatic Estimation of Aquifer Coefficients

From Aquifer Test Data

By:

Glenn M. Duffield
and
James O. Rumbaugh, III

Geraghty & Miller Modeling Group
1895 Preston White Drive, Suite 301
Reston, VA 22091

(703) 476-0335

A Q T E S O L V is a user-friendly program designed to analyze data from aquifer tests automatically. Aquifer coefficients for a variety of aquifer test conditions can be estimated by A Q T E S O L V, including the following:

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<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>

A Q T E S O L V   R E S U L T S

Version 1.10

07/23/92 11:37:45

TEST DESCRIPTION

Data set............ B:AMW14BR.DAT
Data set title...... AMW14B RISING HEAD TEST

Knowns and Constants:
- No. of data points.................. 20
- Pumping rate........................ 1
- Radius (distance) to obs. well....... 0.08333

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

		Estimate		Std. Error
T	=	6.7431E-001	+/-	1.4971E+000
S	=	1.0000E-008	+/-	3.6346E-007

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

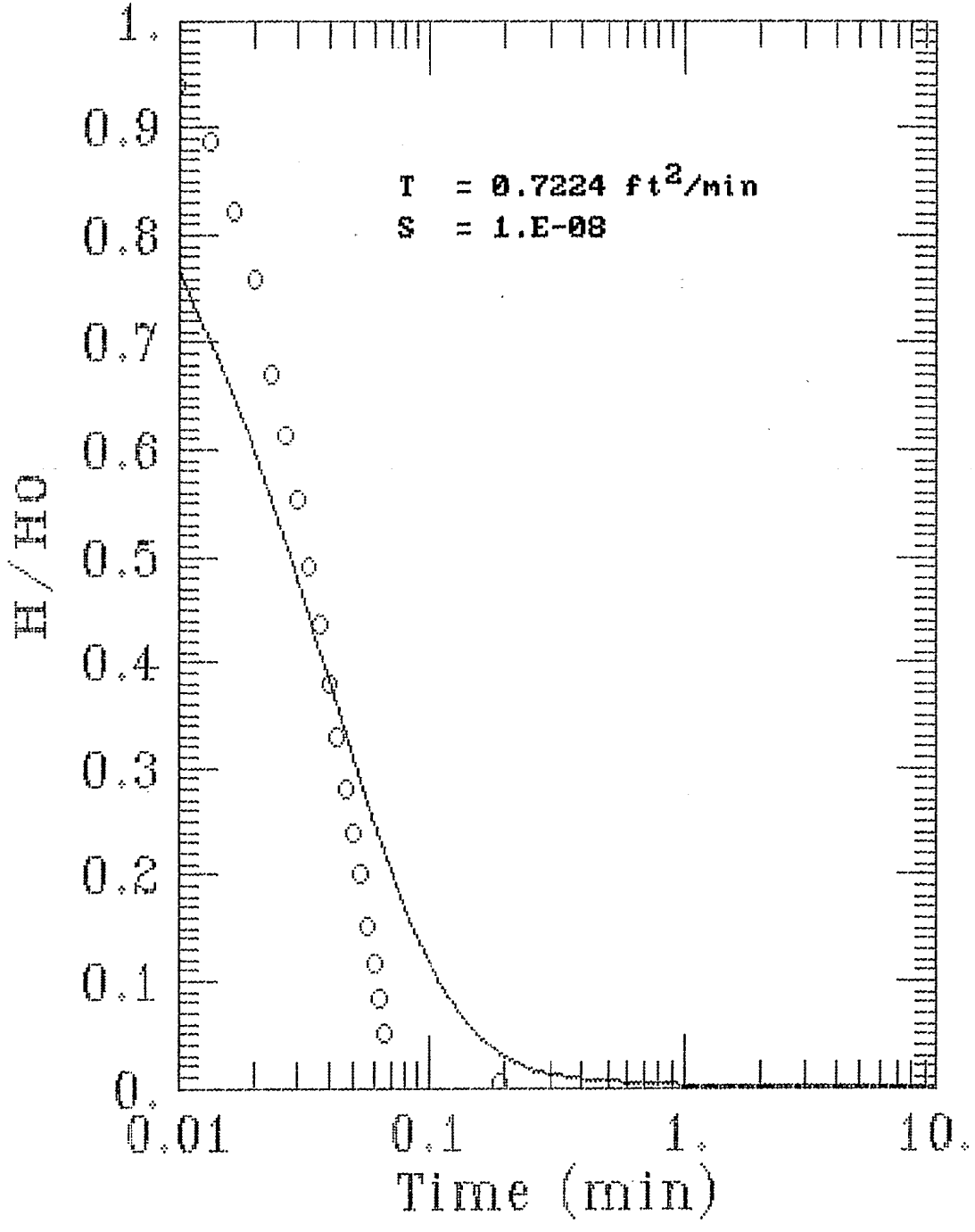
Weighted Residual Statistics:
- Number of residuals................. 20
- Number of estimated parameters..... 2
- Degrees of freedom.................. 18
- Residual mean....................... 0.01232
- Residual standard deviation........ 0.1435
- Residual variance.................. 0.0206

del Residuals:

Time	Observed	Calculated	Residual	Weight
0.0033	0.958	0.91492	0.043083	1
0.0066	0.926	0.84433	0.081672	1
0.01	0.832	0.77972	0.052276	1

0.0166	[illegible]	[illegible]	[illegible]	1.
0.02	0.754	0.62334	0.13066	1.
0.0233	0.801	0.58037	0.22063	1.
0.0266	0.691	0.54088	0.15012	1.
0.03	0.722	0.50346	0.21854	1.
0.0333	0.518	0.47002	0.047982	1.
0.0366	0.565	0.43914	0.12586	1.
0.04	0.408	0.40976	-0.0017609	1.
0.0433	0.439	0.38341	0.055593	1.
0.0466	0.22	0.359	-0.139	1.
0.05	0.235	0.33571	-0.10071	1.
0.0533	0.094	0.31476	-0.22076	1.
0.0566	0.063	0.29532	-0.23232	1.
0.0633	0.094	0.25996	-0.16596	1.
0.0766	0.047	0.20338	-0.15638	1.
0.1433	0.031	0.069258	-0.038258	1.

AMW14B FALLING HEAD TEST



AQTESOLV

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A Q T E S O L V   R E S U L T S
Version 1.10

07/23/92 11:25:37

TEST DESCRIPTION

Data set............ B:AMW14BF.DAT
Data set title...... AMW14B FALLING HEAD TEST

Knowns and Constants:
- No. of data points.................... 21
- Pumping rate.......................... 1
- Radius (distance) to obs. well....... 0.08333

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
T =	7.2238E-001	+/-	1.3339E+000
S =	1.0000E-008	+/-	3.0413E-007

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
- Number of residuals................ 21
- Number of estimated parameters..... 2
- Degrees of freedom................. 19
- Residual mean...................... 0.05084
- Residual standard deviation........ 0.3406
- Residual variance.................. 0.116

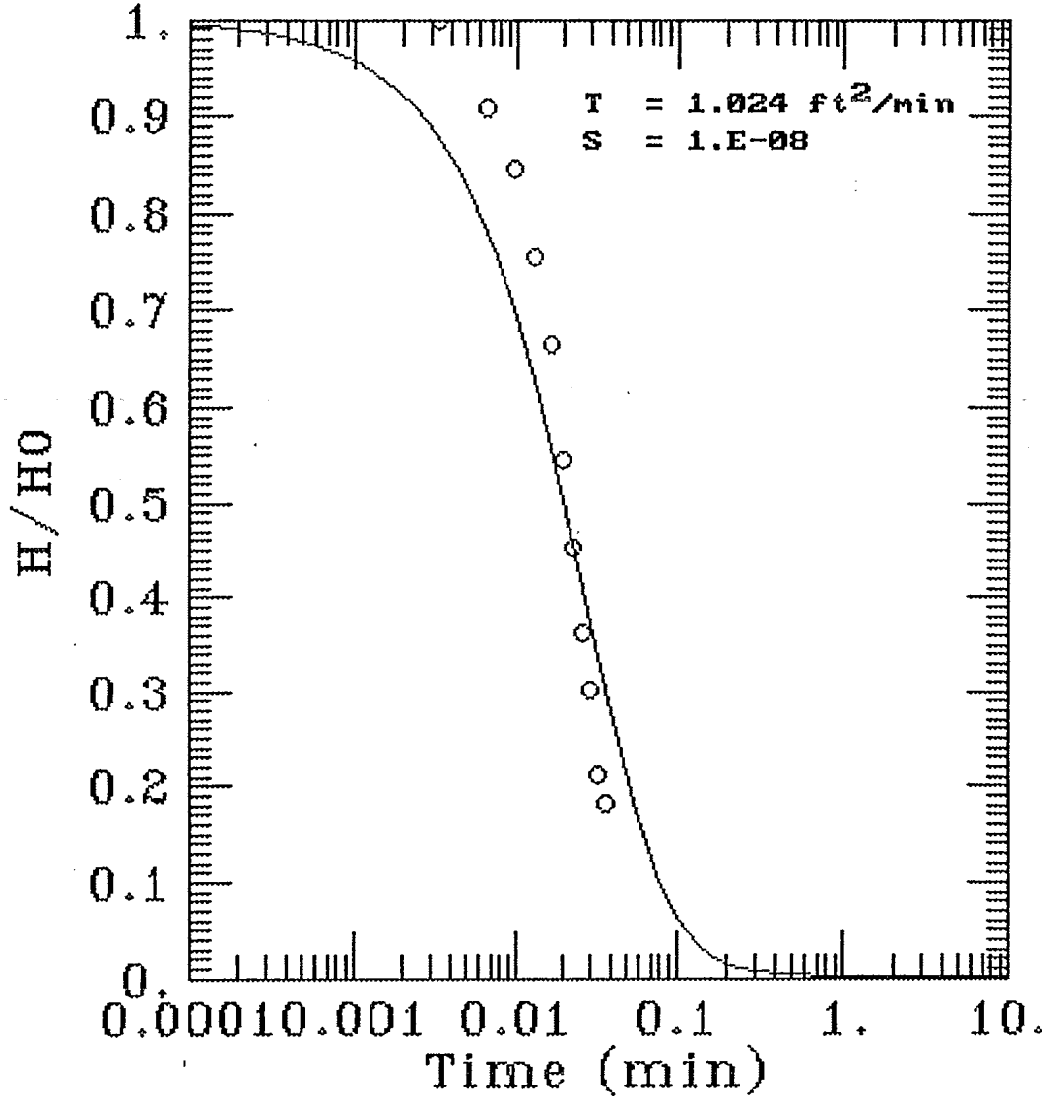
Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0034	2.795	2.55	0.24501	1
0.0067	2.748	2.3411	0.40689	1
0.01	2.638	2.1561	0.48195	1

0.0167	2.376	1.8551	0.52267	1.
0.02	2.135	1.6987	0.43625	1.
0.0234	1.884	1.5708	0.31322	1.
0.0267	1.727	1.4574	0.26964	1.
0.03	1.554	1.3534	0.20056	1.
0.0334	1.382	1.2553	0.12668	1.
0.0367	1.225	1.1679	0.057089	1.
0.04	1.067	1.0875	-0.020488	1.
0.0434	0.926	1.0113	-0.085261	1.
0.0467	0.785	0.94313	-0.15813	1.
0.05	0.675	0.88026	-0.20526	1.
0.0534	0.565	0.82051	-0.25551	1.
0.0567	0.424	0.76696	-0.34296	1.
0.06	0.33	0.71744	-0.38744	1.
0.0634	0.235	0.67026	-0.43526	1.
0.0667	0.141	0.62789	-0.48689	1.
0.19	0.015	0.092174	-0.077174	1.

==========

AMW15B RISING HEAD TEST



AQTES

GERAGHT & MILLER

Modeling

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A Q T E S O L V   R E S U L T S
Version 1.10

07/23/92 15:44:16

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TEST DESCRIPTION

Data set........... a:amw15br.dat
Data set title..... AMW15B RISING HEAD TEST

Knowns and Constants:
   No. of data points.................. 11
   Pumping rate........................ 1
   Radius (distance) to obs. well...... 0.08333

==

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

==

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
T =	1.0239E+000	+/-	3.0459E+000
S =	1.0000E-008	+/-	4.7387E-007

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
   Number of residuals............... 11
   Number of estimated parameters.... 2
   Degrees of freedom................ 9
   Residual mean..................... 0.01666
   Residual standard deviation....... 0.06049
   Residual variance................. 0.003659

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0033	0.518	0.45438	0.063616	1
0.0066	0.471	0.40369	0.067309	1
0.01	0.439	0.35907	0.079926	1
0.0133	0.392	0.32152	0.070485	1

0.0166	0.345	0.2886	0.0564	1
0.02	0.282	0.25878	0.02322	1
0.0233	0.235	0.23323	0.0017653	1
0.0266	0.188	0.21058	-0.022578	1
0.03	0.157	0.18986	-0.03286	1
0.0333	0.11	0.17198	-0.061977	1
0.0366	0.094	0.15602	-0.062016	1

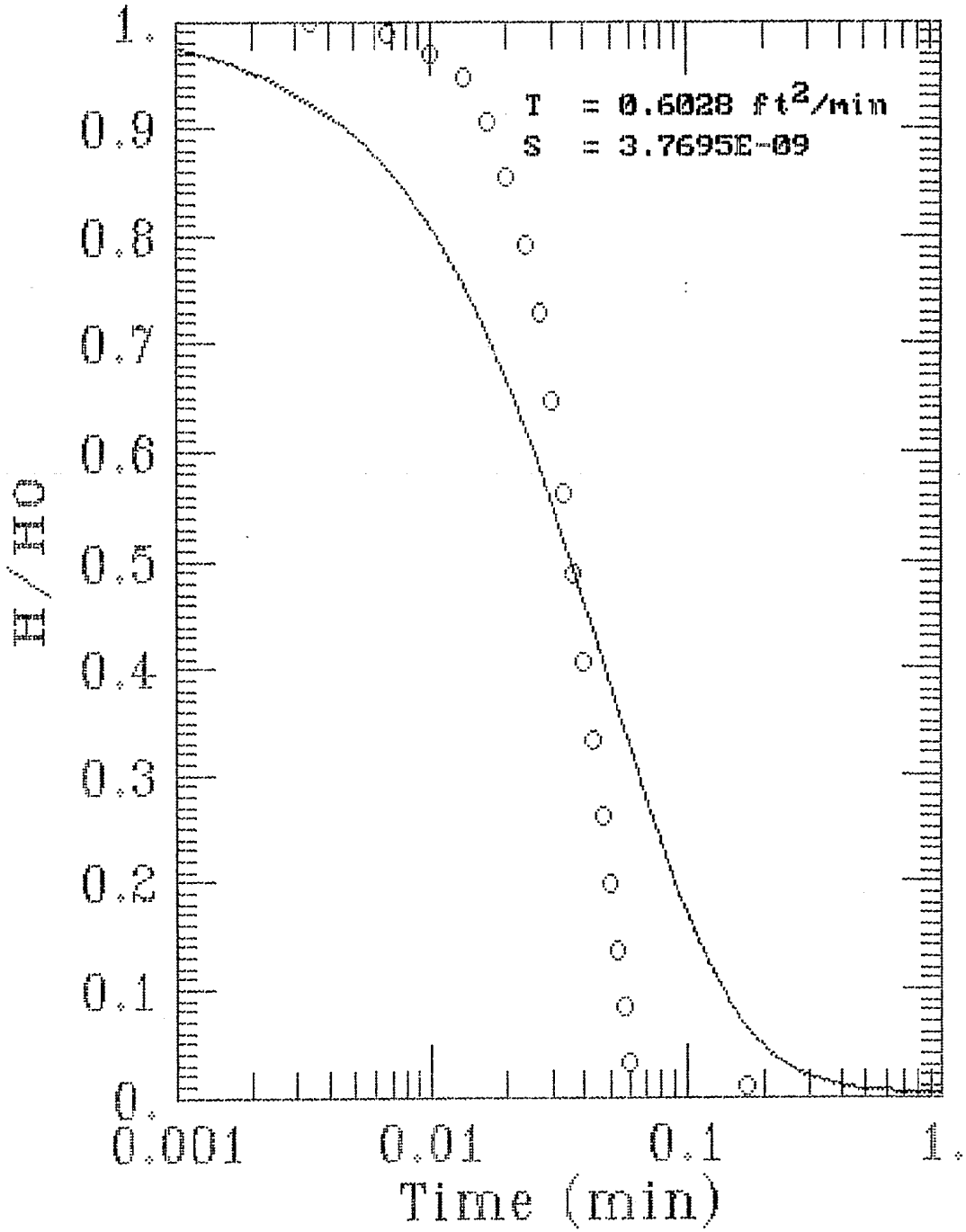
==========

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

		Estimate
T	=	1.0239E+000

AMW15B FALLING HEAD TEST



AQTESOLV

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A Q T E S O L V   R E S U L T S
Version 1.10

07/23/92 15:02:34

TEST DESCRIPTION

Data set............ A:AMW15BF.DAT
Data set title...... AMW15B FALLING HEAD TEST

Knowns and Constants:
- No. of data points..................... 19
- Pumping rate........................... 1
- Radius (distance) to obs. well........ 0.08333

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
T =	6.2270E-001	+/-	1.8505E+000
S =	1.0000E-008	+/-	4.8160E-007

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
- Number of residuals.................. 19
- Number of estimated parameters..... 2
- Degrees of freedom................. 17
- Residual mean...................... 0.03514
- Residual standard deviation........ 0.2574
- Residual variance.................. 0.06627

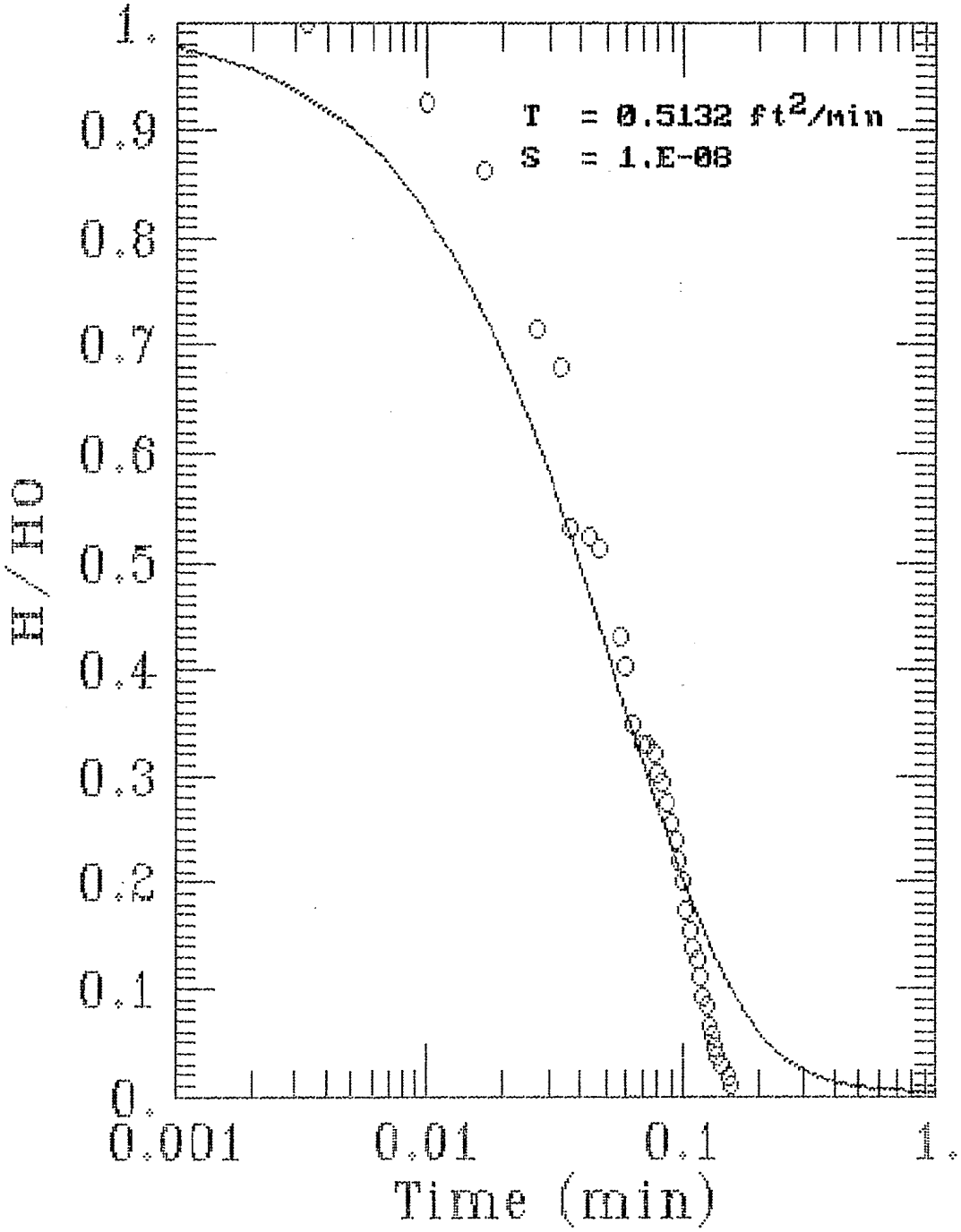
del Residuals:

Time	Observed	Calculated	Residual	Weight
0.0034	1.508	1.3852	0.12277	1
0.0067	1.492	1.2858	0.20617	1
0.01	1.461	1.1968	0.26418	1

0.0167	1.366	1.0376	0.0464	1
0.02	1.288	0.97199	0.31601	1
0.0234	1.194	0.90767	0.28633	1
0.0267	1.099	0.85007	0.24893	1
0.03	0.974	0.79676	0.17724	1
0.0334	0.848	0.7459	0.1021	1
0.0367	0.738	0.70013	0.037868	1
0.04	0.613	0.65761	-0.044607	1
0.0434	0.503	0.6169	-0.1139	1
0.0467	0.393	0.58016	-0.18716	1
0.05	0.298	0.54593	-0.24793	1
0.0534	0.204	0.51309	-0.30909	1
0.0567	0.126	0.48338	-0.35738	1
0.06	0.047	0.45564	-0.40864	1
0.1734	0.016	0.082931	-0.066931	1

RESULTS FROM VISUAL CURVE MATCHING

AMW16BR RISING HEAD TEST



AQTESOLV

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A Q T E S O L V   R E S U L T S
Version 1.10

07/23/92 14:04:54

TEST DESCRIPTION

Data set.............. A:AMW16BR.DAT
Data set title....... AMW16BR RISING HEAD TEST

Knowns and Constants:
- No. of data points...................... 35
- Pumping rate............................ 1
- Radius (distance) to obs. well........ 0.08333

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
T =	5.1315E-001	+/-	3.6390E-001
S =	1.0000E-008	+/-	1.2171E-007

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

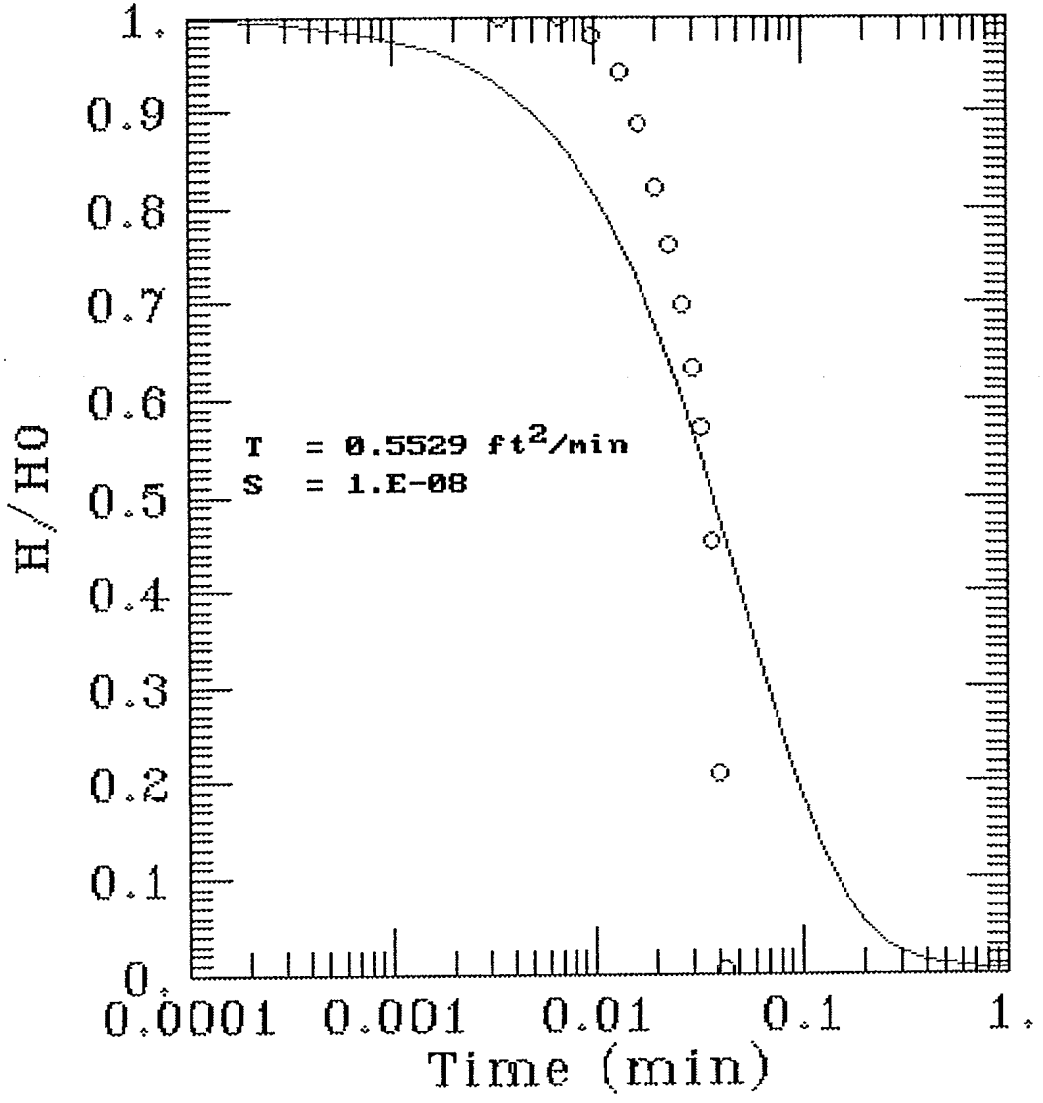
Weighted Residual Statistics:
- Number of residuals................. 35
- Number of estimated parameters..... 2
- Degrees of freedom.................. 33
- Residual mean...................... 3.144E-006
- Residual standard deviation........ 0.1123
- Residual variance.................. 0.01261

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0033	1.708	1.5941	0.11392	1
0.01	1.583	1.408	0.17496	1
0.0167	1.473	1.2518	0.22123	1

0.0333	[illegible]	[illegible]	[illegible]	[illegible]
0.0367	0.909	0.89819	0.010812	1.
0.0433	0.893	0.8086	0.084399	1.
0.0467	0.878	0.76655	0.11145	1.
0.0567	0.736	0.65684	0.079163	1.
0.06	0.69	0.62471	0.06529	1.
0.0633	0.596	0.59439	0.0016113	1.
0.07	0.564	0.53792	0.026083	1.
0.0733	0.564	0.5124	0.051599	1.
0.0767	0.548	0.48757	0.060433	1.
0.08	0.517	0.46479	0.05221	1.
0.0833	0.501	0.44324	0.05776	1.
0.0867	0.47	0.42224	0.047757	1.
0.09	0.439	0.40296	0.036037	1.
0.0933	0.407	0.3847	0.022297	1.
0.0967	0.376	0.36689	0.009107	1.
0.1	0.345	0.35052	-0.0055241	1.
0.1033	0.298	0.33501	-0.037006	1.
0.1067	0.266	0.31986	-0.053856	1.
0.11	0.235	0.30592	-0.070919	1.
0.1133	0.219	0.29269	-0.073695	1.
0.1167	0.188	0.27977	-0.091772	1.
0.12	0.157	0.26787	-0.11087	1.
0.1233	0.141	0.25657	-0.11557	1.
0.1267	0.11	0.24552	-0.13552	1.
0.13	0.094	0.23534	-0.14134	1.
0.1333	0.078	0.22566	-0.14766	1.
0.1367	0.063	0.21618	-0.15318	1.
0.1433	0.047	0.19913	-0.15213	1.
0.15	0.031	0.18347	-0.15247	1.
0.1533	0.016	0.17632	-0.16032	1.

AMW16B FALLING HEAD TEST



AQTESOLV

GERAGHTY & MILLER, INC.

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<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>

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A Q T E S O L V   R E S U L T S

Version 1.10

07/23/92 16:49:51

TEST DESCRIPTION

Data set........... A:AMW16BF.DAT
Data set title..... AMW16B FALLING HEAD TEST

Knowns and Constants:
No. of data points................... 13
Pumping rate......................... 1
Radius (distance) to obs. well...... 0.08333

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
T =	5.5297E-001	+/-	3.3429E+000
S =	1.0000E-008	+/-	9.4818E-007

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
Number of residuals............... 13
Number of estimated parameters.... 2
Degrees of freedom................ 11
Residual mean..................... 0.1444
Residual standard deviation....... 0.8412
Residual variance................. 0.7076

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0034	4.216	3.9072	0.30876	1
0.0067	4.216	3.6552	0.56078	1
0.01	4.138	3.4276	0.71036	1
0.0134	3.966	3.2133	0.75271	1

0.0167	3.746	3.0218	0.72422	1
0.02	3.464	2.8444	0.61956	1
0.0234	3.213	2.675	0.53804	1
0.0267	2.947	2.522	0.42497	1
0.03	2.665	2.3795	0.28554	1
0.0334	2.398	2.2425	0.15553	1
0.0367	1.913	2.1183	-0.2053	1
0.04	0.878	2.0021	-1.1241	1
0.0434	0.015999	1.8901	-1.8741	1

==

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

		Estimate
T	=	5.5297E-001
S	=	1.0000E-008

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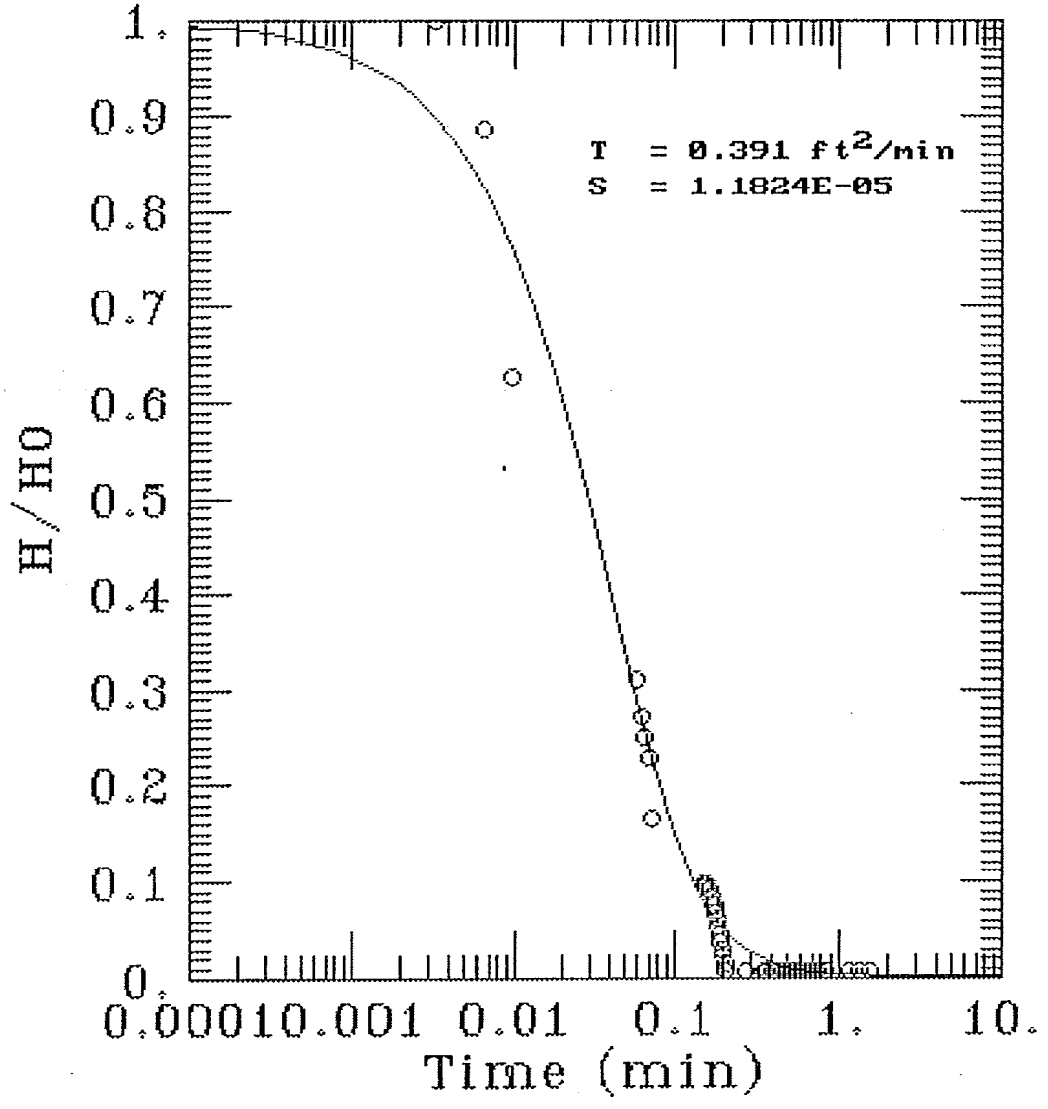
AMW17B FALLING HEAD TEST



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

A Q T E S O L V

A Program for

Automatic Estimation of Aquifer Coefficients

From Aquifer Test Data

By:

Glenn M. Duffield
and
James O. Rumbaugh, III

Geraghty & Miller Modeling Group
1895 Preston White Drive, Suite 301
Reston, VA 22091

(703) 476 - 0335

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A Q T E S O L V   R E S U L T S
Version 1.10

07/23/92 17:58:15

TEST DESCRIPTION

Data set........... A:AMW17BF.DAT
Data set title..... AMW17B FALLING HEAD TEST

Knowns and Constants:
- No. of data points.................. 57
- Pumping rate........................ 1
- Radius (distance) to obs. well...... 0.08333

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
T =	3.9095E-001	+/-	6.3351E-002
S =	1.1824E-005	+/-	1.9665E-005

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

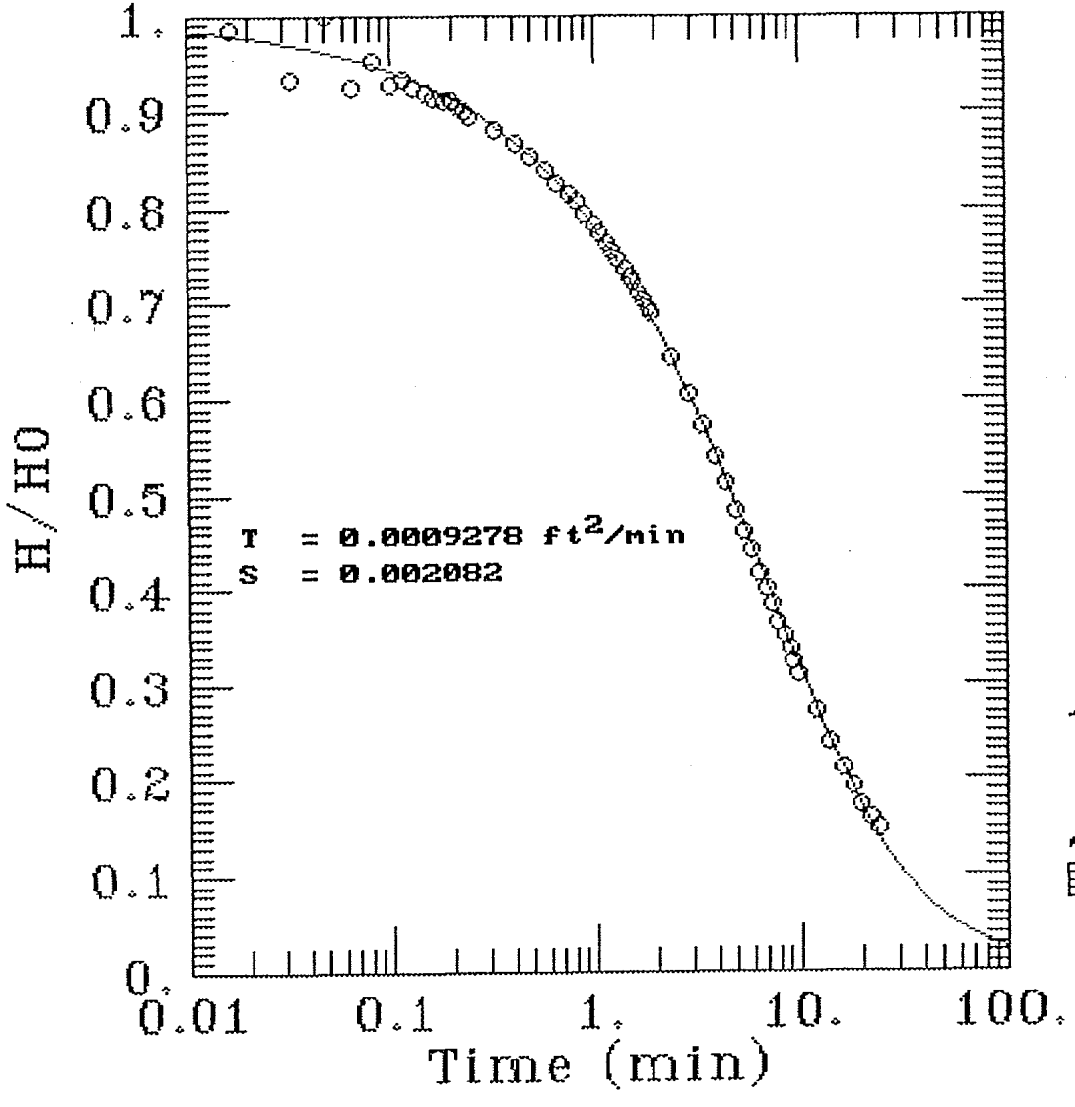
Weighted Residual Statistics:
- Number of residuals............... 57
- Number of estimated parameters.... 2
- Degrees of freedom................ 55
- Residual mean..................... -3.761E-006
- Residual standard deviation....... 0.05928
- Residual variance................. 0.003514

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0033	2.074	1.8616	0.2124	1
0.0066	1.838	1.7059	0.13213	1
0.01	1.304	1.5687	-0.26468	1
0.06	0.643	0.57918	0.063818	1

0.0633	0.565	0.54731	0.017693	1
0.0666	0.518	0.51764	0.00035922	1
0.07	0.471	0.4892	-0.018196	1
0.0733	0.345	0.46348	-0.11848	1
0.1533	0.204	0.15706	0.046941	1
0.1566	0.204	0.15147	0.052532	1
0.16	0.204	0.14601	0.057993	1
0.1633	0.188	0.14098	0.047021	1
0.1666	0.188	0.1362	0.051797	1
0.17	0.188	0.13153	0.05647	1
0.1733	0.172	0.12722	0.04478	1
0.1766	0.157	0.12312	0.03388	1
0.18	0.157	0.1191	0.037898	1
0.1833	0.141	0.11539	0.02561	1
0.1866	0.125	0.11185	0.013146	1
0.19	0.109	0.10838	0.00061755	1
0.1933	0.094	0.10517	-0.011171	1
0.1966	0.078	0.10211	-0.024107	1
0.2	0.062	0.099094	-0.037094	1
0.2033	0.047	0.096303	-0.049303	1
0.2066	0.031	0.093635	-0.062635	1
0.21	0.015	0.091009	-0.076009	1
0.28	0.015	0.055826	-0.040826	1
0.2833	0.015	0.054768	-0.039768	1
0.3533	0.015	0.038805	-0.023805	1
0.37	0.015	0.03625	-0.02125	1
0.4033	0.015	0.032039	-0.017039	1
0.42	0.015	0.030276	-0.015276	1
0.4366	0.015	0.028708	-0.013708	1
0.4533	0.015	0.027288	-0.012288	1
0.47	0.015	0.026003	-0.011003	1
0.4866	0.015	0.024842	-0.0098417	1
0.5033	0.015	0.023775	-0.008775	1
0.52	0.015	0.022797	-0.007797	1
0.5366	0.015	0.021902	-0.0069023	1
0.5533	0.015	0.021071	-0.006071	1
0.57	0.015	0.020301	-0.0053008	1
0.5866	0.015	0.019589	-0.0045894	1
0.6033	0.015	0.018922	-0.0039224	1
0.62	0.015	0.018299	-0.0032994	1
0.6366	0.015	0.017719	-0.0027194	1
0.6533	0.015	0.017172	-0.0021719	1
0.67	0.015	0.016657	-0.001657	1
0.6866	0.015	0.016175	-0.0011748	1
0.7033	0.015	0.015717	-0.00071684	1
0.72	0.015	0.015284	-0.00028394	1
0.7366	0.015	0.014876	0.00012355	1
0.7533	0.015	0.014488	0.00051234	1
0.77	0.015	0.014118	0.00088152	1
0.8533	0.015	0.012524	0.002476	1
1.17	0.015	0.0087493	0.0062507	1
1.37	0.015	0.0073476	0.0076524	

B-15WB RISING HEAD TEST



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A Q T E S O L V   R E S U L T S

Version 1.10

07/24/92 09:08:34

TEST DESCRIPTION

Data set........... A:B15WBR.DAT
Data set title..... B-15WB RISING HEAD TEST

Knowns and Constants:
No. of data points.................. 58
Pumping rate........................ 1
Radius (distance) to obs. well...... 0.08333

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

		Estimate		Std. Error
T	=	9.2778E-004	+/-	2.2235E-005
S	=	2.0822E-003	+/-	1.5095E-004

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

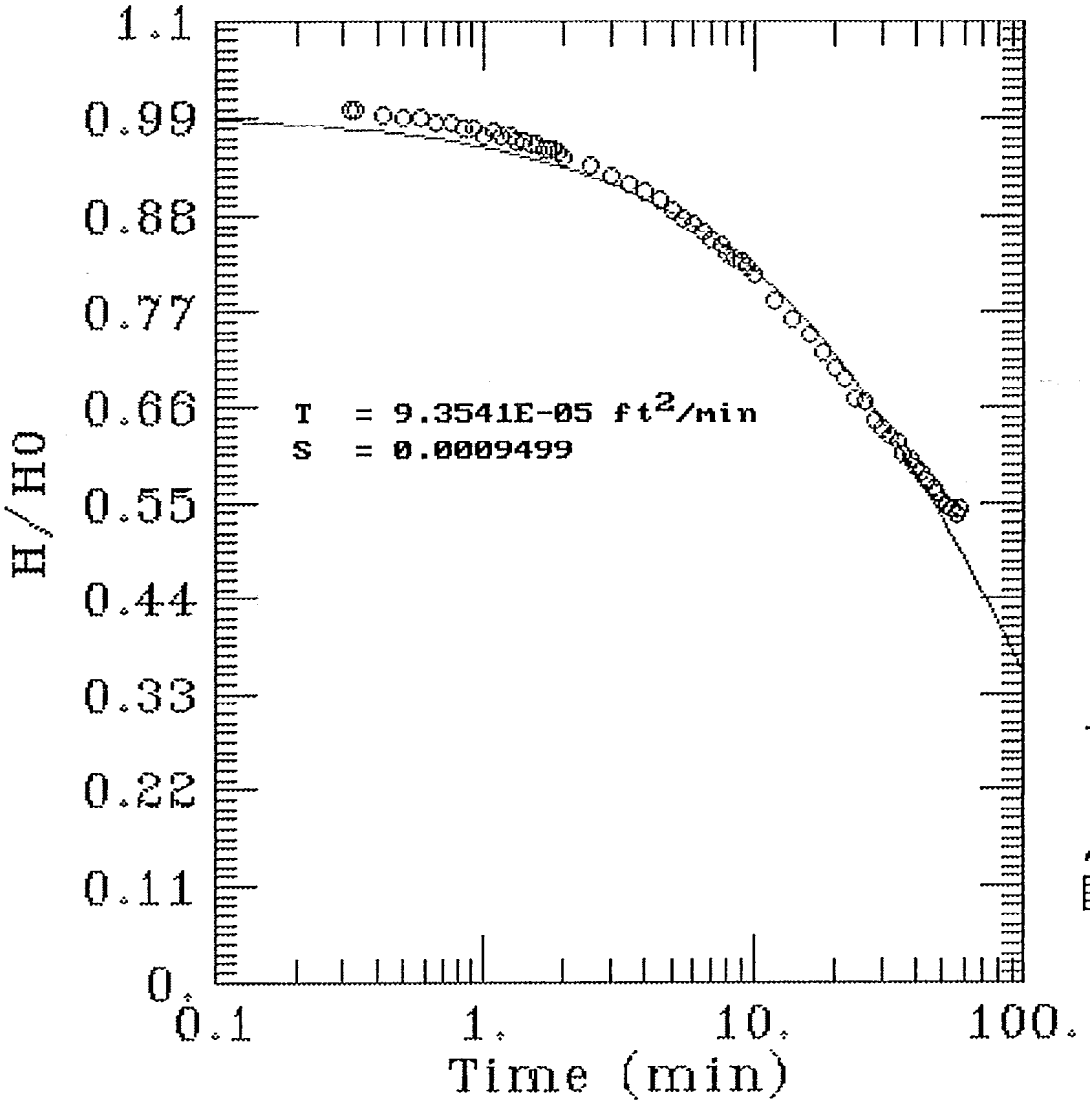
Weighted Residual Statistics:
Number of residuals................ 58
Number of estimated parameters.... 2
Degrees of freedom................ 56
Residual mean..................... -0.001904
Residual standard deviation....... 0.0318
Residual variance................. 0.001011

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0167	3.294	3.27	0.023975	1
0.0333	3.121	3.2377	-0.11665	1
0.05	3.341	3.2118	0.1292	1
0.0667	3.09	3.1891	-0.099137	1

0.0833	3.184	3.1685	0.01545	1
0.1	3.106	3.1497	-0.04367	1
0.1167	3.121	3.132	-0.011009	1
0.1333	3.09	3.1154	-0.025422	1
0.15	3.074	3.0996	-0.025565	1
0.1667	3.058	3.0844	-0.026437	1
0.1833	3.043	3.0699	-0.02694	1
0.2	3.043	3.0556	-0.012616	1
0.2167	3.028	3.0414	-0.013352	1
0.2333	3.012	3.0285	-0.016543	1
0.25	2.996	3.017	-0.02104	1
0.3333	2.949	2.9554	-0.0064374	1
0.4167	2.902	2.8999	0.0021348	1
0.5	2.855	2.8529	0.0021258	1
0.5833	2.808	2.8068	0.0012297	1
0.6667	2.761	2.7632	-0.0021881	1
0.75	2.73	2.722	0.008048	1
0.8333	2.698	2.6827	0.015311	1
0.9167	2.651	2.6451	0.0058929	1
1	2.62	2.6091	0.010897	1
1.0833	2.588	2.5745	0.013528	1
1.1667	2.557	2.541	0.015954	1
1.25	2.526	2.5088	0.017205	1
1.3333	2.495	2.4776	0.017414	1
1.4167	2.463	2.4473	0.015695	1
1.5	2.432	2.418	0.014046	1
1.5833	2.416	2.3894	0.026564	1
1.6667	2.384	2.3617	0.022334	1
1.75	2.352	2.3347	0.017338	1
1.8333	2.321	2.3083	0.012651	1
1.9167	2.305	2.2827	0.022342	1
2.4167	2.149	2.1406	0.0083829	1
2.9167	2.024	2.0155	0.0085015	1
3.4167	1.913	1.9037	0.0092505	1
3.9167	1.804	1.8029	0.0010607	1
4.4167	1.71	1.7113	-0.0013018	1
4.9167	1.616	1.6275	-0.011497	1
5.4167	1.537	1.5505	-0.013476	1
5.9167	1.475	1.4794	-0.004394	1
6.4167	1.397	1.4136	-0.016561	1
6.9167	1.334	1.3524	-0.018401	1
7.4167	1.285	1.2954	-0.010429	1
7.9167	1.223	1.2422	-0.019229	1
8.4167	1.176	1.1924	-0.016444	1
8.9167	1.129	1.1458	-0.016764	1
9.4167	1.082	1.1019	-0.019916	1
9.9167	1.035	1.0607	-0.025661	1
11.917	0.909	0.91765	-0.008652	1
13.917	0.8	0.80265	-0.002649	1
15.917	0.706	0.70865	-0.0026486	1
17.917	0.643	0.63078	0.012218	1
19.917	0.58	0.56555	0.014454	

B15WB FALLING HEAD TEST



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A Q T E S O L V   R E S U L T S
Version 1.10

07/24/92 09:19:30

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TEST DESCRIPTION

Data set........... A:B15WBF.DAT
Data set title..... B15WB FALLING HEAD TEST

Knowns and Constants:
No. of data points.................. 62
Pumping rate........................ 1
Radius (distance) to obs. well...... 0.08333

==

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

==

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
T =	9.4719E-005	+/-	5.8828E-006
S =	8.3086E-004	+/-	1.7202E-004

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
Number of residuals............... 62
Number of estimated parameters.... 2
Degrees of freedom................ 60
Residual mean..................... 0.01231
Residual standard deviation....... 0.04935
Residual variance................. 0.002435

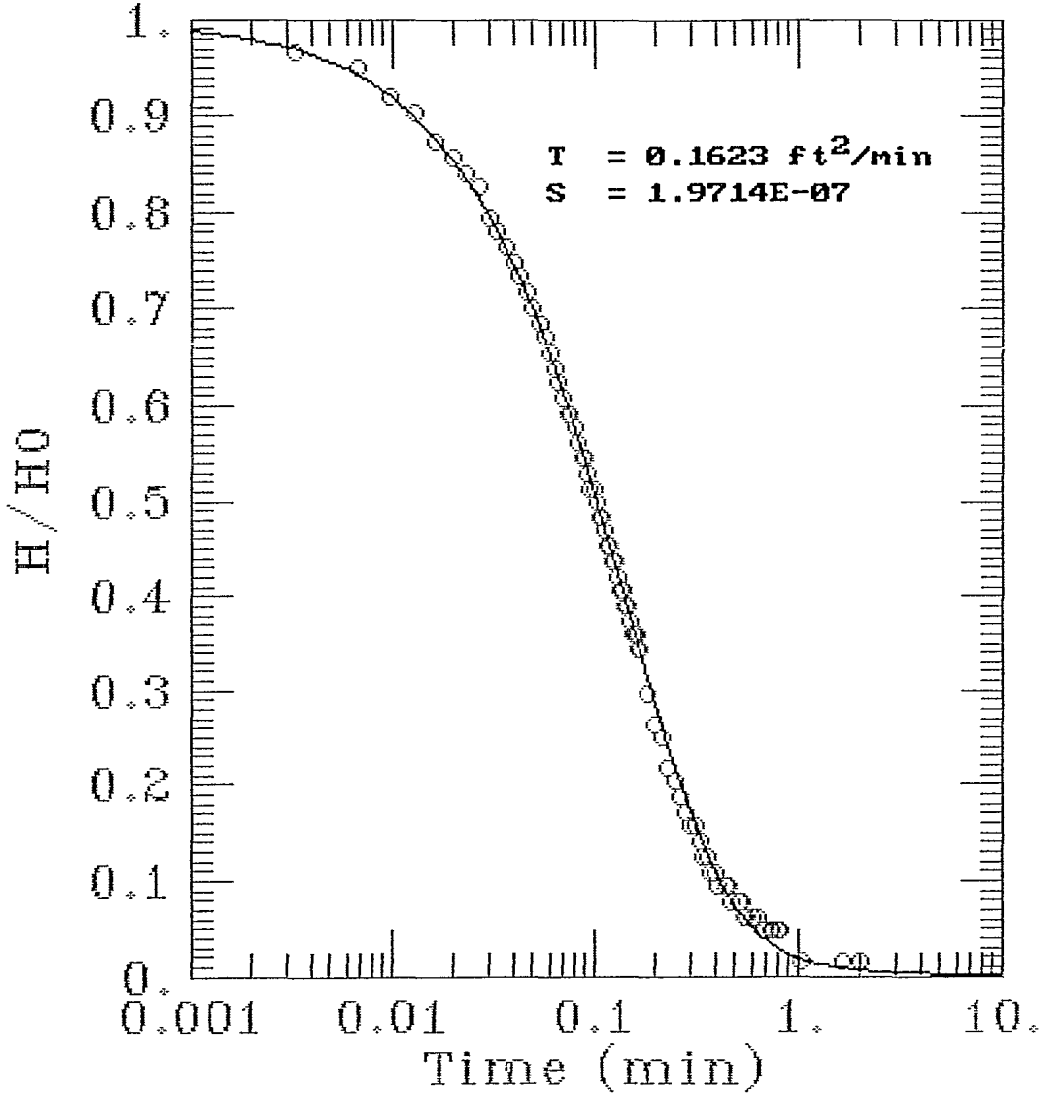
Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.3166	3.184	3.1179	0.06605	1
0.3333	3.184	3.1159	0.068056	1
0.4166	3.168	3.1065	0.061518	1
0.5	3.153	3.0977	0.055316	1

0.5833	3.153	3.0894	0.063575	1
0.6666	3.137	3.0816	0.055392	1
0.75	3.137	3.0741	0.062948	1
0.8333	3.121	3.0666	0.0544	1
0.9166	3.121	3.0597	0.061299	1
1	3.09	3.0538	0.036231	1
1.0833	3.106	3.0473	0.058733	1
1.1666	3.09	3.0391	0.050934	1
1.25	3.09	3.0322	0.057794	1
1.3333	3.074	3.0286	0.045425	1
1.4166	3.074	3.024	0.050048	1
1.5	3.059	3.016	0.042994	1
1.5833	3.059	3.0087	0.050251	1
1.6666	3.043	3.0041	0.03885	1
1.75	3.043	2.9996	0.043444	1
1.8333	3.043	2.9938	0.049162	1
1.9166	3.027	2.9882	0.038847	1
2	3.011	2.9829	0.028127	1
2.5	2.981	2.9526	0.028438	1
3	2.949	2.9242	0.024795	1
3.5	2.917	2.8974	0.019588	1
4	2.886	2.8719	0.014104	1
4.5	2.855	2.8475	0.0075435	1
5	2.824	2.8239	5.7967E-005	1
5.5	2.792	2.8012	-0.0092382	1
6	2.776	2.7793	-0.0032544	1
6.5	2.745	2.7579	-0.012917	1
7	2.714	2.7372	-0.023167	1
7.5	2.698	2.717	-0.018952	1
8	2.666	2.6972	-0.031231	1
8.5	2.651	2.678	-0.026967	1
9	2.635	2.6591	-0.024129	1
9.5	2.619	2.6407	-0.021687	1
10	2.588	2.6226	-0.034619	1
12	2.494	2.5537	-0.059678	1
14	2.431	2.4893	-0.05832	1
16	2.368	2.4288	-0.060802	1
18	2.306	2.3716	-0.065586	1
20	2.243	2.3173	-0.074261	1
22	2.212	2.2655	-0.053506	1
24	2.133	2.2161	-0.083062	1
26	2.118	2.1687	-0.050716	1
28	2.055	2.1233	-0.068288	1
30	2.024	2.0796	-0.055625	1
32	1.992	2.0376	-0.045596	1
34	1.977	1.9971	-0.020086	1
36	1.93	1.958	-0.027994	1
38	1.914	1.9202	-0.0062302	1
40	1.882	1.8837	-0.0017146	1
42	1.866	1.8484	0.017625	1
44	1.836	1.8141	0.021853	1
46	1.804	1.781	0.023029	1
48	1.788	1.7488	0.039207	1
50	1.757	1.7176	0.039436	1
52	1.741	1.6872	0.053763	1
54	1.725	1.6578	0.067228	1
56	1.71	1.6291	0.080872	1
58	1.725	1.6013	0.12373	1

==========

BMW8B RISING HEAD TEST



AQTESOLV

GERAGHTY & MILLER, INC.

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A Q T E S O L V   R E S U L T S

Version 1.10

08/06/92 09:55:28

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TEST DESCRIPTION

Data set........... B:BMW8BR.DAT
Data set title..... BMW8B RISING HEAD TEST

Knowns and Constants:
No. of data points.................. 85
Pumping rate........................ 1
Radius (distance) to obs. well...... 0.08333

==

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

==

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

		Estimate		Std. Error
T	=	1.6231E-001	+/-	6.3725E-003
S	=	1.9714E-007	+/-	1.0285E-007

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
Number of residuals............... 82
Number of estimated parameters.... 2
Degrees of freedom................ 80
Residual mean..................... 0.001647
Residual standard deviation....... 0.007846
Residual variance................. 6.155E-005

Model Residuals:

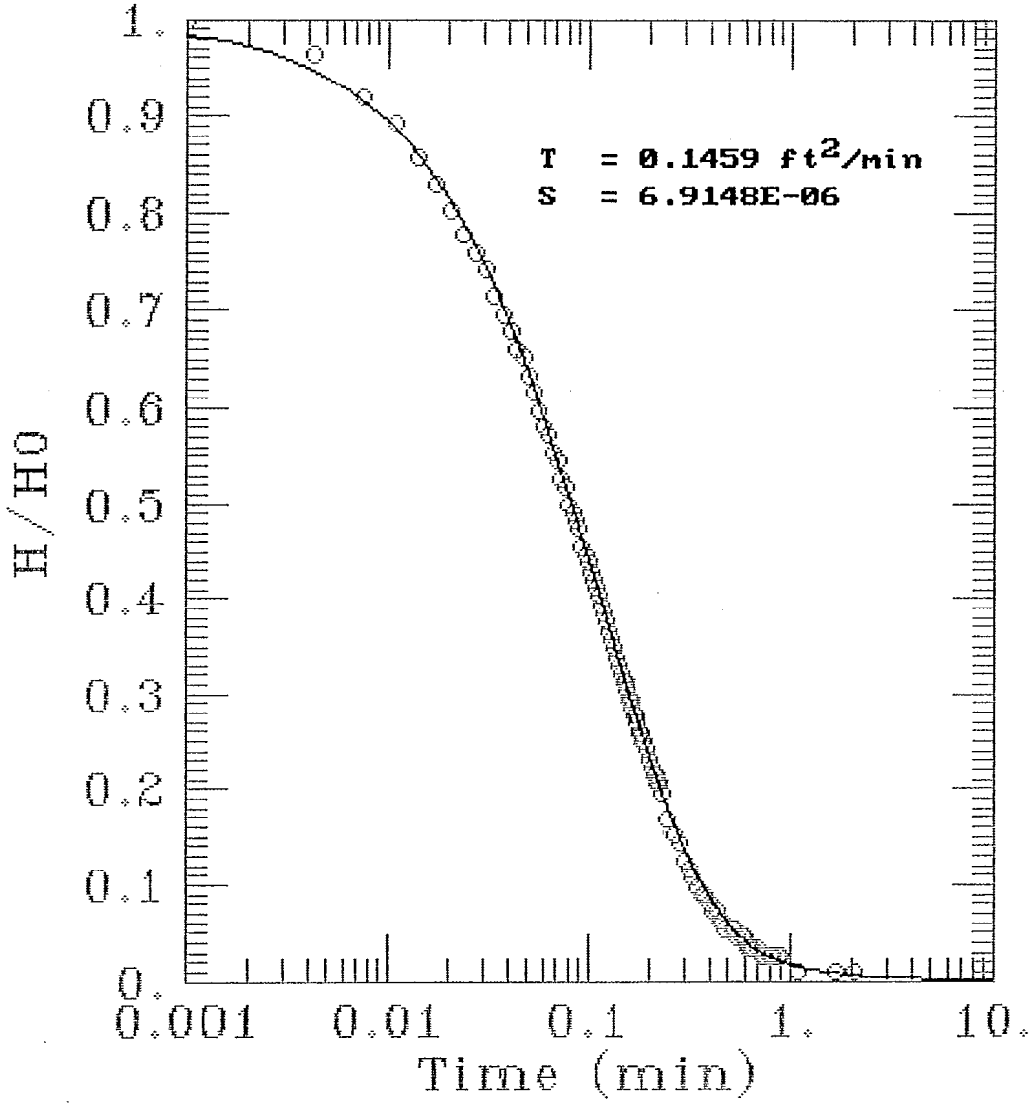
Time	Observed	Calculated	Residual	Weight
0.0001	0.998	0.99857	-0.00057252	1
0.0033	0.967	0.96962	-0.0026196	1
0.0067	0.951	0.94323	0.0077672	1
0.01	0.92	0.91943	0.00056765	1

0.0133	0.904	0.8969	0.0071016	1
0.0167	0.873	0.87475	-0.0017517	1
0.02	0.858	0.85415	0.0038538	1
0.0233	0.842	0.83432	0.0076827	1
0.0267	0.827	0.81462	0.012377	1
0.03	0.795	0.79616	-0.0011624	1
0.0333	0.78	0.7783	0.0016989	1
0.0367	0.764	0.76048	0.0035158	1
0.04	0.748	0.74373	0.0042741	1
0.0433	0.733	0.72747	0.0055345	1
0.0467	0.717	0.71121	0.0057937	1
0.05	0.702	0.69588	0.0061186	1
0.0533	0.686	0.68099	0.0050146	1
0.0567	0.671	0.66607	0.0049331	1
0.06	0.655	0.65199	0.0030141	1
0.0633	0.639	0.63828	0.00071804	1
0.0667	0.624	0.62454	-0.00054161	1
0.07	0.608	0.61156	-0.0035592	1
0.0733	0.592	0.59891	-0.0069126	1
0.0767	0.592	0.58622	0.0057787	1
0.08	0.577	0.57422	0.0027795	1
0.0833	0.561	0.56252	-0.0015213	1
0.0867	0.546	0.55077	-0.0047727	1
0.09	0.546	0.53966	0.0063441	1
0.0933	0.53	0.52881	0.0011879	1
0.0967	0.514	0.51792	-0.0039161	1
0.1	0.514	0.5076	0.0063996	1
0.1033	0.499	0.49753	0.0014671	1
0.1067	0.483	0.48741	-0.0044119	1
0.11	0.483	0.47783	0.0051745	1
0.1133	0.468	0.46847	-0.0004656	1
0.1167	0.452	0.45905	-0.007052	1
0.12	0.452	0.45013	0.0018681	1
0.1233	0.436	0.44142	-0.0054192	1
0.1267	0.436	0.43265	0.0033468	1
0.13	0.421	0.42434	-0.0033438	1
0.1333	0.421	0.41622	0.0047752	1
0.1367	0.405	0.40805	-0.0030533	1
0.14	0.405	0.4003	0.0046951	1
0.1433	0.39	0.39273	-0.0027317	1
0.1467	0.39	0.38511	0.0048928	1
0.15	0.374	0.37788	-0.0038753	1
0.1533	0.374	0.3708	0.0031951	1
0.1567	0.359	0.36368	-0.0046847	1
0.16	0.359	0.35693	0.0020708	1
0.1633	0.359	0.35032	0.0086771	1
0.1667	0.343	0.34367	-0.00066822	1
0.17	0.343	0.33735	0.0056471	1
0.1867	0.296	0.30744	-0.011437	1
0.2033	0.265	0.28078	-0.015785	1
0.22	0.249	0.25671	-0.0077111	1
0.2367	0.218	0.23507	-0.017069	1
0.2533	0.203	0.21569	-0.012694	1
0.27	0.187	0.19811	-0.011115	1
0.2867	0.171	0.18224	-0.011243	1
0.3033	0.156	0.16798	-0.011976	1
0.32	0.156	0.15498	0.0010202	1
0.3367	0.14	0.1432	-0.0032015	1
0.3533	0.125	0.13257	-0.007575	1
0.37	0.125	0.12286	0.0021397	1

0.3867	0.109	0.11403	-0.0050259	1
0.4033	0.109	0.10603	0.0029732	1
0.42	0.093	0.098689	-0.0056892	1
0.4533	0.093	0.085911	0.0070891	1
0.47	0.093	0.080304	0.012696	1
0.4867	0.078	0.075179	0.0028207	1
0.52	0.078	0.066197	0.011803	1
0.5367	0.078	0.062237	0.015763	1
0.57	0.062	0.055302	0.0066978	1
0.6033	0.062	0.04938	0.01262	1
0.6367	0.062	0.044315	0.017685	1
0.67	0.047	0.039895	0.0071055	1
0.7367	0.047	0.032958	0.014042	1
0.8033	0.047	0.027908	0.019092	1
0.8367	0.047	0.025785	0.021215	1
1.0367	0.016	0.017289	-0.0012894	1
1.6367	0.016	0.0086317	0.0073683	1
2.0367	0.016	0.0065247	0.0094753	1

RESULT

BMW8B FALLING HEAD TEST



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

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A Q T E S O L V

A Program for Automatic Estimation of Aquifer Coefficients From Aquifer Test Data

By:

Glenn M. Duffield
and
James O. Rumbaugh, III

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1895 Preston White Drive, Suite 301
Reston, VA 22091

(703) 476 - 0335

A Q T E S O L V is a user-friendly program designed to analyze data from aquifer tests automatically. Aquifer coefficients for a variety of aquifer test conditions can be estimated by A Q T E S O L V , including the following:

- o confined aquifers, unconfined aquifers, and leaky aquifers
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Features:

- o Interactive, menu-driven program design
- o Nonlinear least-squares estimation of aquifer coefficients
- o Statistical analysis of results
- o Complete graphical display of results

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A Q T E S O L V   R E S U L T S
Version 1.10

08/06/92 09:04:46

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TEST DESCRIPTION

Data set........... B:\BMW8BF.DAT
Data set title..... BMW8B FALLING HEAD TEST

Knowns and Constants:
   No. of data points.................. 104
   Pumping rate........................ 1
   Radius (distance) to obs. well...... 0.08333

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ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

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RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
T =	1.4590E-001	+/-	2.4762E-003
S =	6.9148E-006	+/-	1.1493E-006

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
   Number of residuals............... 101
   Number of estimated parameters.... 2
   Degrees of freedom................ 99
   Residual mean..................... -6.177E-005
   Residual standard deviation....... 0.008295
   Residual variance................. 6.88E-005

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.001	1.746	1.7183	0.027717	1
0.0043	1.684	1.6539	0.030103	1
0.0076	1.606	1.5986	0.0073913	1
0.011	1.559	1.5466	0.012405	1

0.0143	1.497	1.4996	-0.0025572	1
0.0176	1.45	1.4552	-0.0052369	1
0.021	1.403	1.412	-0.0089775	1
0.0243	1.357	1.372	-0.015029	1
0.0276	1.325	1.3339	-0.0088746	1
0.031	1.294	1.2963	-0.0022633	1
0.0343	1.247	1.2613	-0.01427	1
0.0376	1.216	1.2277	-0.011652	1
0.041	1.185	1.1944	-0.0093534	1
0.0443	1.154	1.1632	-0.0092481	1
0.0476	1.138	1.1333	0.0047347	1
0.051	1.107	1.1035	0.0035199	1
0.0543	1.076	1.0756	0.00041484	1
0.0576	1.045	1.0486	-0.0036368	1
0.061	1.014	1.0218	-0.0078116	1
0.0643	0.998	0.99664	0.0013569	1
0.0676	0.967	0.97229	-0.0052889	1
0.071	0.951	0.94801	0.0029906	1
0.0743	0.92	0.9252	-0.0051977	1
0.0776	0.904	0.9031	0.0009039	1
0.081	0.873	0.88104	-0.0080361	1
0.0843	0.858	0.86029	-0.0022866	1
0.0876	0.842	0.84016	0.0018374	1
0.091	0.827	0.82006	0.0069432	1
0.0943	0.795	0.80113	-0.006128	1
0.0976	0.78	0.78275	-0.0027541	1
0.101	0.764	0.76438	-0.0003818	1
0.1043	0.748	0.74707	0.00092846	1
0.1076	0.733	0.73026	0.0027437	1
0.111	0.717	0.71343	0.0035694	1
0.1143	0.702	0.69757	0.0044333	1
0.1176	0.686	0.68215	0.0038534	1
0.121	0.671	0.66671	0.0042928	1
0.1243	0.655	0.65214	0.0028583	1
0.1276	0.639	0.63798	0.0010244	1
0.131	0.624	0.62378	0.0002163	1
0.1343	0.608	0.61039	-0.0023878	1
0.1376	0.592	0.59735	-0.0053525	1
0.141	0.592	0.58429	0.007713	1
0.1443	0.577	0.57195	0.0050518	1
0.1476	0.561	0.55994	0.0010642	1
0.151	0.546	0.54789	-0.0018899	1
0.1543	0.546	0.53651	0.0094911	1
0.1576	0.53	0.52542	0.0045758	1
0.161	0.514	0.5143	-0.00030374	1
0.1643	0.514	0.50379	0.010207	1
0.1676	0.499	0.49355	0.0054489	1
0.171	0.483	0.48327	-0.00027237	1
0.1743	0.483	0.47355	0.0094469	1
0.1776	0.468	0.46408	0.0039207	1
0.181	0.452	0.45457	-0.0025677	1
0.1843	0.452	0.44557	0.0064297	1
0.1876	0.436	0.4368	-0.00079719	1
0.191	0.436	0.42799	0.0080143	1
0.1943	0.421	0.41965	0.0013522	1
0.1976	0.421	0.41151	0.0094851	1
0.201	0.405	0.40334	0.0016563	1
0.2043	0.405	0.39561	0.009391	1
0.2076	0.39	0.38806	0.0019379	1
0.211	0.39	0.38048	0.0095229	1

0.2143	0.374	0.3733	0.00070494	1
0.2176	0.374	0.36629	0.0077149	1
0.221	0.359	0.35924	-0.00023769	1
0.2243	0.359	0.35256	0.0064375	1
0.2276	0.359	0.34605	0.012955	1
0.231	0.343	0.33949	0.0035085	1
0.2343	0.343	0.33328	0.0097181	1
0.251	0.296	0.304	-0.0080047	1
0.2676	0.265	0.27812	-0.013119	1
0.2843	0.249	0.2549	-0.0059026	1
0.301	0.218	0.23417	-0.016168	1
0.3176	0.203	0.21572	-0.012717	1
0.3343	0.187	0.19907	-0.012065	1
0.351	0.171	0.1841	-0.013104	1
0.3676	0.156	0.17071	-0.014711	1
0.3843	0.156	0.15856	-0.0025554	1
0.401	0.14	0.14757	-0.007572	1
0.4176	0.125	0.13769	-0.012687	1
0.4343	0.125	0.12867	-0.0036661	1
0.451	0.109	0.12047	-0.011472	1
0.4676	0.109	0.11306	-0.004059	1
0.4843	0.093	0.10626	-0.01326	1
0.5176	0.093	0.094408	-0.0014084	1
0.5343	0.093	0.089206	0.0037936	1
0.551	0.078	0.084434	-0.0064342	1
0.5843	0.078	0.076037	0.0019629	1
0.601	0.078	0.072316	0.0056841	1
0.6176	0.062	0.068901	-0.0069007	1
0.6676	0.062	0.06007	0.0019297	1
0.701	0.062	0.055181	0.0068194	1
0.7343	0.047	0.050953	-0.0039527	1
0.801	0.047	0.044022	0.0029776	1
0.8676	0.047	0.038649	0.0083509	1
0.901	0.047	0.036396	0.010604	1
1.101	0.016	0.026907	-0.010907	1
1.701	0.016	0.015146	0.00085381	1
2.101	0.016	0.011742	0.0042578	1

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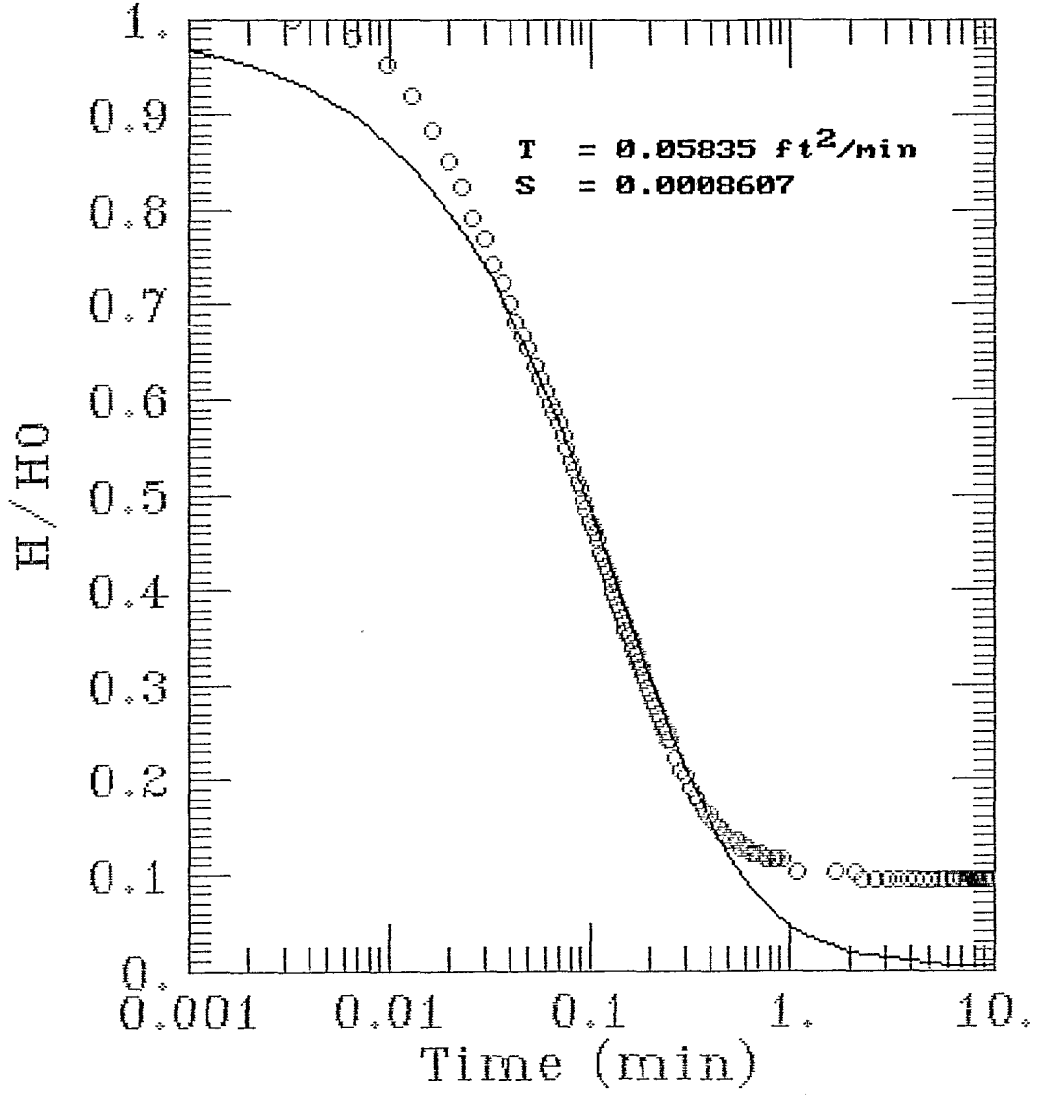
RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

	Estimate
T =	1.4590E-

BMW9B RISING HEAD TEST



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A Program for

Automatic Estimation of Aquifer Coefficients

From Aquifer Test Data

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- pumping tests, injection tests, recovery tests, and slug tests

Features:

- Interactive, menu-driven program design
- Nonlinear least-squares estimation of aquifer coefficients
- Statistical analysis of results
- Complete graphical display of results

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A Q T E S O L V   R E S U L T S
Version 1.10

08/06/92 09:11:16

TEST DESCRIPTION

Data set........... B:BMW9BR.DAT
Data set title..... BMW9B RISING HEAD TEST

Knowns and Constants:
No. of data points.................. 130
Pumping rate........................ 1
Radius (distance) to obs. well...... 0.08333

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

		Estimate		Std. Error
T	=	5.8348E-002	+/-	5.5510E-003
S	=	8.6074E-004	+/-	3.6947E-004

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
Number of residuals............... 129
Number of estimated parameters.... 2
Degrees of freedom................ 127
Residual mean..................... 0.04847
Residual standard deviation....... 0.1026
Residual variance................. 0.01053

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0033	2.307	2.1581	0.14894	1
0.0066	2.261	2.0761	0.18485	1
0.01	2.198	2.0059	0.19208	1
0.0133	2.12	1.9457	0.17429	1

0.0166	2.042	1.891	0.15105	1
0.02	1.964	1.8389	0.1251	1
0.0233	1.902	1.7918	0.11019	1
0.0266	1.824	1.7475	0.076456	1
0.03	1.777	1.7045	0.072527	1
0.0333	1.715	1.6648	0.050173	1
0.0366	1.668	1.6271	0.040932	1
0.04	1.621	1.5899	0.03106	1
0.0433	1.575	1.5555	0.019533	1
0.0466	1.543	1.5224	0.0206	1
0.05	1.512	1.4897	0.022314	1
0.0533	1.465	1.4591	0.0058511	1
0.0566	1.434	1.4297	0.0042755	1
0.06	1.403	1.4005	0.0025059	1
0.0633	1.372	1.3731	-0.00111	1
0.0666	1.356	1.3466	0.0093611	1
0.07	1.325	1.3203	0.004735	1
0.0733	1.294	1.2955	-0.0014909	1
0.0766	1.263	1.2715	-0.0084851	1
0.08	1.232	1.2475	-0.015514	1
0.0833	1.216	1.2249	-0.0089497	1
0.0866	1.185	1.203	-0.018044	1
0.09	1.169	1.1811	-0.012131	1
0.0933	1.138	1.1605	-0.02247	1
0.0966	1.122	1.1404	-0.018382	1
0.1	1.091	1.1203	-0.029256	1
0.1033	1.076	1.1013	-0.025255	1
0.1066	1.06	1.0828	-0.022757	1
0.11	1.045	1.0642	-0.019202	1
0.1133	1.013	1.0467	-0.033663	1
0.1166	0.998	1.0296	-0.03157	1
0.12	0.982	1.0124	-0.030406	1
0.1233	0.966	0.99617	-0.030166	1
0.1266	0.951	0.98032	-0.029323	1
0.13	0.935	0.9644	-0.0294	1
0.1333	0.92	0.94932	-0.029321	1
0.1366	0.904	0.9346	-0.030599	1
0.14	0.889	0.91979	-0.030791	1
0.1433	0.873	0.90576	-0.032757	1
0.1466	0.857	0.89204	-0.035044	1
0.15	0.842	0.87824	-0.036241	1
0.1533	0.826	0.86515	-0.039151	1
0.1566	0.81	0.85235	-0.042352	1
0.16	0.81	0.83946	-0.02946	1
0.1633	0.795	0.82723	-0.032226	1
0.1666	0.779	0.81526	-0.036257	1
0.17	0.764	0.8032	-0.039195	1
0.1733	0.764	0.79174	-0.027741	1
0.1766	0.748	0.78053	-0.032529	1
0.18	0.732	0.76922	-0.037224	1
0.1833	0.732	0.75848	-0.026483	1
0.1866	0.717	0.74796	-0.030964	1
0.19	0.701	0.73735	-0.036352	1
0.1933	0.701	0.72727	-0.026265	1
0.1966	0.686	0.71738	-0.031382	1
0.2	0.67	0.70741	-0.037406	1
0.2033	0.67	0.69792	-0.02792	1
0.2066	0.654	0.68862	-0.034621	1
0.21	0.654	0.67923	-0.025231	1
0.2133	0.639	0.6703	-0.031298	1

0.2166	0.639	0.66154	-0.022538	1
0.22	0.623	0.65269	-0.029689	1
0.2233	0.623	0.64427	-0.021266	1
0.2266	0.608	0.636	-0.028004	1
0.23	0.608	0.62765	-0.019655	1
0.2333	0.592	0.61971	-0.027705	1
0.2366	0.592	0.6119	-0.019904	1
0.24	0.577	0.60402	-0.027018	1
0.2433	0.577	0.59651	-0.019506	1
0.2466	0.577	0.58913	-0.012132	1
0.25	0.561	0.58168	-0.020675	1
0.2533	0.561	0.57457	-0.013571	1
0.27	0.514	0.54052	-0.026516	1
0.2866	0.483	0.50955	-0.02655	1
0.3033	0.467	0.48099	-0.013986	1
0.32	0.436	0.45474	-0.018743	1
0.3366	0.421	0.43072	-0.0097218	1
0.3533	0.405	0.40842	-0.0034248	1
0.37	0.389	0.38782	0.0011808	1
0.3866	0.374	0.36885	0.0051468	1
0.4033	0.374	0.35116	0.022844	1
0.42	0.358	0.33472	0.023281	1
0.4366	0.343	0.31952	0.023482	1
0.4533	0.343	0.30527	0.03773	1
0.47	0.327	0.29198	0.035022	1
0.4866	0.327	0.27963	0.047367	1
0.5033	0.311	0.26802	0.042984	1
0.5366	0.311	0.24699	0.064007	1
0.5533	0.311	0.23741	0.073587	1
0.57	0.296	0.22841	0.06759	1
0.6033	0.296	0.21201	0.083992	1
0.62	0.296	0.20448	0.091516	1
0.6366	0.28	0.19742	0.082576	1
0.6533	0.28	0.19071	0.089287	1
0.6866	0.28	0.1784	0.1016	1
0.72	0.28	0.16731	0.11269	1
0.7533	0.265	0.15735	0.10765	1
0.7866	0.265	0.14835	0.11665	1
0.82	0.265	0.14017	0.12483	1
0.8533	0.265	0.13275	0.13225	1
0.8866	0.265	0.12599	0.13901	1
0.92	0.265	0.11979	0.14521	1
1.12	0.234	0.091721	0.14228	1
2.12	0.234	0.040498	0.1935	1
2.32	0.218	0.036335	0.18167	1
2.72	0.218	0.030115	0.18789	1
3.12	0.218	0.025696	0.1923	1
3.52	0.218	0.022398	0.1956	1
3.92	0.218	0.019844	0.19816	1
4.32	0.218	0.01781	0.20019	1
4.72	0.218	0.016151	0.20185	1
5.12	0.218	0.014773	0.20323	1
5.52	0.218	0.013611	0.20439	1
5.92	0.218	0.012617	0.20538	1
6.32	0.218	0.011759	0.20624	1
6.52	0.218	0.011371	0.20663	1
6.92	0.218	0.010669	0.20733	1
7.32	0.218	0.010048	0.20795	1
7.72	0.218	0.0094947	0.20851	1
7.92	0.218	0.0092404	0.20876	1

8.12	0.218	0.0089993	0.209	1
8.52	0.218	0.008553	0.20945	1
8.92	0.218	0.0081489	0.20985	1
9.32	0.218	0.0077811	0.21022	1
9.72	0.218	0.0074451	0.21055	1

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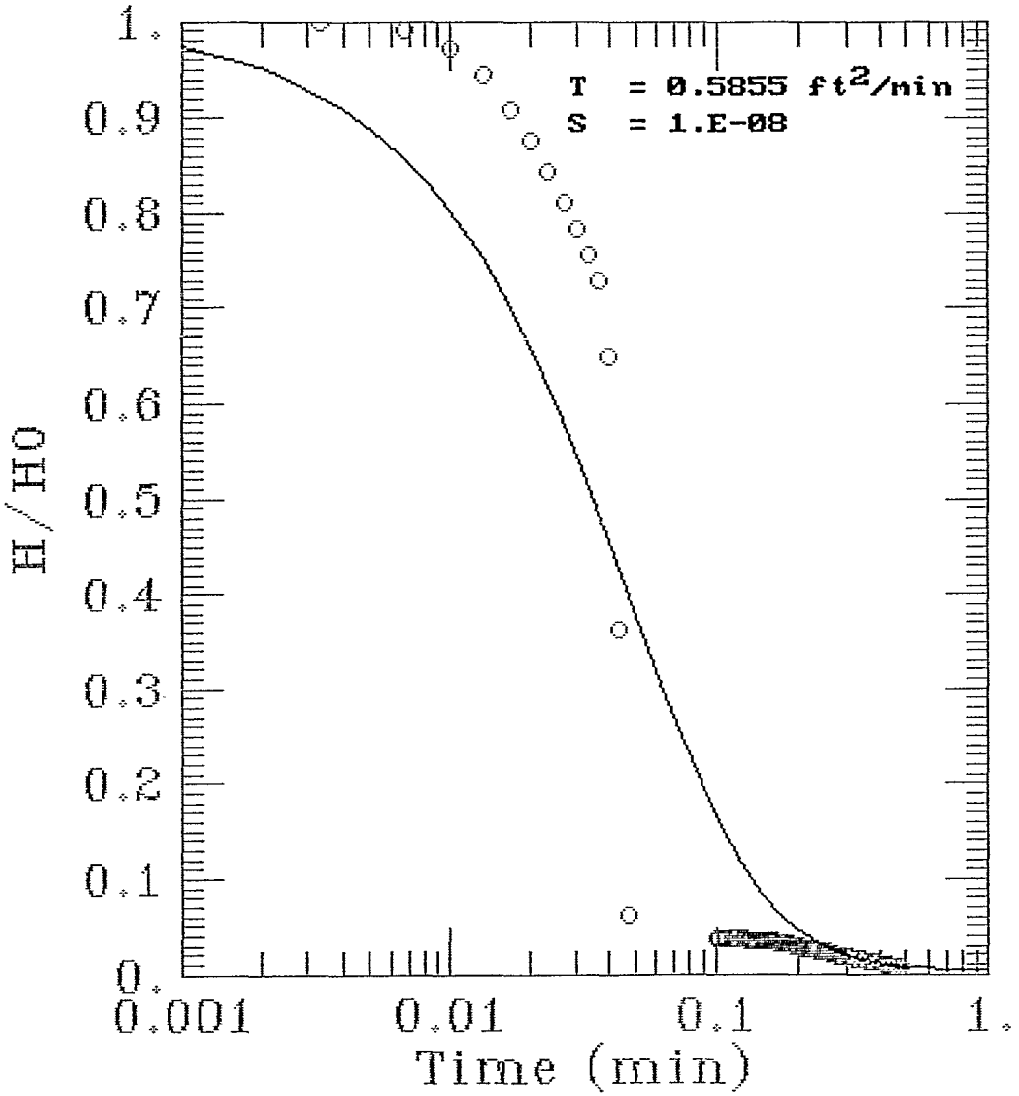
RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

Esti

BMW9B FALLING TEST HEAD



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Features:

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A Q T E S O L V R E S U L T S
Version 1.10

08/06/92 09:29:51

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TEST DESCRIPTION

Data set........... B:BMW9BF.DAT
Data set title..... BMW9B FALLING TEST HEAD

Knowns and Constants:
No. of data points.................. 83
Pumping rate........................ 1
Radius (distance) to obs. well...... 0.08333

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ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

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RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

		Estimate		Std. Error
T	=	5.8548E-001	+/-	3.3115E-001
S	=	1.0000E-008	+/-	9.8734E-008

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
Number of residuals............... 83
Number of estimated parameters.... 2
Degrees of freedom................ 81
Residual mean..................... -0.009381
Residual standard deviation....... 0.5926
Residual variance................. 0.3512

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0033	6.113	5.6543	0.45871	1
0.0067	6.066	5.2589	0.80715	1
0.01	5.942	4.9142	1.0278	1
0.0133	5.77	4.6	1.17	1

0.0167	5.552	4.3029	1.2491	1
0.02	5.365	4.0372	1.3278	1
0.0233	5.162	3.7914	1.3706	1
0.0267	4.959	3.5567	1.4023	1
0.03	4.788	3.3453	1.4427	1
0.0333	4.616	3.1487	1.4673	1
0.0367	4.46	2.9601	1.4999	1
0.04	3.977	2.7895	1.1875	1
0.0433	2.215	2.6303	-0.41532	1
0.0467	0.374	2.4772	-2.1032	1
0.1	0.218	1.0365	-0.81854	1
0.1033	0.218	0.9861	-0.7681	1
0.1067	0.218	0.93716	-0.71916	1
0.11	0.218	0.89241	-0.67441	1
0.1133	0.218	0.8502	-0.6322	1
0.1167	0.218	0.8092	-0.5912	1
0.12	0.218	0.77166	-0.55366	1
0.1233	0.218	0.73622	-0.51822	1
0.1267	0.218	0.70175	-0.48375	1
0.13	0.203	0.67017	-0.46717	1
0.1333	0.203	0.64031	-0.43731	1
0.1367	0.203	0.61124	-0.40824	1
0.14	0.203	0.58458	-0.38158	1
0.1433	0.203	0.55935	-0.35635	1
0.1467	0.203	0.53476	-0.33176	1
0.15	0.203	0.51219	-0.30919	1
0.1533	0.203	0.4908	-0.2878	1
0.1567	0.203	0.46994	-0.26694	1
0.16	0.203	0.45076	-0.24776	1
0.1633	0.203	0.43258	-0.22958	1
0.1667	0.187	0.41483	-0.22783	1
0.17	0.187	0.39849	-0.21149	1
0.1733	0.187	0.38298	-0.19598	1
0.1767	0.187	0.36782	-0.18082	1
0.18	0.187	0.35386	-0.16686	1
0.1833	0.187	0.34059	-0.15359	1
0.1867	0.187	0.32761	-0.14061	1
0.19	0.172	0.31565	-0.14365	1
0.1933	0.172	0.30426	-0.13226	1
0.1967	0.172	0.29311	-0.12111	1
0.2	0.172	0.28282	-0.11082	1
0.2033	0.172	0.27303	-0.10103	1
0.2067	0.156	0.26342	-0.10742	1
0.21	0.156	0.25454	-0.098543	1
0.2133	0.156	0.24608	-0.090085	1
0.2167	0.156	0.23778	-0.081782	1
0.22	0.156	0.2301	-0.074103	1
0.2233	0.156	0.22278	-0.066778	1
0.2267	0.156	0.21558	-0.059581	1
0.23	0.156	0.20892	-0.052917	1
0.2333	0.14	0.20255	-0.062553	1
0.2367	0.14	0.19629	-0.056294	1
0.24	0.14	0.19049	-0.050492	1
0.2433	0.14	0.18495	-0.044946	1
0.2467	0.14	0.17949	-0.039486	1
0.25	0.14	0.17442	-0.03442	1
0.2533	0.14	0.16957	-0.029572	1
0.2567	0.125	0.16479	-0.039793	1
0.26	0.125	0.16036	-0.035355	1
0.2633	0.125	0.1561	-0.031104	1

0.2667	0.125	0.15191	-0.026909	1
0.27	0.125	0.14801	-0.023008	1
0.2733	0.125	0.14427	-0.019268	1
0.2767	0.109	0.14057	-0.031573	1
0.28	0.109	0.13713	-0.028134	1
0.2833	0.109	0.13383	-0.024833	1
0.2867	0.109	0.13057	-0.021569	1
0.29	0.109	0.12753	-0.018527	1
0.3067	0.109	0.11384	-0.0048427	1
0.3233	0.094	0.10262	-0.008617	1
0.34	0.094	0.093213	0.00078726	1
0.3567	0.078001	0.085316	-0.007315	1
0.3733	0.078001	0.078663	-0.00066227	1
0.39	0.078001	0.072941	0.0050595	1
0.4067	0.062	0.068011	-0.0060108	1
0.4233	0.062	0.063751	-0.0017509	1
0.44	0.047001	0.059997	-0.012996	1
0.4567	0.047001	0.056685	-0.0096837	1
0.4733	0.047001	0.053759	-0.0067576	1

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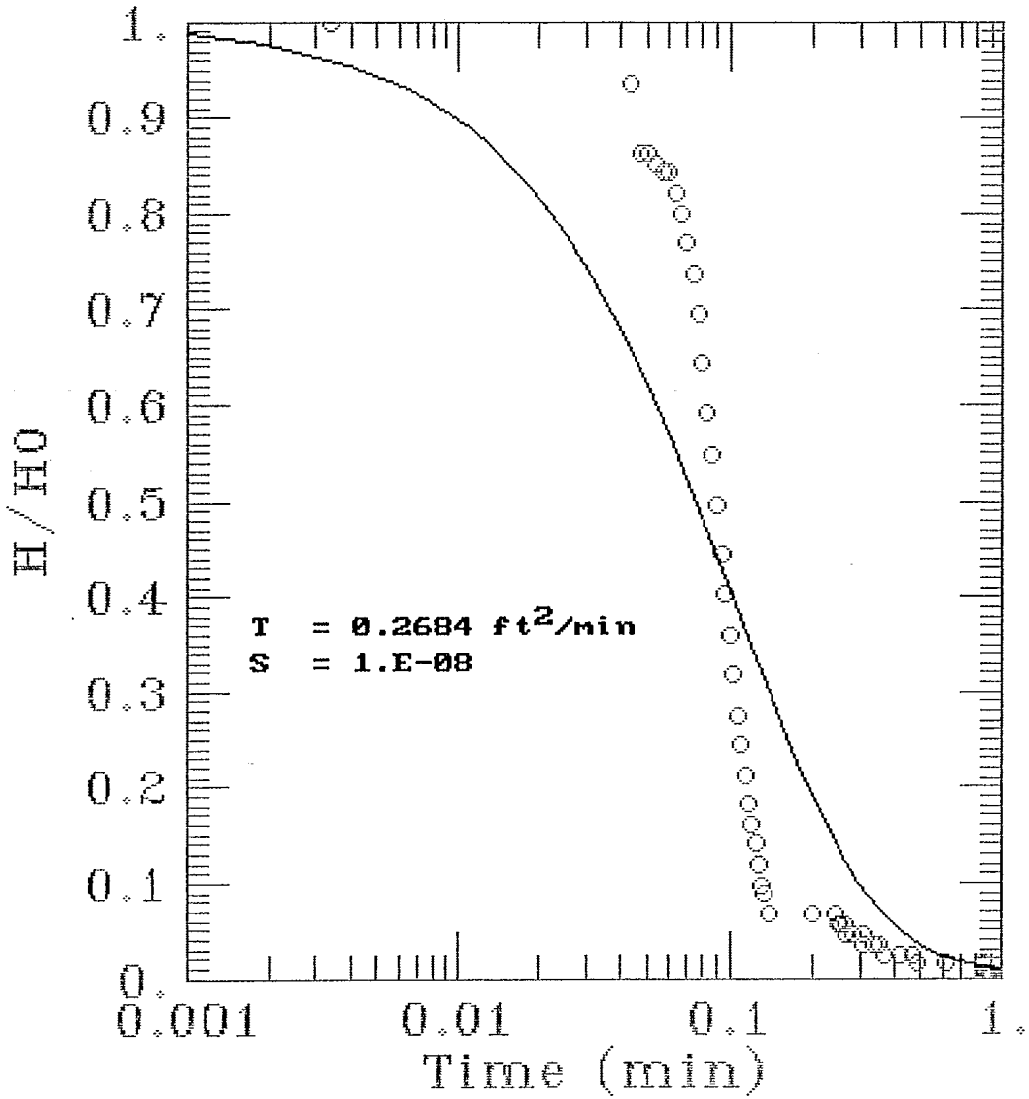
BMW11B RISING HEAD TEST



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

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A Q T E S O L V

A Program for

Automatic Estimation of Aquifer Coefficients

From Aquifer Test Data

By:

Glenn M. Duffield
and
James O. Rumbaugh, III

Geraghty & Miller Modeling Group
1895 Preston White Drive, Suite 301
Reston, VA 22091

(703) 476 - 0335

A Q T E S O L V is a user-friendly program designed to analyze data from aquifer tests automatically. Aquifer coefficients for a variety of aquifer test conditions can be estimated by A Q T E S O L V , including the following:

- o confined aquifers, unconfined aquifers, and leaky aquifers
- o pumping tests, injection tests, recovery tests, and slug tests

Features:

- o Interactive, menu-driven program design
- o Nonlinear least-squares estimation of aquifer coefficients
- o Statistical analysis of results
- o Complete graphical display of results

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A Q T E S O L V R E S U L T S

Version 1.10

08/06/92 09:17:26

TEST DESCRIPTION

Data set........... B:BMW11BR.DAT
Data set title..... BMW11B RISING HEAD TEST

Knowns and Constants:
No. of data points................. 51
Pumping rate........................ 1
Radius (distance) to obs. well...... 0.08333

ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
T =	2.6844E-001	+/-	3.6866E-001
S =	1.0000E-008	+/-	2.2856E-007

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

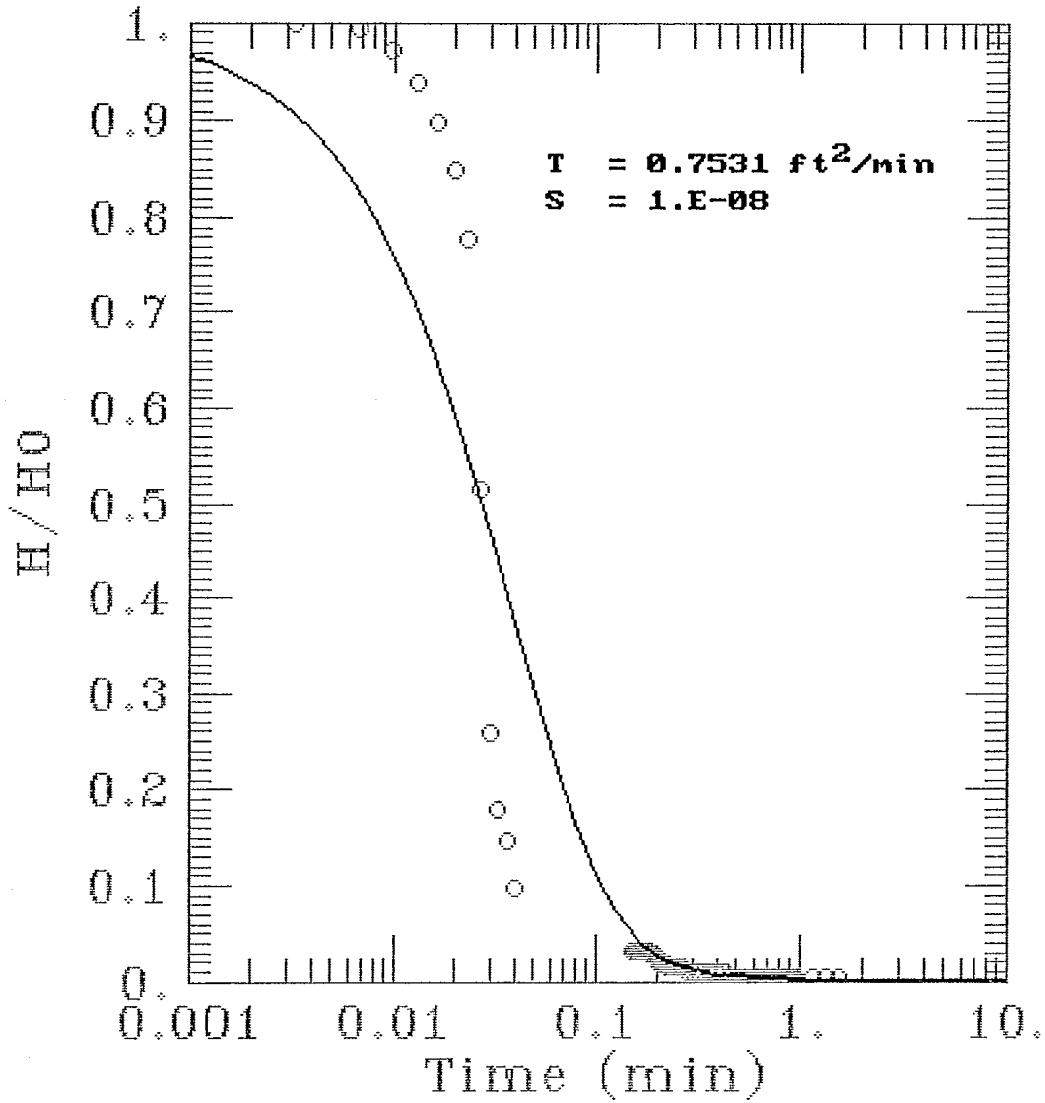
Weighted Residual Statistics:
Number of residuals............... 51
Number of estimated parameters.... 2
Degrees of freedom................ 49
Residual mean..................... 0.006342
Residual standard deviation....... 0.2301
Residual variance................. 0.05297

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0034	1.497	1.4398	0.057179	1
0.0434	1.403	0.9906	0.4124	1
0.0467	1.293	0.96236	0.33064	1
0.05	1.293	0.93509	0.35791	1

0.0534	1.277	0.90796	0.36904	1
0.0567	1.261	0.88254	0.37846	1
0.06	1.261	0.85795	0.40305	1
0.0634	1.23	0.83347	0.39653	1
0.0667	1.198	0.8105	0.3875	1
0.07	1.151	0.78827	0.36273	1
0.0734	1.104	0.76612	0.33788	1
0.0767	1.041	0.74531	0.29569	1
0.08	0.963	0.72516	0.23784	1
0.0834	0.885	0.70506	0.17994	1
0.0867	0.822	0.68617	0.13583	1
0.09	0.743	0.66787	0.075127	1
0.0934	0.665	0.64961	0.015391	1
0.0967	0.602	0.63243	-0.030435	1
0.1	0.539	0.61579	-0.076786	1
0.1034	0.476	0.59916	-0.12316	1
0.1067	0.413	0.58352	-0.17052	1
0.11	0.366	0.56835	-0.20235	1
0.1134	0.319	0.5532	-0.2342	1
0.1167	0.272	0.53894	-0.26694	1
0.12	0.241	0.5251	-0.2841	1
0.1234	0.209	0.51127	-0.30227	1
0.1267	0.178	0.49825	-0.32025	1
0.13	0.146	0.48562	-0.33962	1
0.1334	0.131	0.47298	-0.34198	1
0.14	0.099	0.44953	-0.35053	1
0.2	0.099	0.28837	-0.18937	1
0.2434	0.099	0.21347	-0.11447	1
0.2467	0.083	0.20879	-0.12579	1
0.2534	0.083	0.19966	-0.11666	1
0.2634	0.083	0.18691	-0.10391	1
0.2667	0.068	0.18292	-0.11492	1
0.2834	0.068	0.16426	-0.096262	1
0.3067	0.068	0.14197	-0.073973	1
0.31	0.052	0.13913	-0.087127	1
0.3334	0.052	0.12087	-0.068873	1
0.35	0.052	0.10974	-0.057737	1
0.3667	0.036	0.099829	-0.063829	1
0.4167	0.036	0.076394	-0.040394	1
0.4667	0.036	0.059851	-0.023851	1
0.4834	0.021	0.055451	-0.034451	1
0.6167	0.021	0.032907	-0.011907	1
0.85	0.021	0.017885	0.0031153	1
0.8667	0.005	0.017308	-0.012308	1
0.8834	0.005	0.016768	-0.011768	

BMW11B FALLING HEAD TEST



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

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A Q T E S O L V

A Program for Automatic Estimation of Aquifer Coefficients From Aquifer Test Data

By:

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- confined aquifers, unconfined aquifers, and leaky aquifers
- pumping tests, injection tests, recovery tests, and slug tests

Features:

- Interactive, menu-driven program design
- Nonlinear least-squares estimation of aquifer coefficients
- Statistical analysis of results
- Complete graphical display of results

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A Q T E S O L V   R E S U L T S
Version 1.10

08/06/92 09:22:50

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TEST DESCRIPTION

Data set........... B:BMW11BF.DAT
Data set title..... BMW11B FALLING HEAD TEST

Knowns and Constants:
No. of data points................. 91
Pumping rate........................ 1
Radius (distance) to obs. well...... 0.08333

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ANALYTICAL METHOD

Cooper et al. (Confined Aquifer Slug Test)

==

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error
T =	7.5313E-001	+/-	4.8279E-001
S =	1.0000E-008	+/-	1.0605E-007

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:
Number of residuals............... 91
Number of estimated parameters.... 2
Degrees of freedom................ 89
Residual mean..................... 0.01226
Residual standard deviation....... 0.2743
Residual variance................. 0.07526

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0033	3.408	3.0882	0.31977	1
0.0067	3.392	2.8179	0.57409	1
0.01	3.313	2.5868	0.72623	1
0.0133	3.203	2.3799	0.82309	1

0.0167	3.062	2.1879	0.87408	1
0.02	2.889	2.0193	0.86969	1
0.0233	2.654	1.866	0.78799	1
0.0267	1.759	1.7222	0.036758	1
0.03	0.879	1.595	-0.71598	1
0.0333	0.612	1.4785	-0.86655	1
0.0367	0.502	1.3688	-0.86679	1
0.04	0.33	1.2712	-0.9412	1
0.15	0.11	0.17028	-0.060283	1
0.1533	0.11	0.16253	-0.052531	1
0.1567	0.11	0.15504	-0.045043	1
0.16	0.11	0.14823	-0.038226	1
0.1633	0.11	0.14182	-0.031822	1
0.1667	0.11	0.13563	-0.025625	1
0.17	0.11	0.12997	-0.019974	1
0.1733	0.11	0.12466	-0.014657	1
0.1767	0.11	0.1195	-0.0095026	1
0.18	0.11	0.11479	-0.0047943	1
0.1833	0.11	0.11036	-0.00035606	1
0.1867	0.094	0.10605	-0.012047	1
0.19	0.094	0.1021	-0.0081038	1
0.1933	0.094	0.09838	-0.0043803	1
0.1967	0.094	0.094759	-0.00075901	1
0.2	0.078	0.091439	-0.013439	1
0.2033	0.078	0.088299	-0.010299	1
0.2067	0.078	0.08524	-0.0072397	1
0.21	0.063	0.08243	-0.01943	1
0.2133	0.063	0.079768	-0.016768	1
0.2167	0.063	0.07717	-0.01417	1
0.22	0.063	0.074779	-0.011779	1
0.2233	0.063	0.07251	-0.0095104	1
0.2267	0.063	0.070292	-0.007292	1
0.23	0.047	0.068247	-0.021247	1
0.2333	0.047	0.066303	-0.019303	1
0.2367	0.047	0.064399	-0.017399	1
0.24	0.047	0.062641	-0.015641	1
0.2433	0.047	0.060966	-0.013966	1
0.2467	0.047	0.059323	-0.012323	1
0.25	0.047	0.057803	-0.010803	1
0.2533	0.047	0.056353	-0.009353	1
0.26	0.047	0.053606	-0.0066064	1
0.2667	0.047	0.0511	-0.0041003	1
0.2833	0.031	0.045765	-0.014765	1
0.2867	0.031	0.044804	-0.013804	1
0.29	0.031	0.043909	-0.012909	1
0.3067	0.031	0.039881	-0.0088811	1
0.3233	0.031	0.036564	-0.005564	1
0.34	0.031	0.033762	-0.0027621	1
0.3567	0.031	0.031381	-0.0003811	1
0.3733	0.031	0.029345	0.0016548	1
0.39	0.031	0.027564	0.0034358	1
0.4067	0.031	0.026001	0.0049993	1
0.4233	0.031	0.024623	0.0063765	1
0.44	0.031	0.023386	0.0076143	1
0.4567	0.016	0.022272	-0.0062723	1
0.49	0.016	0.020351	-0.0043511	1
0.5067	0.016	0.01951	-0.0035102	1
0.5233	0.016	0.018741	-0.0027413	1
0.54	0.016	0.018027	-0.0020268	1
0.5567	0.016	0.017365	-0.0013647	1

0.5733	0.016	0.016753	-0.00075275	1
0.59	0.016	0.016179	-0.00017853	1
0.6067	0.016	0.015642	0.00035831	1
0.6233	0.016	0.015142	0.00085848	1
0.64	0.016	0.014669	0.0013311	1
0.6567	0.016	0.014224	0.0017759	1
0.6733	0.016	0.013807	0.0021928	1
0.69	0.016	0.013411	0.0025889	1
0.7067	0.016	0.013036	0.0029636	1
0.7233	0.016	0.012684	0.0033163	1
0.74	0.016	0.012347	0.003653	1
0.7567	0.016	0.012027	0.0039726	1
0.7733	0.016	0.011725	0.0042748	1
0.79	0.016	0.011436	0.0045642	1
0.8067	0.016	0.01116	0.00484	1
0.8233	0.016	0.010898	0.0051015	1
0.84	0.016	0.010647	0.0053528	1
0.8567	0.016	0.010407	0.0055929	1
0.8733	0.016	0.010179	0.0058212	1
0.89	0.016	0.0099589	0.0060411	1
0.9067	0.016	0.0097481	0.0062519	1
0.9233	0.016	0.0095472	0.0064528	1
0.94	0.016	0.0093532	0.0066468	1
0.9567	0.016	0.0091669	0.0068331	1
1.1567	0.016	0.0074019	0.0085981	1
1.3567	0.016	0.0062112	0.0097888	1
1.5567	0.016			

APPENDIX K

APPENDIX K
AQUIFER TEST INFORMATION

APPENDIX K

AQUIFER TEST

K.1 Introduction

Aquifer tests (step drawdown and constant discharge tests) were conducted on well A-MW8B at Area A of the Camp Allen Landfill between June 24 and 27, 1992. The purpose of these tests was to develop an estimation of hydrogeologic parameters of the site. This information will be used to develop a conceptual site model to evaluate groundwater flow and contaminant movement as well as potential groundwater remedial alternatives.

Section K.2 of this appendix presents a discussion of the step drawdown test. Section K.3 presents the results of the constant discharge pump test. A summary and discussion of the aquifer test results is given in Section K.4. Supporting information and calculations are provided in the Attachments K-1 through K-5 of this appendix.

K.2 Step Drawdown Test

A preliminary pump test and a step drawdown test were conducted in Well A-MW8B on June 24 and June 25, 1992. Water levels in monitoring wells A-MW8B, and A-P8 were measured throughout the duration of these tests with In-Situ Environmental Inc. Hermit Data Loggers equipped with pressure transducers. Two tests were conducted during this period, a preliminary pump test and an abbreviated step drawdown test, as discussed below.

The first test conducted was a preliminary constant discharge test. The purpose of this test was to develop a preliminary estimate of the productivity of the pumping well, A-MW8B. This test was initiated on June 24, 1992 by pumping Well A-MW8B at approximately 15 gallons per minute for a period of 120 minutes. The test was terminated at this time because it was determined through observation water level measurements that the system had come to equilibrium. The recovery portion of the test was conducted for an additional 137 minutes.

A maximum drawdown in A-MW8B of about 2.3 feet was reached within approximately 45 minutes from the initiation of the pumping portion of the preliminary test. The maximum drawdown measured in monitoring well A-P8 of 0.93 feet was reached within approximately 75 minutes from the initiation of the pumping portion of the test.

The data from the preliminary pump test was evaluated using the Jacobs straight line method (refer to Section K.3.1 for a detailed discussion of this method). This evaluation yielded a transmissivity range of 17,200 GPD/ft to 31,700 GPD/ft with an average of 22,300 GPD/ft, typical of a sandy aquifer. The storativity from the preliminary test ranged from 7.47×10^{-2} to 1.75×10^{-7}, with an average of 3.74×10^{-2}. This value is between the typical storativity ranges for confined (5×10^{-3} to 5×10^{-5}) or unconfined (1×10^{-2} to 3×10^{-1}) aquifer conditions. This indicated potentially semi-confined aquifer conditions. A summary of this data is provided in Table K-1. Detailed calculations are given in Attachment K-1.

The step drawdown test was conducted on June 25, 1992. Water levels in the pumping well A-MW8B, monitoring well A-P8 and two staff gauges set in the adjacent stream were continuously monitored with data loggers equipped with pressure transducers throughout the duration of this test.

The step drawdown test was initiated by pumping Well A-MW8B at approximately 25 gallons per minute for a period of 18 minutes. A short transitional period of about 5 minutes occurred while readjusting the flow rate. Well A-MW8B then was pumped at a constant rate of approximately 38 gallons per minute for 97 minutes. The recovery period for this test lasted for 95 minutes after termination of pumping.

A maximum drawdown in the pumping well, A-MW8B, of 8.3 feet was measured within approximately 86 minutes from the initiation of the test. A maximum drawdown from monitoring well A-P8 of approximately 2.39 feet was attained within 119 minutes from the initiation of the test. These results indicate that the aquifer could sustain a pumping rate of at least 38 gpm with only small to moderate drawdown. Specific capacity data obtained from the pumping well during this test are given in Attachment K-1.

The results from these two tests indicated an average transmissivity 22,300 GPD/ft. The test results also indicate that the well A-MW8B could sustain a pumping rate of 38 gpm with an estimated equilibrium drawdown of approximately 9.0 feet. It is likely that greater pumping rates could be sustained by this well; however, on-site pumping equipment was limited to a maximum of 38 gallons per minute.

TABLE K-1

Camp Allen Landfill RI/FS

Preliminary Pump Test Evaluation Results

Jacob Straight Line Method

Well #	Transmissivity * (GPD/ft)	Storativity
Drawdown		
A-P8	31700	1.75E-07
Recovery		
A-P8	18000	7.47E-02
A-MW8B	17200	N/A

Notes:

N/A - Not applicable to the pumping well

A-MW8B is the pumping well

* Transmissivity values rounded to the nearest 100.

K.3 Constant Discharge Pumping Test

A constant discharge aquifer test was performed on A-MW8B on June 26, 1992. The purpose of the constant discharge test was to develop the data necessary to calculate various aquifer parameters such as transmissivity (T) and storativity (S).

The pumping well for this test was designated as A-MW8B. The screened interval for this well is set near the top of the Yorktown Aquifer. Well A-MW8B was pumped at an average rate of 38 gpm for a period of 25 hours for the drawdown portion of the test. The recovery portion of the test commenced on June 27, 1992 and lasted for 300 minutes.

Water levels were measured in a total of ten monitoring wells using In-Situ Environmental, Inc. Hermit Data Loggers equipped with pressure transducers. The screened intervals for these wells are set in three zones, as follows in an effort to more fully investigate potentially separate subsurface groundwater flow regimes:

- Shallow monitoring wells (surficial aquifer)
  - A-MW8A
  - A-MW9A
  - A-MW10A
  - B-20W
  - B-20WSS

- Yorktown Aquifer (screened near the top and middle of the aquifer)
  - A-MW8B (pumping well)
  - A-P8
  - A-MW9B
  - A-MW10B

- Yorktown Aquifer (screened near the bottom of the aquifer)
  - A-MW9C

The data obtained from this pumping test were analyzed using three different methods: (1) Jacob straight line method; (2) the Hantush (Modified) method; and (3) Walton's Type Curve for Leaky Aquifers method as discussed in the following sections.

There are numerous assumptions associated with each of the three evaluation methods. These assumptions are discussed in detail in Driscoll (1986), Kruseman and De Ridder (1979), Lohman (1972), Roscoe Moss Company (1990), and Freeze and Cherry (1979) and will not be repeated here. In general, violation of some of the assumptions associated with these methods generally produces relatively small errors, within the range of natural aquifer variation, in transmissivity and storativity calculations.

The results of the aquifer tests will be presented in the following manner: first, a description of the Jacob Straight Line Method will be given (Section K.3.1). This description will include a general procedure by which transmissivity and storativity values are calculated, and a description of some of the assumptions inherent in this method. This description will be followed by a brief discussion and presentation of the calculated T and S values, as well as a very general interpretation of what these values mean. This format will be followed for the Hantush Modified Method in Section K.3.2 and the Walton's Type Curve Method for Leaky Aquifers in Section K.3.3.

A summary of the pumping test results will be given in Section K.4 following presentation of the aquifer test data and calculation results.

K.3.1 Jacob Straight Line Method

The Jacob Straight Line Method, described in Driscoll, 1986, was used to evaluate drawdown-time data from the constant discharge pump test conducted on well A-MW8B and surrounding monitoring wells. The Jacob method is based on a modified form of the Theis non-equilibrium equation. Application of this method consists of the following steps:

- Drawdown and time values are plotted on a semi-logarithmic graph in which drawdown is plotted along the arithmetic scale and time is plotted on the log scale.
- A straight line (or lines) is fitted to the data.
- The change in drawdown per one log cycle is determined from the graph.
- The time at which zero drawdown occurs (t_0) also is determined from the graph.
- The values of Q and s are substituted into the following equation to obtain T:

$$T = \frac{264Q}{\Delta s}$$

where:

T = transmissivity (gpd/ft)

Q = discharge (gpm)

s = drawdown (feet per one log cycle)

- The values of T, t_0, and r are substituted into the following equation to obtain S:

$$S = \frac{0.3\,T\,t_0}{r^2}$$

where

S = storativity

T = transmissivity (gpd/ft)

t_0 = time at which zero drawdown occurs (minutes)

r = radial distance of an observation well from the pumping well (feet)

There are numerous assumptions inherent in the application of this method (Kruseman and De Ridder, 1979):

- The aquifer has an infinite areal extent.
- The aquifer is homogeneous, isotropic, and of uniform thickness.
- The piezometric surface is nearly horizontal prior to pumping.
- The aquifer is pumped at a constant discharge rate.
- The pumping well penetrates the entire aquifer thickness.
- Flow is steady.
- Water removed from storage is discharged instantaneously with decline in head.
- Storage in the well can be neglected.
- The value of u (argument of the well function) is less than 0.01 to 0.05 (Driscoll, 1986).

Some of these assumptions likely are violated to some extent. However, the impact on the evaluation results is expected to be minimal. One additional restriction that is placed on this

method is that it is not applicable to time-drawdown data collected for the pumping well during the pumping phase of the test.

The Jacob Straight Line Method was applied to drawdown-time data for A-P8, A-MW9B, A-MW10B, and A-MW9C, and to recovery-time data for A-MW8B, A-P8, A-MW9B, A-MW10B, and A-MW9C. Measurable drawdown was not evident in the data collected from monitoring wells A-MW8A, A-MW9A, A-MW10A, B-20W, and B-20WSS. Therefore, this method was not applicable to the drawdown and recovery data collected for these wells. Time-drawdown graphs and accompanying calculations are given in Attachment K-2. Transmissivity and storativity values calculated using the Jacobs Straight Line Method are summarized in Table K-2.

Transmissivities for the shallow aquifer ranged from 64,000 GPD/ft to 112,100 GPD/ft in monitoring well A-MW10A, with an average of 80,050 GPD/ft. This transmissivity range is typical of a sandy aquifer. The calculated storativity from A-MW10A was approximately 3.7×10^{-3}, within the range typical of semi-confined to confined aquifers. Note that measured drawdowns in the shallow wells were small and variable. Therefore, the reliability of these T and S values is suspect.

Transmissivities calculated from data collected from the middle depth wells (monitoring wells screened near the top or middle of the Yorktown Aquifer) were relatively consistent and ranged from 19,000 GPD/ft to 36,000 GPD/ft with an average of about 27,900 GPD/ft. Storativities ranged from 0.123 to 3.50×10^{-6} with an average of 2.21×10^{-2}. This value is greater than the range typical of confined conditions indicating potentially semi-confined aquifer conditions. Note that due to the range in S, semi-confined conditions may be defined as leakage through a confining layer, interspersed zones of confined and unconfined conditions (i.e., a discontinuous clay layer), or a combination of the two.

Transmissivities calculated from data collected from the deep well, A-MW9C, screened near the bottom of the Yorktown Aquifer were somewhat lower than those from the middle depths. The values of T calculated from monitoring well A-MW9C were relatively consistent, ranging from 16,000 GPD/ft to 17,000 GPD/ft with an average of about 16,500 GPD/ft. The somewhat lower transmissivity values from A-MW9C may be due to clay lenses or other relatively low permeable zones inhibiting the vertical flow through the aquifer (i.e., from the deep portion of the aquifer to the shallow portion where the pump was set). These lower T values also may be a manifestation of the inapplicability of the Jacob Method to non-horizontal groundwater flow.

TABLE K-2

Camp Allen Landfill RI/FS

25 Hr Pump Test Results

Transmissivity, Storativity and Well Function - Jacob Straight Line Method

Monitoring Well #	Radial Distance From Pumping Well (ft)	Drawdown Phase			Recovery Phase		
		Transmissivity T (GPD/ft)	Storativity S	Well Function u	Transmissivity T (GPD/ft)	Storativity S	Well Function u
Shallow Wells - Screened in the surficial unconfined aquifer							
A-MW8A	21.76	NR	NR	NR	NR	NR	NR
A-MW9A	110.1	NR	NR	NR	NR	NR	NR
A-MW10A (early)	236.59	64000	3.79E-03	0.005984	112100	3.70E-03	0.003329
A-MW10A (late)		1800 (1)	2.79E-02 (1)	0.1683 (1)	N/A	N/A	N/A
B-20W	241.1	NR	NR	NR	NR	NR	NR
B-20WSS	239.16	22000 (1)	1.18E-02 (1)	0.0561 (1)	NR	NR	NR
Middle Depth Wells - screened in the upper to middle of the Yorktown Aquifer							
A-MW8B ***	0.167	12700 **	9.48E-08 **	**	28000	6.96E+2 *	**
A-P8	11.64	24000	3.50E-06	0.010098	28000	1.23E-01	0.001029
A-MW9B	117.75	29000	6.45E-05	5.61E-05	31000	2.35E-03	0.00187
A-MW10B (early)	243.49	34000	3.31E-04	0.001029	37000	7.18E-04	0.002057
A-MW10B (late)		19000	6.25E-03	0.035156	N/A	N/A	N/A
Deep Well - screened at the bottom of the Yorktown Aquifer							
A-MW9C (early)	121.16	17000	6.70E-03	0.010098	16000	6.42E-04	0.001029
A-MW9C (late)		12000 (1)	3.10E-02 (1)	0.70034 (1)	N/A	N/A	N/A

Notes:

NR - No response to the pumping well

N/A - Not Applicable

*** - Pumping Well

** - Not applicable to the drawdown phase of the pumping well

* - Unrealistic result; storativity cannot be greater than one.

(1) - u greater than 0.05; therefore the calaulated T and S values are unreliable.

Storativities for A-MW9C ranged from 6.70×10^{-3} to 6.42×10^{-4}, within the range typical of confined to semi-confined aquifers.

The following summarizes the constant discharge pump test results using the Jacob Straight Line Method:

Transmissivity Range (GPD/ft)	Average Transmissivity (GPD/ft)
Shallow Aquifer 64,000 to 112,100	80,050
Yorktown Aquifer (top) 19,000 to 37,000	28,750
Yorktown Aquifer (bottom) 16,000 to 17,000	16,500

K.3.2 Hantush Modified Method

The Hantush Modified Method, described in Lohman, 1972, and Reed, 1980, also was used to evaluate the time drawdown data obtained from the constant discharge pumping test. This method was chosen because it is generally applicable to aquifers acting under confined to semi-confined or leaky conditions as indicated by the storativities calculated from the Jacob Method (Section K.3.1). The Hantush Modified Method uses a modification of the Theis equation, and the equation developed by Hantush and Jacob (1955), that takes into account the storage of water in semi-pervious, confining layers.

The Hantush Modified Method consists of the following steps:

- Drawdown and time values are plotted on log-log graph paper;

- These points should lie on a curve and are matched to the appropriate portion or portions of the type curves for confined and/or semi-confined aquifers (i.e., type curves of $H(\mu,\beta)$, the Hantush well function, verses $1/\mu$, the inverse of the argument of the well function, for various values of β);

- A match point is chosen from which the values of $H(\mu,\beta)$, $1/\mu$, s (drawdown), and t (time) are determined;

- The values of Q (discharge), s, and $H(\mu,\beta)$ are substituted into the following equation to obtain a value for T (transmissivity):

$$T = \frac{Q\,H(\mu, \beta)}{4\pi s}$$

where:

T = transmissivity (gpd/ft)

Q = discharge rate (gpm)

s = drawdown (feet)

$H(\mu,\beta)$ = Hantush well function.

- The values of T, t, r, and $1/\mu$ are substituted into the following equation to obtain a value for S:

$$S = \frac{4Tt}{r^2\,(1/\mu)}$$

where:

T = transmissivity (gpd/ft)

t = time (minutes)

r = radial distance of an observation well from pumping well (feet)

μ = argument of Hantush well function

S = storativity

Since this method requires matching data points to type curves, some judgment is required in determining the match point. This could result in different investigators obtaining slightly different results; however, the variation between results is generally small.

There are numerous assumptions inherent in this method (Reed, 1980):

- The aquifer has an infinite areal extent.
- The aquifer is homogeneous, isotropic, and of uniform thickness.
- The piezometric surface is nearly horizontal prior to pumping.
- The aquifer is pumped at a constant discharge rate.
- The pumping well penetrates the entire aquifer thickness.

- The well diameter is negligible.
- Flow in the aquifer is two-dimensional and radial in the horizontal plane.
- Flow in the confining beds is vertical.
- There are constant head plane sources above and below the aquifer.

As with the Jacob Straight Line Method, these assumptions are often violated in actual field conditions. However, this generally causes only small errors in the calculation of T and S. For conditions at the Camp Allen Landfill Site, most of these assumptions are probably not violated to a large extent and the resultant error likely is relatively small. One additional restriction that is placed on this method is that it is not appropriate to use time-drawdown data collected for the pumping well during the pumping phase of the test.

Data collected from monitoring wells A-MW8A, A-MW9A, B-20W, B-20WSS and A-MW8B indicated no measurable drawdown, hence this method was not applicable to the drawdown and recovery data for these five wells.

The Hantush Modified Method was applied to drawdown-time data for A-MW10A, A-P8, A-MW9B, A-MW10B, and A-MW9C and to recovery-time data for A-MW8B, A-P8, A-MW9B, A-MW10B, and A-MW9C. Time drawdown graphs and accompanying calculations are given in Attachment K-3. Transmissivity and storativity values for these wells as calculated by the Hantush Modified Method are summarized in Table K-3.

For the shallow wells, sufficient response for application of this method was observed only in monitoring well A-MW10A for the drawdown portion of the constant discharge test. Application of the Hantush Modified Method to data collected from this well yielded a transmissivity in the shallow aquifer of 34,800 GPD/ft and a storativity of 4.39×10^{-3}.

Transmissivities calculated from data collected from the middle depth wells (monitoring wells screened near the top or middle of the Yorktown Aquifer) were relatively consistent and ranged from 14,500 GPD/ft to 29,000 GPD/ft with an average of about 21,500 GPD/ft. Storativities ranged from 0.104 to 7.96×10^{-5}, within the range typical of semi-confined to confined aquifers. These T and S values are comparable to those calculated by the Jacob Method.

Beta values also are determined by the Hantush Method. Beta is a function of the hydraulic conductivity and storativity of semi-confining or leaky aquifer zones. This parameter gives an

TABLE K-3

Camp Allen Landfill RI/FS

25 Hr Pump Test Results

Transmissivity and Storativity Values - Hantush Modified Method

Monitoring Well #	Radial Distance From Pumping Well (ft)	Drawdown Phase			Recovery Phase		
		Transmissivity T (GPD/ft)	Storativity S	Beta B	Transmissivity T (GPD/ft)	Storativity S	Beta B
Shallow Wells - Screened in the surficial unconfined aquifer							
A-MW8A	21.76	NR	NR	NR	NR	NR	NR
A-MW9A	110.1	NR	NR	NR	NR	NR	NR
A-MW10A	236.59	34800	4.39E-03	0.05	NR	NR	NR
B-20W	241.1	NR	NR	NR	NR	NR	NR
B-20WSS	239.16	NR	NR	NR	NR	NR	NR
Middle Depth Wells - screened in the top/middle of the Yorktown Aquifer							
A-MW8B **	0.167	NR	NR	NR	25600	767 *	0.00
A-P8	11.64	14500	7.96E-05	0.01	15800	1.04E-01	0.[illegible]
A-MW9B	117.75	16700	9.87E-05	0.10	24900	2.83E-03	0.00
A-MW10B	243.49	24200	4.85E-04	0.00	29000	8.91E-04	0.02
Deep Well - screened at the bottom of the Yorktown Aquifer							
A-MW9C	121.16	7600	3.26E-03	0.40	1700	6.61E-05	0.00

Notes:

NR - No response to the pumping well

N/A - Not Applicable

** - Pumping Well

* - Unrealistic result; storativity cannot be greater than one.

indication as to whether there is leakage through a confining unit. For example, values of beta equal to 0 indicate little or no leakage through a confining unit, whereas values of beta greater than 0 indicate some degree of leakage. For the middle depth wells, the beta values ranges from 0 to 0.2. These values confirm the assumption that confined to semi-confined aquifer conditions prevail at the site.

Transmissivities calculated from data collected from the deep well, A-MW9C, screened near the bottom of the Yorktown Aquifer were somewhat lower than those from the middle depths. The values of T calculated from monitoring well A-MW9C ranged from 1,700 GPD/ft to 7,600 GPD/ft with an average of about 4,650 GPD/ft. The somewhat lower transmissivity values from A-MW9C may be due to clay lenses or other relatively low permeable zones inhibiting the vertical flow through the aquifer (i.e., from the deep portion of the aquifer to the shallow portion where the pump was set). These lower T values also may be a manifestation of the inapplicability of the Hantush Modified Method to non-horizontal groundwater flow. Storativities ranged from 3.26×10^{-3} to 6.61×10^{-5}, within the range typical of confined to semi-confined aquifers. Similarly, beta values ranged from 0 to 0.4, confirming this observation.

Note that the results from the Hantush Method for the deep well A-MW9C are somewhat lower than those calculated by the Jacob Method. The reason for this could be the difficulty of fitting a curve or straight line to data with a relatively high variance.

The following summarizes the constant discharge pump test results using the Hantush Modified Method:

Transmissivity Range (GPD/ft)	Average Transmissivity (GPD/ft)
Shallow Aquifer 34,800	34,800
Yorktown Aquifer (top) 14,500 to 29,000	21,500
Yorktown Aquifer (bottom) 1,700 to 7,600	4,650

K.3.3 Walton's Type Curve Method for Leaky Aquifers

The Walton's Type Curve Method (Roscoe Moss Company, 1990) also was applied to the data generated by the constant discharge pump test. This method was chosen because it is generally applicable when an aquifer is semi-confined and there is unsteady state flow to a well. This method presents a solution for the leaky aquifer problem.

Application of the Walton Type Curve Method consists of the following steps:

- Drawdown and time values are plotted of log-log graph paper.

- These points should lie on a curve and are matched to the appropriate portion or portions of the type curves for confined and/or semi-confined aquifers (i.e., type curves of $W(\mu, r/B)$ verses $1/\mu$ for various values of r/B).

- A match point is chosen from which the values of $W(\mu, r/B)$, $1/\mu$, r/B, t, and s are determined.

- The values of Q, $W(\mu, r/B)$, and s are substituted into the following equation to obtain a value for T:

$$T = \frac{Q\,W(\mu, r/B)}{4\pi s}$$

  where:

  T = transmissivity (gpd/ft)

  Q = discharge rate (gpm)

  s = drawdown (feet)

  $W(\mu, r/B)$ = Walton's well function.

- The values of T, t, r, and $1/\mu$ are substituted into the following equation to obtain a value for S:

$$S = \frac{4\,T\,t}{r^2\,(1/\mu)}$$

where:

S = storativity

T = transmissivity (gpd/ft)

t = time (minutes)

r = radial distance of an observation well from pumping well (feet)

μ = argument of Hantush well function

- When the value for r/B is greater than 0 a value for leakage may be calculated using the following equations:

$$B = \frac{r}{x} \qquad\qquad L = \frac{B^2}{T}$$

where:

r = radial distance of an observation well from pumping well (ft)

T = transmissivity (gpd/ft)

B = leakage factor (ft)

Since this method requires matching data points of type curves, some judgment is required in determining the match point. This could result in different investigators obtaining slightly different results; however, the variation between results is generally small.

There are numerous assumptions inherent in this method:

- The aquifer has an infinite areal extent.
- The aquifer is homogeneous, isotropic, and of uniform thickness.
- The piezometric surface is nearly horizontal prior to pumping.
- The aquifer is pumped at a constant discharge rate.
- The pumping well penetrates the entire aquifer thickness.
- The aquifer is semi-confined.
- The flow to the well is in an unsteady state.
- The water removed from storage is discharged instantaneously with decline of head.
- The well diameter is very small, so that the storage in the well can be neglected.

As with the Jacob Straight Line Method, these assumptions are often violated in actual field conditions. However, this generally causes only small errors in the calculation of T and S. For

conditions at the Camp Allen Landfill Site, most of these assumptions are probably not violated to a large extent and the resultant error likely is relatively small. One additional restriction that is placed on this method is that it is not appropriate to use time-drawdown data collected for the pumping well during the pumping well during the pumping phase of the test.

Monitoring wells A-MW8A, A-MW9A, B-20W, and B-20WSS displayed essentially no drawdown, hence this method was not applicable to the drawdown and recovery data for these two wells.

The Walton's Type Curve Method was applied to time-drawdown data for A-MW10A, A-P8, A-MW9B, A-MW10B, and A-MW9C, and time-recovery data for A-MW10A, A-MW8B, A-P8, A-MW9B, A-MW10B, and A-MW9C. Time-drawdown and time-recovery graphs and accompanying calculations are given in Attachment K-4. Transmissivity and storativity values for these wells are summarized in Table K-4.

For the shallow wells, sufficient response for application of this method was observed only in monitoring well A-MW10A. Application of Walton's Type Curve Method to data collected from this well yielded a transmissivity in the shallow aquifer ranging from 27,200 GPD/ft to 128,100 GPD/ft, with an average of 77,600 GPD/ft. The storativity ranged from 4.06×10^{-3} to 1.70×10^{-4} with an average of 2.12×10^{-3}. Leakage, or the ability of a confining layer to transmit water also is calculated by Walton's Type Curve Method. The leakage calculated for the drawdown phase of the constant discharge test for A-MW10A was 3.21 per day.

Transmissivities calculated from data collected from the middle depth wells (monitoring wells screened near the top or middle of the Yorktown Aquifer) were relatively consistent and ranged from 21,800 GPD/ft to 27,200 GPD/ft with an average of about 24,700 GPD/ft. The exception was the transmissivity calculated for the pumping phase of the test for monitoring well A-P8, which was 6,967 GPD/ft. Storativities ranged from 1.64×10^{-1} to 1.22×10^{-4}, with an average of 2.83×10^{-2}, within the range typical of semi-confined aquifers. These T and S values are comparable to those calculated by the Jacob and Hantush Methods.

The leakage calculated for the middle depth wells ranged from 0 per day to 96.82 per day, with the highest two values (28.74 and 96.82 per day) calculated for monitoring well A-MW10B. The leakage values indicate varying aquifer conditions, from confined conditions in the vicinity of A-P8 to leaky or semi-confined conditions in A-MW10B.

TABLE K-4

Camp Allen Landfill RI/FS

25 Hr Pump Test Results

Transmissivity and Storativity - Walton's Type Curve Method for Leaky Aquifers

Monitoring Well #	Radial Distance From Pumping Well (ft)	Drawdown Phase			Recovery Phase		
		T (GPD/ft)	S	Leakance (Days)^-1	T (GPD/ft)	S	Leakance (Days)^-1
Shallow Wells - Screened in the surficial unconfined aquifer							
A-MW8A	21.76	NR	NR	NR	NR	NR	NR
A-MW9A	110.1	NR	NR	NR	NR	NR	NR
A-MW10A	236.59	27215	4.06E-03	3.214	128073	1.70E-04	0
B-20W	241.1	NR	NR	NR	NR	NR	NR
B-20WSS	239.16	NR	NR	NR	NR	NR	NR
Middle Depth Wells - screened in the top/middle of the Yorktown Aquifer							
A-MW8B **	0.167	NR	NR	NR	25615	7.7E+02*	0
A-P8	11.64	6967	1.53E-03	0.486	24883	1.64E-01	0
A-MW9B	117.75	21772	1.22E-04	113	25615	3.02E-03	0
A-MW10B	243.49	22918	5.17E-04	28.74	27215	8.86E-04	96.82
Deep Well - screened at the bottom of the Yorktown Aquifer							
A-MW9C	121.16	12807	6.48E-03	4.585	11612	6.17E-04	5.057

Notes:

NR - No response to the pumping well

N/A - Not Applicable

** - Pumping Well

* - Unrealistic result; storativity cannot be greater than one.

Transmissivities calculated from data collected from the deep well, A-MW9C, screened near the bottom of the Yorktown Aquifer were somewhat lower than those from the middle depths. The values of T calculated from monitoring well A-MW9C ranged from 11,600 GPD/ft to 12,800 GPD/ft with an average of about 12,200 GPD/ft. The somewhat lower transmissivity values from A-MW9C may be due to clay lenses or other relatively low permeable zones inhibiting the vertical flow through the aquifer (i.e., from the deep portion of the aquifer to the shallow portion where the pump was set). These lower T values also may be a manifestation of the inapplicability of the Walton Method to non-horizontal groundwater flow. Storativities ranged from 6.48×10^{-3} to 6.17×10^{-4}, within the range typical of confined to semi-confined aquifers. Similarly, the leakage values ranged from 4.59 to 5.06, confirming this observation.

The following summarizes the constant discharge pump test results using Walton's Type Curve Method:

Transmissivity Range (GPD/ft)	Average Transmissivity (GPD/ft)
Shallow Aquifer	
27,200 to 128,100	77,600
Yorktown Aquifer (top)	
21,800 to 27,200	24,700
Yorktown Aquifer (bottom)	
11,600 to 12,800	12,200

K.4 Summary of Aquifer Test Results

The constant discharge pump test results were analyzed using three standard methods: the Jacob's Straight Line Method, the Hantush Modified Method, and Walton's Type Curve Method. All three of the methods yielded relatively consistent transmissivity and storativity values for each the shallow, middle (top and middle of the Yorktown Aquifer) and deep (bottom of the Yorktown Aquifer) aquifers. Additionally, the Hantush and Walton Methods gave strong indications that the Yorktown Aquifer is confined to semi-confined.

The average transmissivities in the shallow aquifer, as calculated by the above mentioned three evaluation methods, ranged from 34,800 to 80,050 GPD/ft. This range is typical of a silty sand to sandy aquifer. The average transmissivities for the middle aquifer were somewhat lower, ranging from 21,500 to 27,900 GPD/ft, typical of a sandy silt to a silty sand aquifer.

Similarly, the average transmissivity for the deep aquifer ranged from 4,650 to 16,500 GPD/ft, typical of a sandy silt aquifer.

K.5 References

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Attachment K-1
Preliminary Pump Test and Step Drawdown Test Calculations

S.O. No. 19084-51-SRN

Subject: CAMP ALLEN LANDFILL RI/FS A-P8

PRELIMINARY PUMP TEST CALCULATIONS

JACOB'S STRAIGHT LINE METHOD

Sheet No. 1 of 1

Drawing No. —

Computed by MEK Checked By _____ Date 14 JAN-93

Baker

DRAWDOWN A-P8

$Q = 15$ GPM

$r = 11.64$ ft.

$t_o = 3.6 \times 10^{-6}$ MIN

$= 2.5 \times 10^{-9}$ DAYS

$s_1 = 0.56$ ft

$s_2 = 0.685$ ft

$$T = \frac{264\,Q}{\Delta s} = \frac{264\,(15)}{(0.685-0.56)}$$

$$\underline{\underline{T = 31{,}680 \text{ GPD/FT}}}$$

$$S = \frac{0.3\,T\,t_o}{r^2} = \frac{0.3\,(31{,}680)(2.5\times10^{-9})}{(11.64)^2}$$

$$\underline{\underline{S = 1.75 \times 10^{-7}}}$$

RECOVERY A-P8

T/T' WAS CALCULATED FOR PLOTTING THE RECOVERY PERIOD

$Q = 15$ GPM

$r = 11.64$ ft

$t_o = 2.7$ MIN

$= 1.875 \times 10^{-3}$ DAYS

$s_1 = 0.13$ ft

$s_2 = 0.35$ ft

$$T = \frac{264\,Q}{\Delta s} = \frac{264\,(15)}{(0.35-0.13)}$$

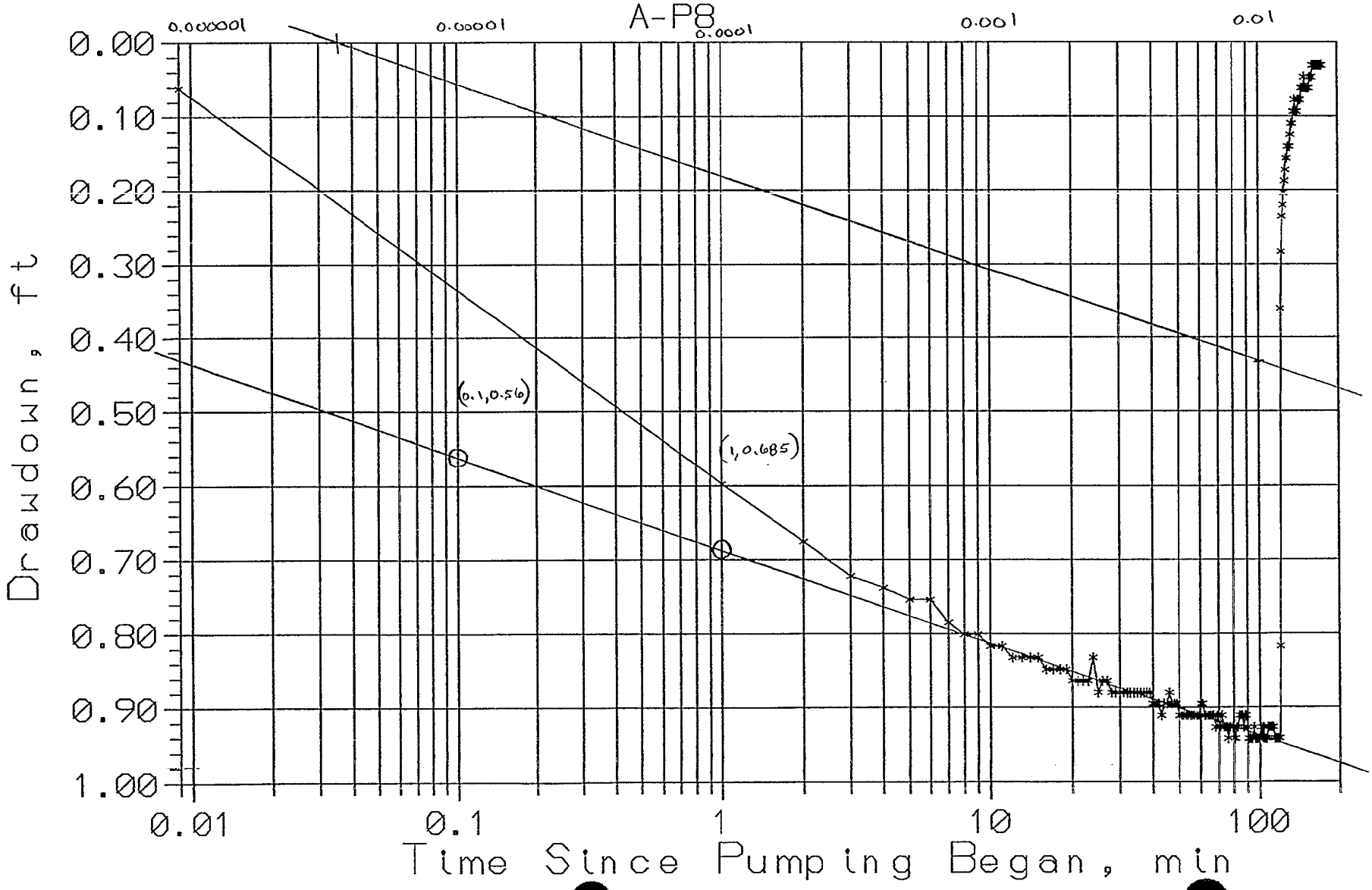
$$\underline{\underline{T = 18{,}000 \text{ GPD/FT}}}$$

$$S = \frac{0.3\,T\,t_o}{r^2} = \frac{0.3\,(18{,}000)\,1.875\times10^{-3}}{(11.64)^2}$$

$$\underline{\underline{S = 7.47 \times 10^{-2}}}$$

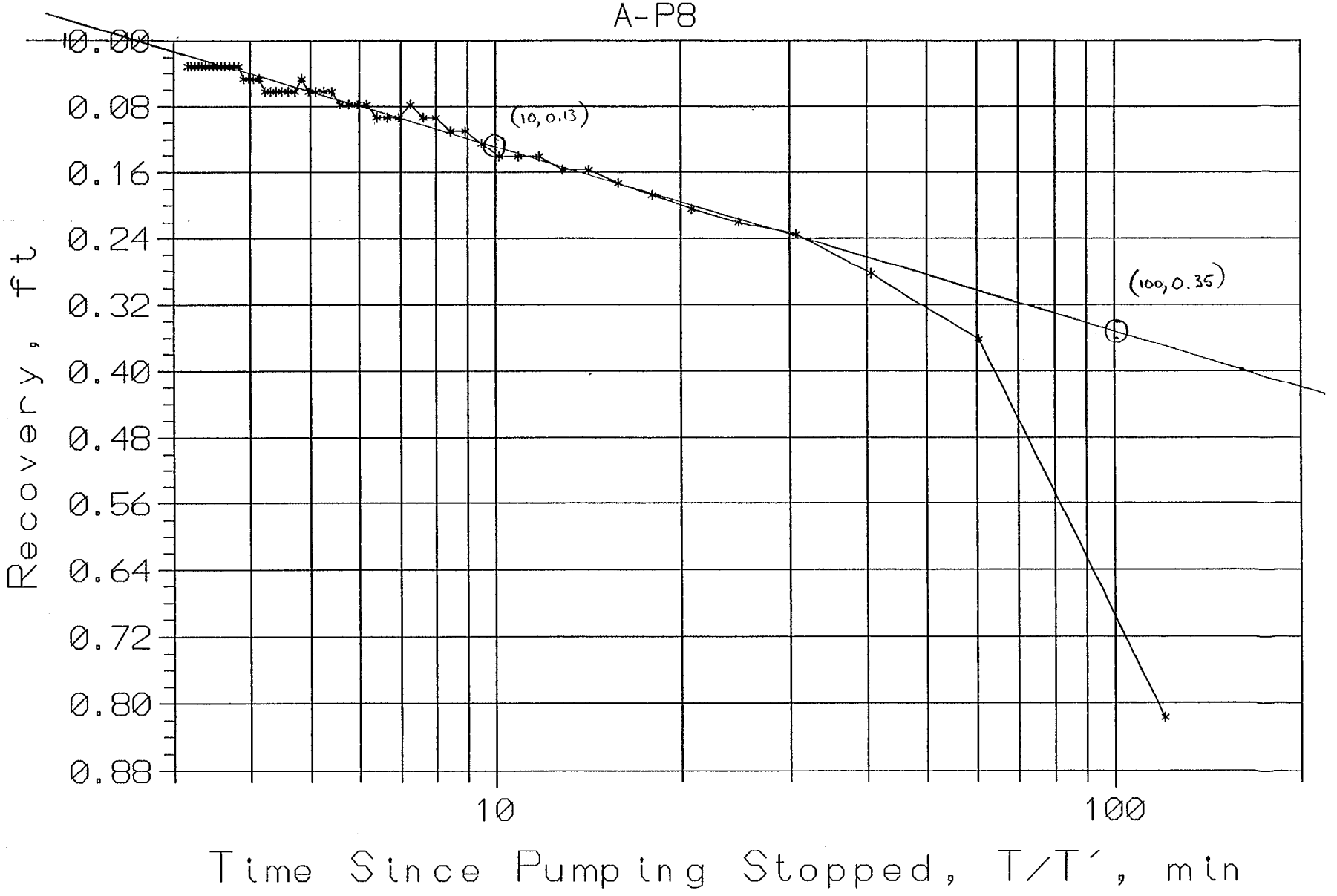
$t_o = 3.6 \times 10^{-6}$ MIN

Camp Allen Landfill RI/FS
Preliminary Step Test
Jacob Straight Line Method
Drawdown vs. Time Graph
A-P8



t_o = 2.7 min

Camp Allen Landfill RI/FS
Preliminary Step Test
Jacob Straight Line Method
Recovery vs. Time Graph
A-P8



S.O. No. 19084-51-SRN

Subject: CAMP ALLEN LANDFILL RI/FS A-MW8B

PRELIMINARY PUMP TEST CALCULATIONS Sheet No. 1 of 1

JACOB'S STRAIGHT LINE METHOD Drawing No. —

Computed by MEK Checked By _____ Date 14 JAN 93

Baker

RECOVERY A-MW8B

- THIS IS THE PUMPING WELL
- T/T' WAS CALCULATED FOR PLOTTING THE RECOVERY PERIOD

$Q = 15$ GPM

$S_1 = 0.11$ ft

$S_2 = 0.34$ ft

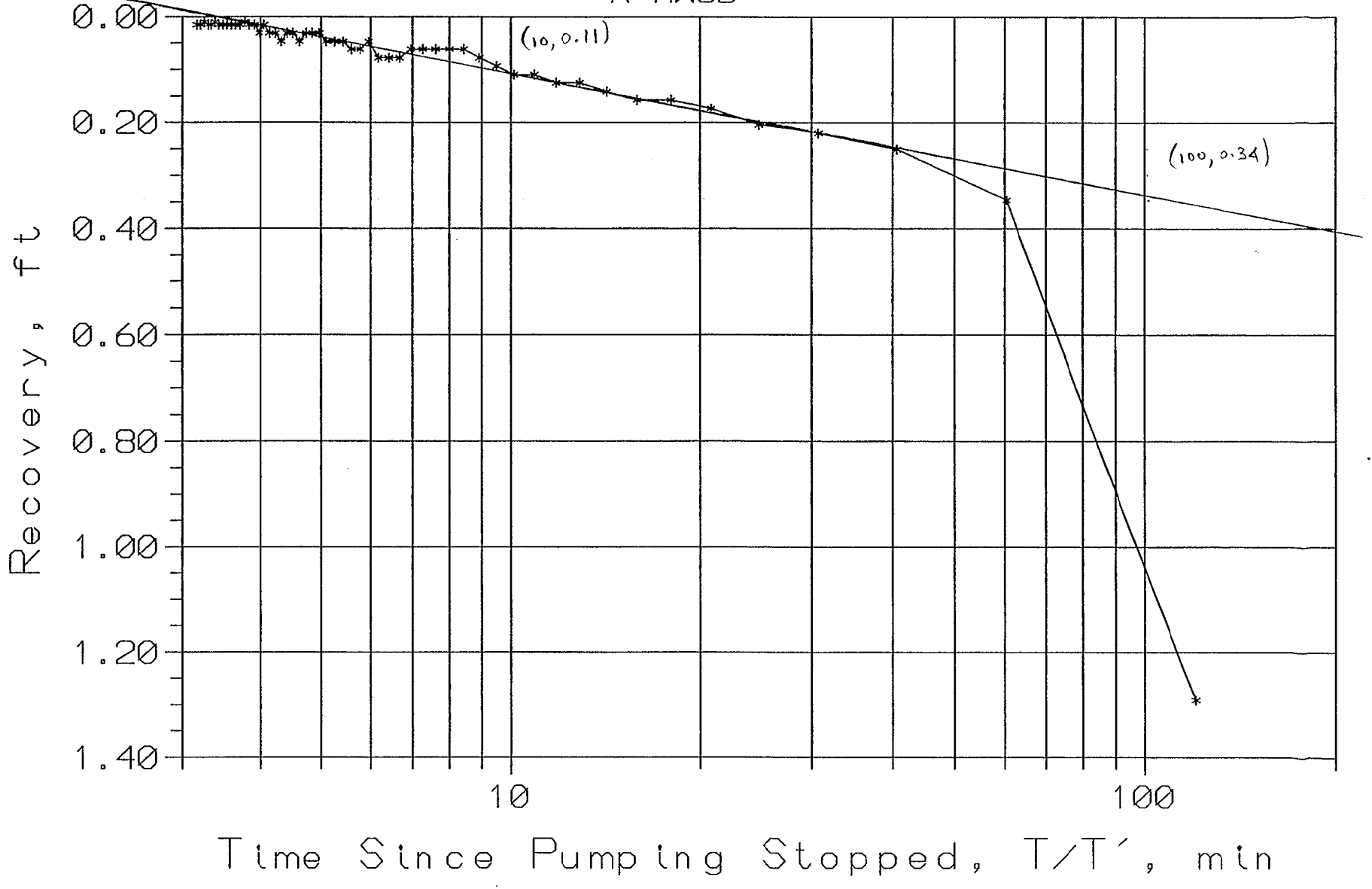
$$T = \frac{264\,Q}{\Delta S}$$

$$= \frac{264\,(15)}{(0.34 - 0.11)}$$

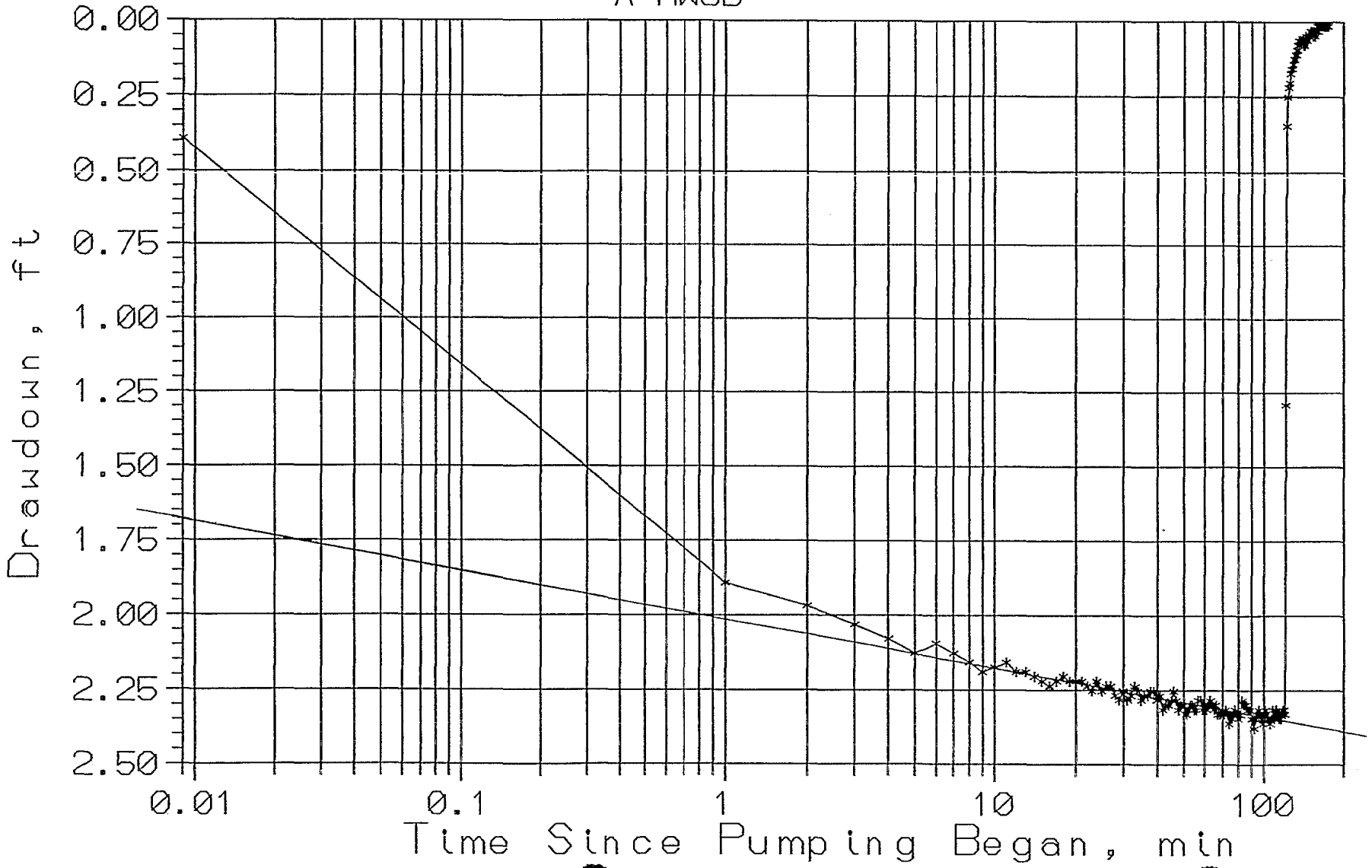
$$T = 17{,}217 \text{ GPD/FT}$$

Camp Allen Landfill RI/FS
Preliminary Step Test
Jacob Straight Line Method
Recovery vs. Time Graph
A-MW8B

t_o = 3.5 min



Camp Allen Landfill RI/FS
Preliminary Step Test
Jacob Straight Line Method
Drawdown vs. Time Graph
A-MW8B



S.O. No. 19084-51-SRN

Subject: CAMP ALLEN LANDFILL RI/FS

PRELIMINARY PUMP TEST CALCULATIONS

SPECIFIC CAPACITY

Sheet No. 1 of 1

Drawing No.

Computed by MEK Checked By Date 15 JAN 93

Baker

STEP DRAWDOWN TEST - SPECIFIC CAPACITY

$$\frac{Q}{S} = \frac{1}{CQ + B}$$

C = SLOPE OF STRAIGHT LINE PLOT OF S/Q VS Q

B = S/Q INTERCEPT

SEE S/Q -VS- Q PLOT

$$C = \frac{0.224 - 0.152}{40 - 24}$$

$$= 0.0045$$

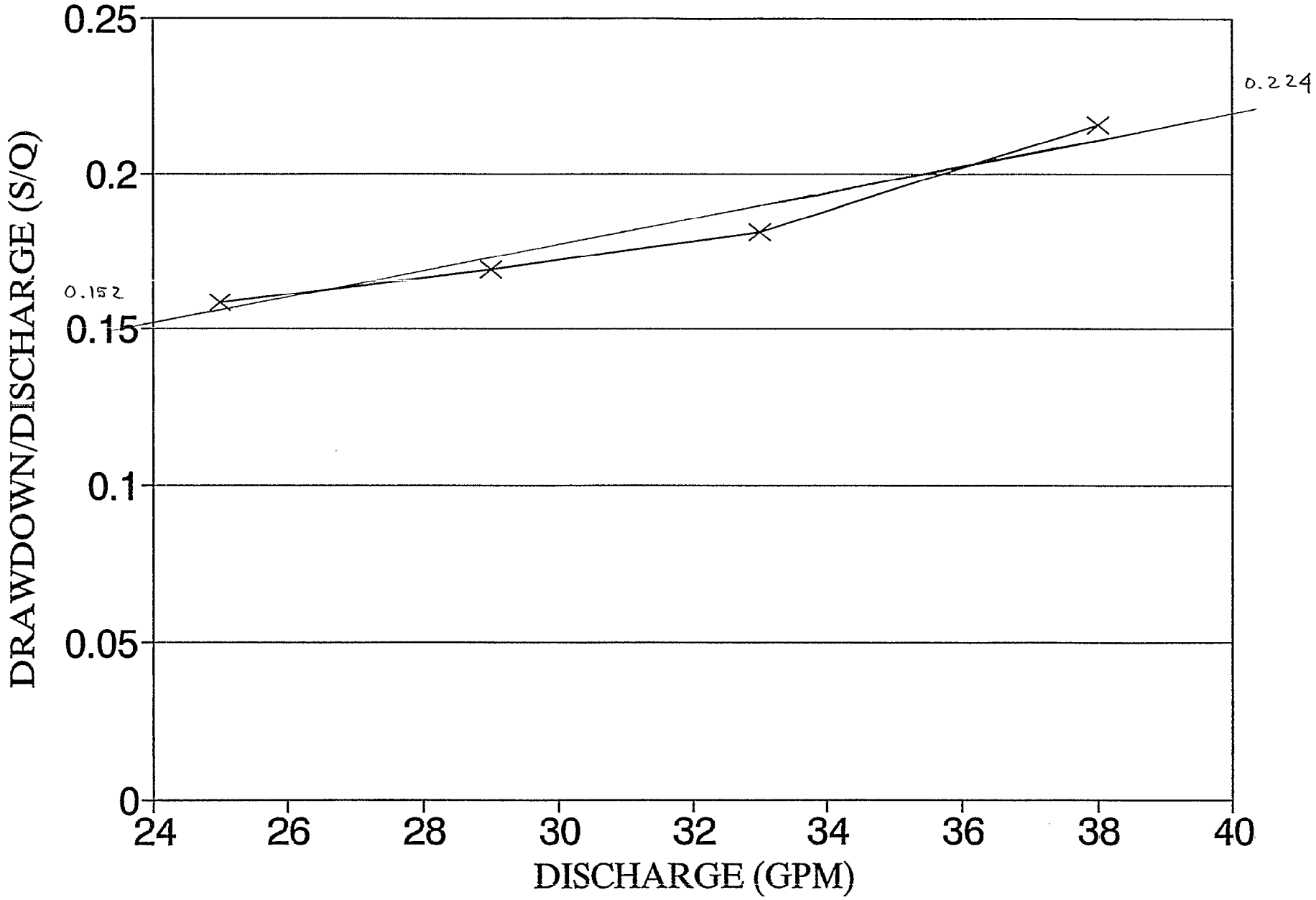
$$B = 0.152$$

THEREFORE: $\frac{Q}{S} = \frac{1}{0.0045\,Q + 0.152}$

SPECIFIC CAPACITY OF A-MW8B

Q	Q/S
25	3.78
29	3.54
33	3.33
38	3.10

STEP DRAWDOWN PUMP TEST FOR A-MW8B
1/(SPECIFIC CAPACITY) -VS- DRAWDOWN



Attachment K-2
Pump Test Calculations - Jacob Straight Line Method

Camp Allen Landfill RI/FS

25 Hr Pump Test Calculations Results

Transmissivity, Storativity and Well Function via Jacob Straight Line Method

Monitoring Well #	Radial Distance From Pumping Well (ft)	Drawdown Phase			Recovery Phase		
		Transmissivity T (GPD/ft)	Storativity S	Well Function u	Transmissivity T (GPD/ft)	Storativity S	Well Function u
Shallow Wells - Screened in the surficial unconfined aquifer							
A-MW8A	21.76	NR	NR	NR	NR	NR	NR
A-MW9A	110.1	NR	NR	NR	NR	NR	NR
A-MW10A (early)	236.59	64000	3.79E-03	0.005984	112100	3.70E-03	0.003329
A-MW10A (late)		1800 (1)	2.79E-02 (1)	0.1683 (1)	N/A	N/A	N/A
B-20W	241.1	NR	NR	NR	NR	NR	NR
B-20WSS	239.16	22000 (1)	1.18E-02 (1)	0.0561 (1)	NR	NR	NR
Middle Depth Wells - screened in the upper to middle of the Yorktown Aquifer							
A-MW8B ***	0.167	12700 **	9.48E-08 **	**	28000	6.96E+2 *	**
A-P8	11.64	24000	3.50E-06	0.010098	28000	1.23E-01	0.001029
A-MW9B	117.75	29000	6.45E-05	5.61E-05	31000	2.35E-03	0.00187
A-MW10B (early)	243.49	34000	3.31E-04	0.001029	37000	7.18E-04	0.002057
A-MW10B (late)		19000	6.25E-03	0.035156	N/A	N/A	N/A
Deep Well - screened at the bottom of the Yorktown Aquifer							
A-MW9C (early)	121.16	17000	6.70E-03	0.010098	16000	6.42E-04	0.001029
A-MW9C (late)		12000 (1)	3.10E-02 (1)	0.70034 (1)	N/A	N/A	N/A

Notes:

NR - No response to the pumping well

N/A - Not Applicable

*** - Pumping Well

** - Not applicable to the drawdown phase of the pumping well

* - Unrealistic result; storativity cannot be greater than one.

(1) - u greater than 0.05; therefore the calaulated T and S values are unreliable.

S.O. No. 19084-51-SRN

Subject: CAMP ALLEN LANDFILL RI/FS

25 HR PUMP TEST, MONITORING WELL A-MW8A Sheet No. 1 of 1

JACOB'S STRAIGHT LINE METHOD Drawing No.

Computed by MEK Checked By Date 17 NOV 92

Baker

RAW PUMP TEST DATA:

- 0.119 WAS ADDED TO ALL THE WATER LEVELS DUE TO NEGATIVE READINGS FROM THE HERMIT. DUE TO THIS NEGATIVE VALUE THE READINGS WERE UNABLE TO BE SET TO ZERO AT THE BEGINNING OF THE PUMP TEST. AFTER THE CORRECTION WAS MADE TO THE NUMBERS THE INITIAL READING OF THE HERMIT PRIOR TO THE START UP OF THE PUMP IS 0.113 ft.
- T/T' WAS CALCULATED FOR PLOTTING THE RECOVERY PERIOD.
- THE DRAWDOWN PHASE OF THE PUMP TEST LASTED FOR 1500 MINS.
- THE RECOVERY PHASE OF THE PUMP TEST LASTED FOR 300 MINS.
- THE GROUNDWATER FLOW RATE WAS 38 GPM.

CALCULATING T & S USING JACOB'S STRAIGHT LINE METHOD

A-MW8A

- DRAWDOWN & RECOVERY: A-MW8A.DAT
- RECOVERY: A-MW8A-R.DAT
- DRAWDOWN A-MW8A

  Q = 38 GPM

  r = 21.76 ft

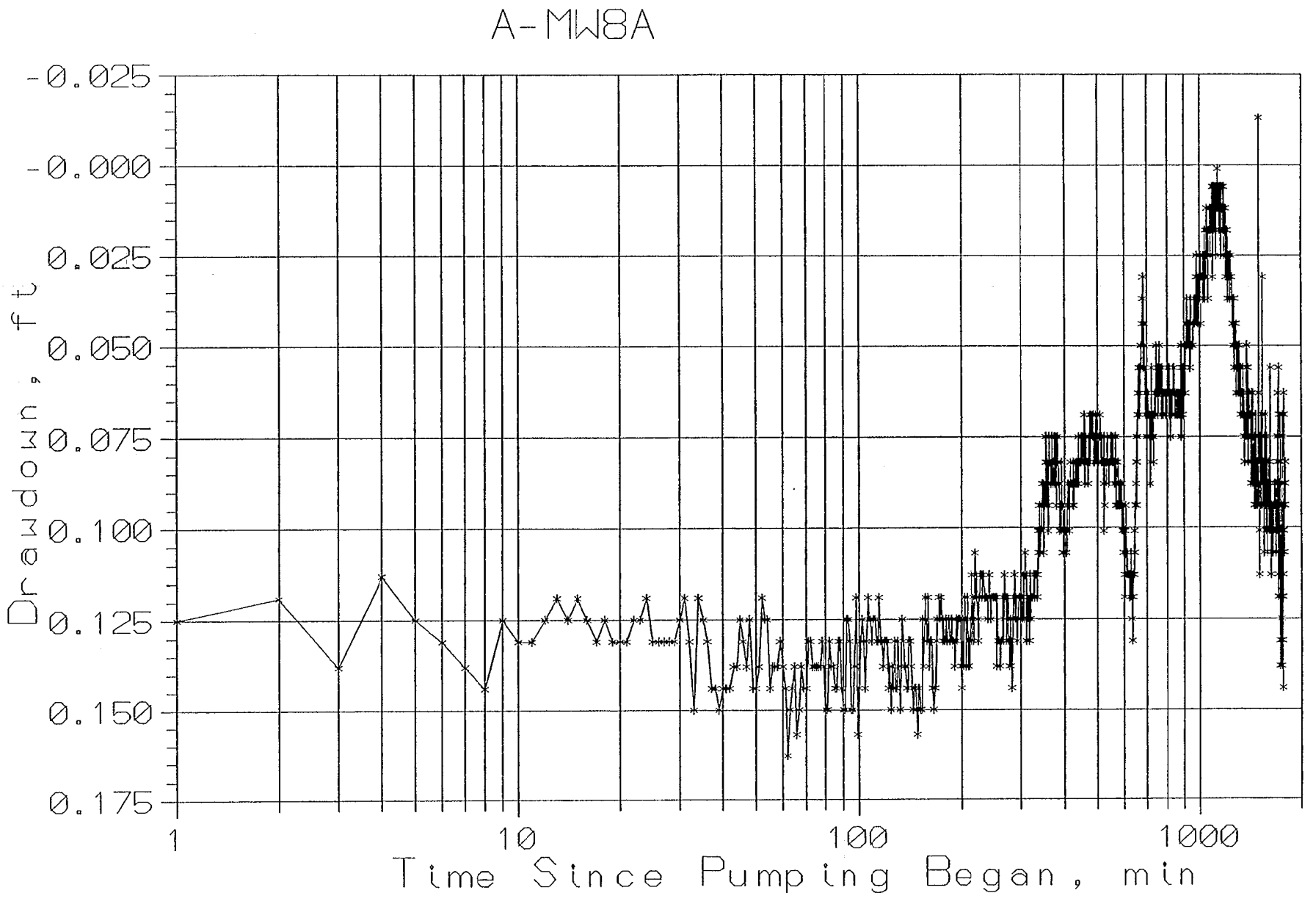
  t_0 =

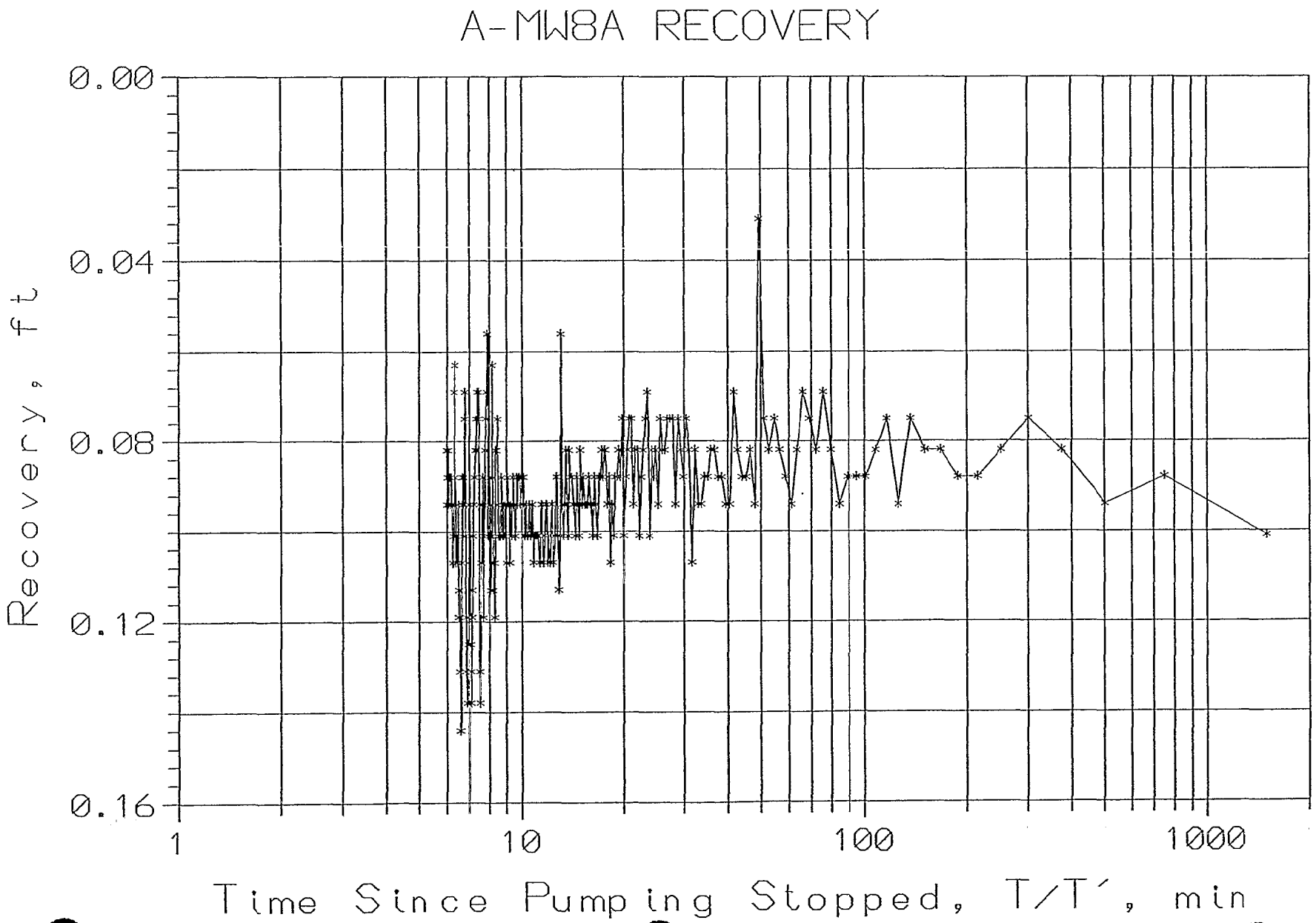
  =

  s_1 =

  s_2 =

- DUE TO NO RESPONSE AND STEADY STATE NO CALCULATIONS WERE PERFORMED USING THIS DATA.


A-MW8A
-0.025
-0.000
0.025
0.050
0.075
0.100
0.125
0.150
0.175
Drawdown, ft
1
10
100
1000
Time Since Pumping Began, min


A-MW8A RECOVERY
0.00
0.04
0.08
0.12
0.16
Recovery, ft
1
10
100
1000
Time Since Pumping Stopped, T/T', min

S.O. No. 19084-51-SRN

Subject: CAMP ALLEN LANDFILL RI/FS

25 HR PUMP TEST, MONITORING WELL A-MW8B — Sheet No. 1 of 1

JACOB'S STRAIGHT LINE METHOD — Drawing No.

Computed by MEK — Checked By — Date 17 NOV 92

Baker

RAW PUMP TEST DATA:

- 4.945 WAS SUBTRACTED FROM EVERY READING TO SET THE DRAWDOWN TO 0.0 AT TIME = 0.
- T/T' WAS CALCULATED FOR PLOTTING THE RECOVERY PERIOD.
- THE DRAWDOWN PHASE OF THE PUMP TEST LASTED 1500 MINS.
- THE RECOVERY PHASE OF THE PUMP TEST LASTED 300 MINS.
- THE GROUNDWATER FLOW RATE WAS 38 GPM.
- THIS IS THE PUMPING WELL

CALCULATING T & S USING JACOB'S STRAIGHT LINE METHOD

A-MW8B

- DRAWDOWN & RECOVERY : A-MW8B.DAT
- RECOVERY : A-MW8B-R.DAT

- DRAWDOWN A-MW8B

$Q = 38$ GPM

$r = 0.167$ ft

$t_0 = 1 \times 10^{-9}$ min

$= 6.94 \times 10^{-13}$ DAYS

$s_1 = 7.83$

$s_2 = 8.62$

$$T = \frac{264\,Q}{\Delta s} = \frac{264(38)}{(8.62-7.83)}$$

$$\underline{\underline{T = 12699 \text{ GPD/ft}}}$$

$$S = \frac{0.3\,T t_0}{r^2} = \frac{0.3(10{,}133)(6.94\times10^{-13})}{(0.167)^2}$$

$$\underline{\underline{S = 9.48 \times 10^{-8}}}$$

- RECOVERY A-MW8B

$Q = 38$ GPM

$r = 0.167$ ft

$t_0 = 3.3$ min

$= 2.3 \times 10^{-3}$ DAYS

$s_1 = 0.175$

$s_2 = 0.53$

$$T = \frac{264\,Q}{\Delta s} = \frac{264(38)}{(0.53-0.175)}$$

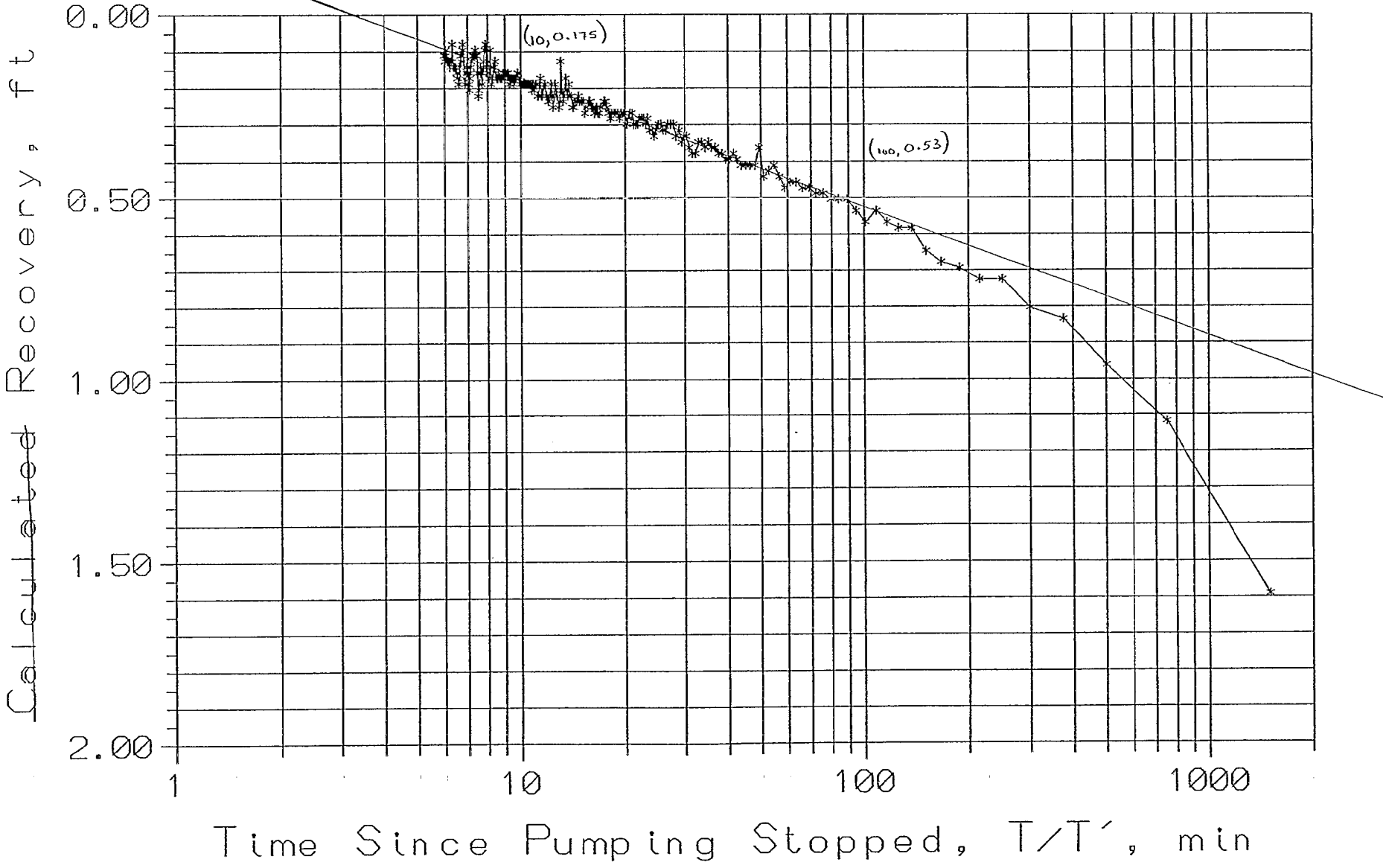
$$\underline{\underline{T = 28{,}259 \text{ GPD/ft}}}$$

$$S = \frac{0.3\,T t_0}{r^2} = \frac{0.3(28{,}259)(2.29\times10^{-3})}{(0.167)^2}$$

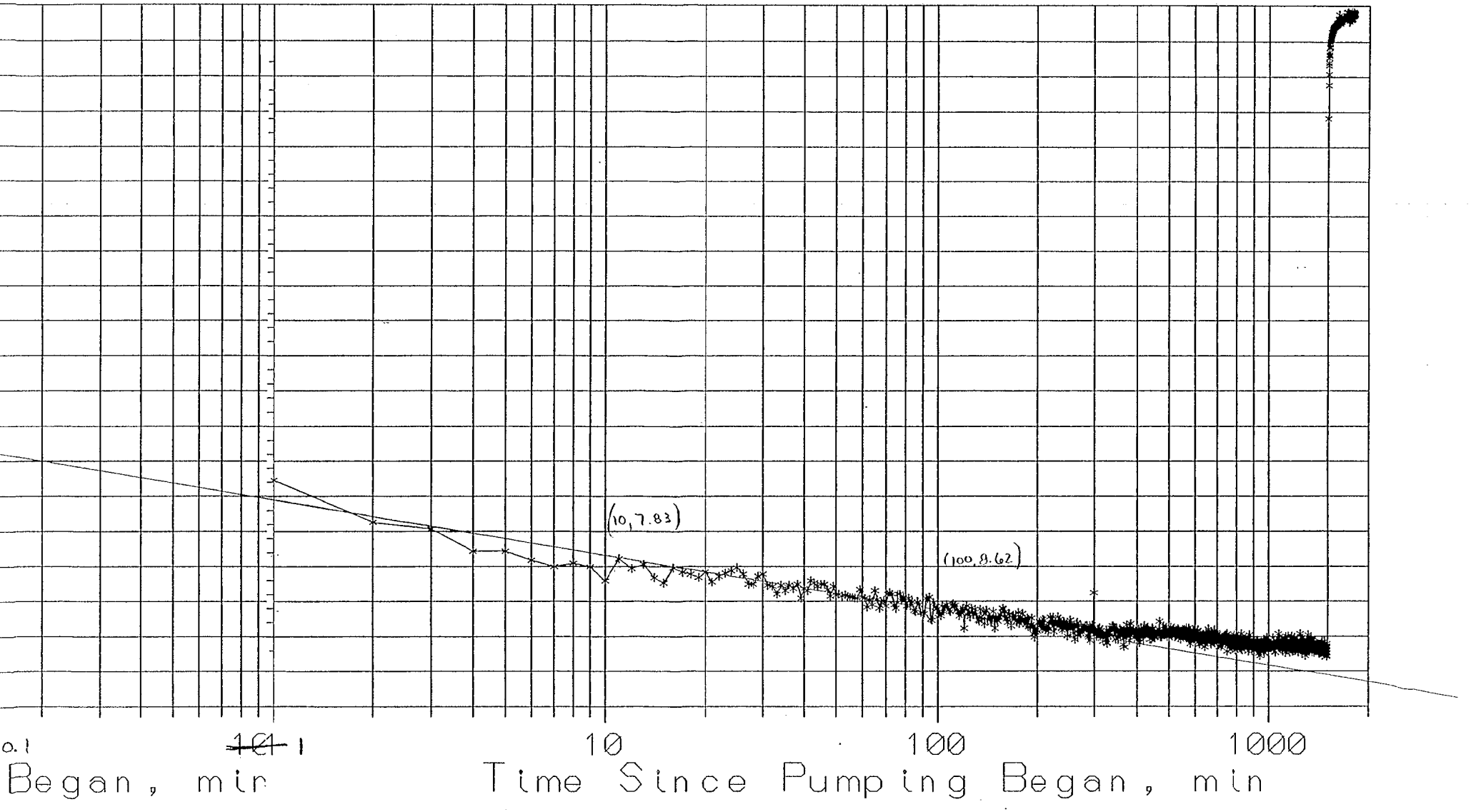
$$\underline{\underline{S = 696}}$$

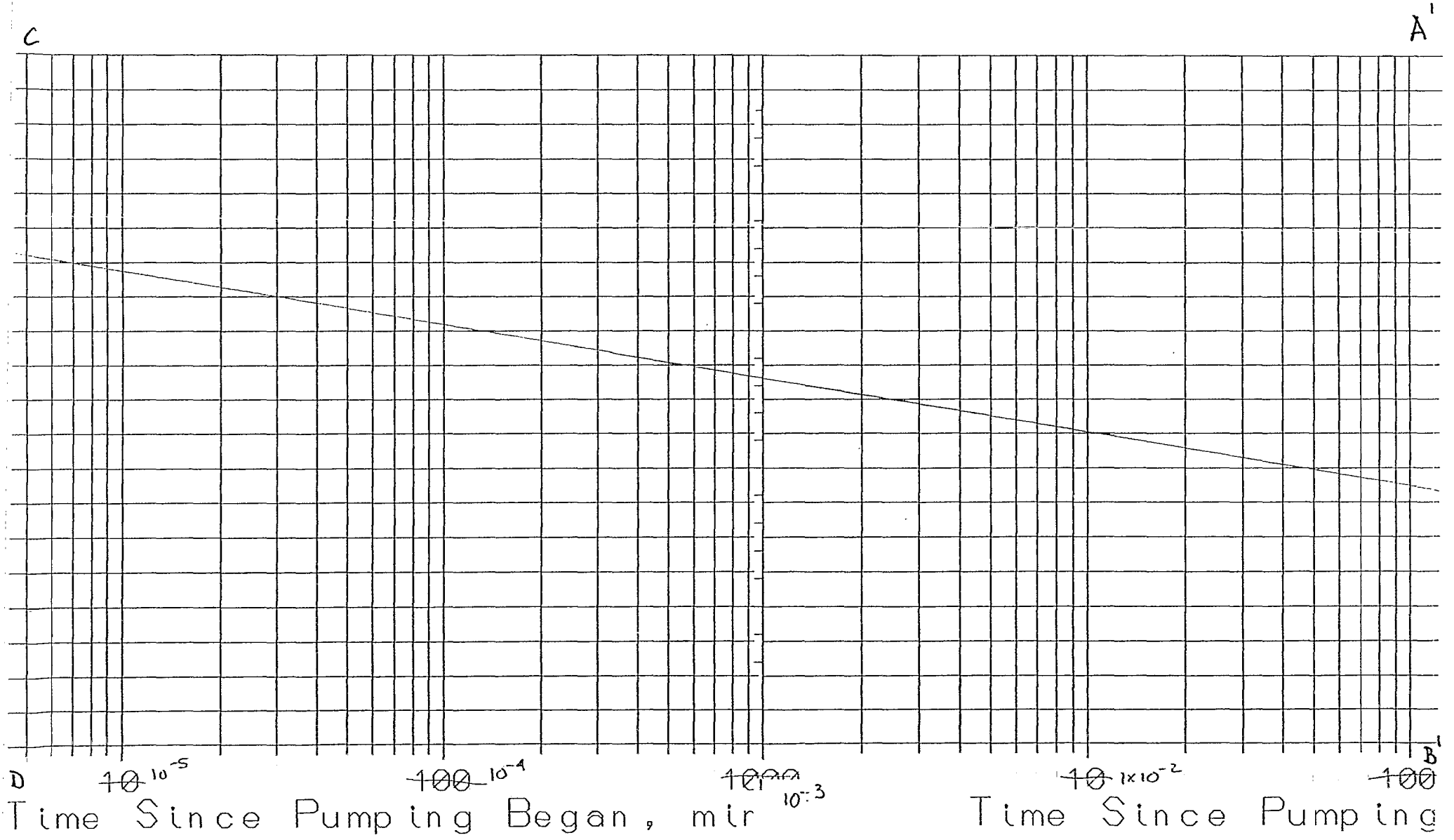
$t_o = 3.3$ min

A-MW8B RECOVERY

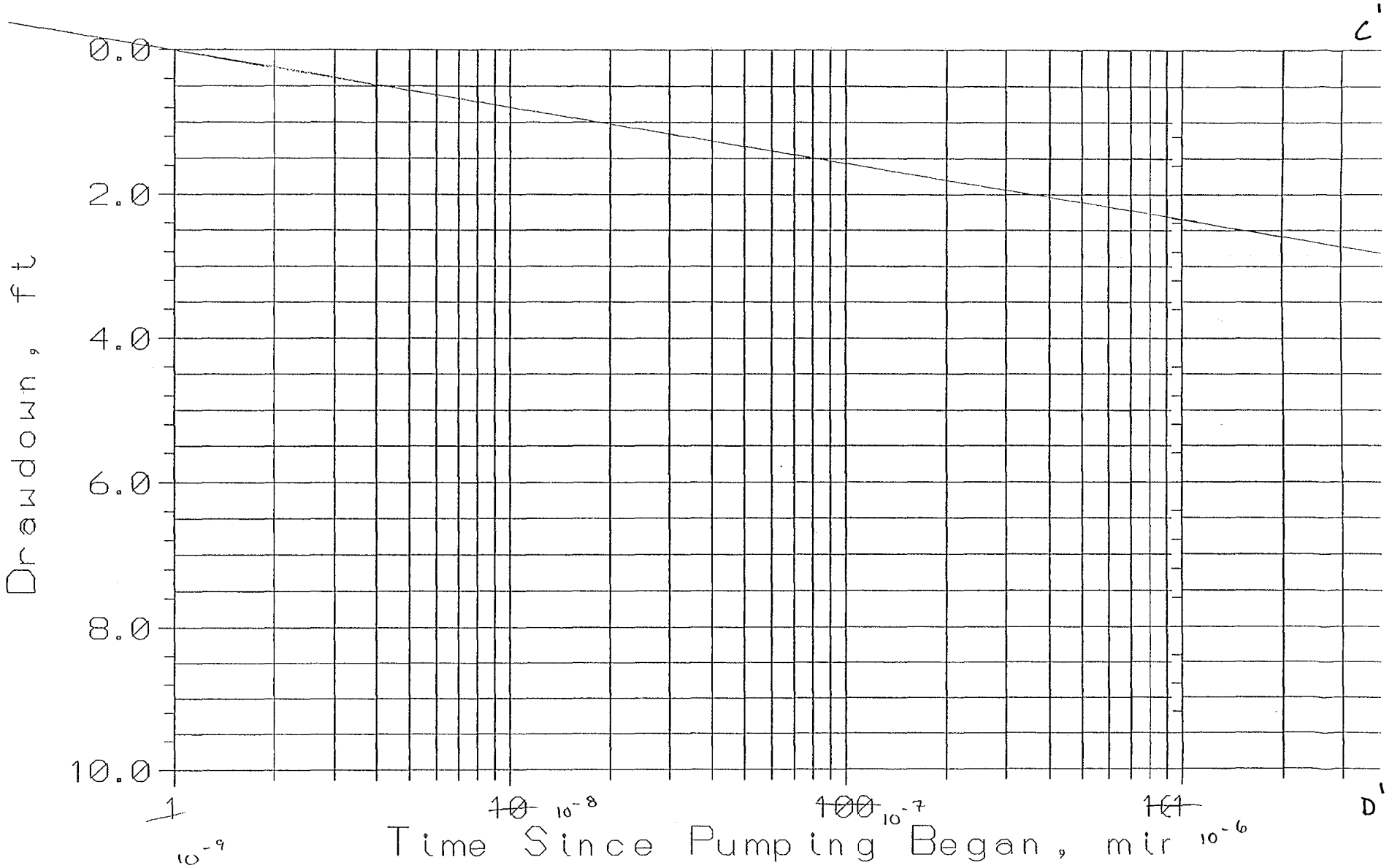


A-MW8B


(10, 7.83)
(100, 8.62)
0.1
~~1.0~~ 1
10
100
1000
Began, min
Time Since Pumping Began, min


C
A'
D
B'
~~10~~ 10^{-5}
~~100~~ 10^{-4}
~~1000~~ 10^{-3}
~~10~~ 1×10^{-2}
~~100~~
Time Since Pumping Began, mir
Time Since Pumpin

$t_o = 1 \times 10^{-9}$ min



S.O. No. 19084-51-SRJ

Subject: CAMP ALLEN LANDFILL RI/FS

25 HR PUMP TEST, MONITORING WELL A-P8 — Sheet No. 1 of 1

JACOB'S STRAIGHT LINE METHOD — Drawing No.

Computed by MEK — Checked By — Date 17 NOV. 92

Baker

RAW PUMP TEST DATA:

- 0.047 WAS ADDED TO EVERY WATER LEVEL TO SET THE WATER LEVEL TO 0.0 INCHES AT TIME = 0.
- T/T' WAS CALCULATED FOR PLOTTING THE RECOVERY PERIOD.
- THE PUMPS WERE TURNED OFF AT 1500 MINS. INTO THE TEST
- THE RECOVERY PERIOD ENDED 300 MINS. AFTER THE DRAWDOWN PERIOD
- THE PUMP DISCHARGED THE GROUNDWATER AT A RATE OF 38 GPM

JACOB'S STRAIGHT-LINE METHOD.

A-P8

- DRAWDOWN & RECOVERY A-P8.DAT
- RECOVERY A-P8-R.DAT

- DRAWDOWN A-P8

$Q = 38$ GPM

$r = 11.64$ ft 11.6 O.K.

$t_0 = 0.000095$ MIN

$= 6.60 \times 10^{-8}$ DAYS

$s_1 = 2.04$

$s_2 = 2.45$

$$T = \frac{264\,Q}{\Delta s} = \frac{264(38)}{(2.45-2.04)}$$

$$\underline{\underline{T = 24{,}468 \text{ GPD/ft}}}$$

$$S = \frac{0.3\,T\,t_0}{r^2} = \frac{0.3(24{,}468)(6.6\times10^{-8})}{(11.64)^2}$$

$$\underline{\underline{S = 3.58\times10^{-6}}}$$

- RECOVERY A-P8

$Q = 38$ GPM

$r = 11.64$ ft

$t_0 = 3.0$ MIN

$= 0.002$ DAYS

$s_1 = 0.18$

$s_2 = 0.54$

$$T = \frac{264\,Q}{\Delta s} = \frac{264(38)}{(0.54-0.18)}$$

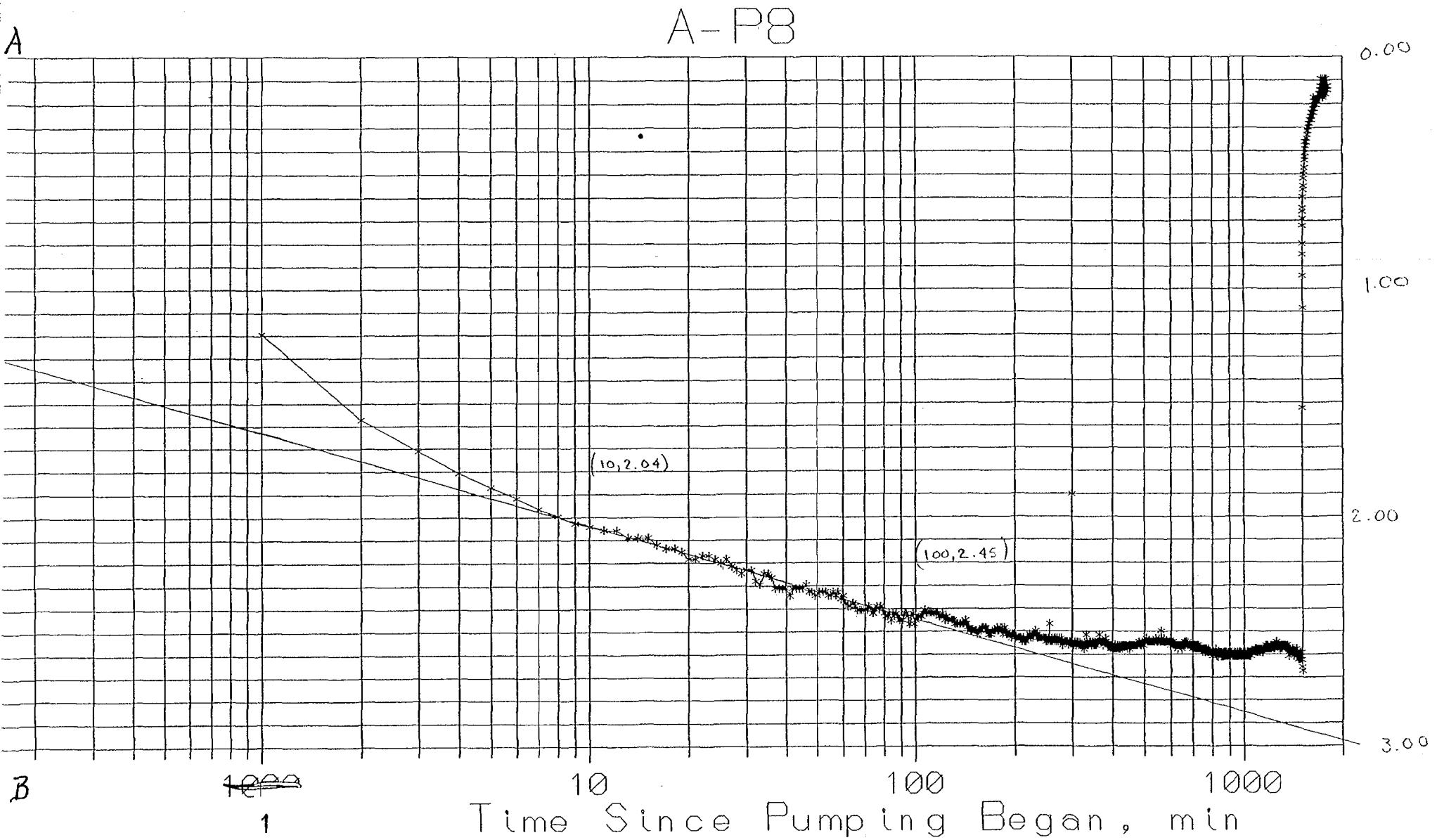
$$\underline{\underline{T = 27{,}867 \text{ GPD/ft}}}$$

$$S = \frac{0.3\,T\,t_0}{r^2} = \frac{0.3(27.867)(0.002)}{(11.64)^2}$$

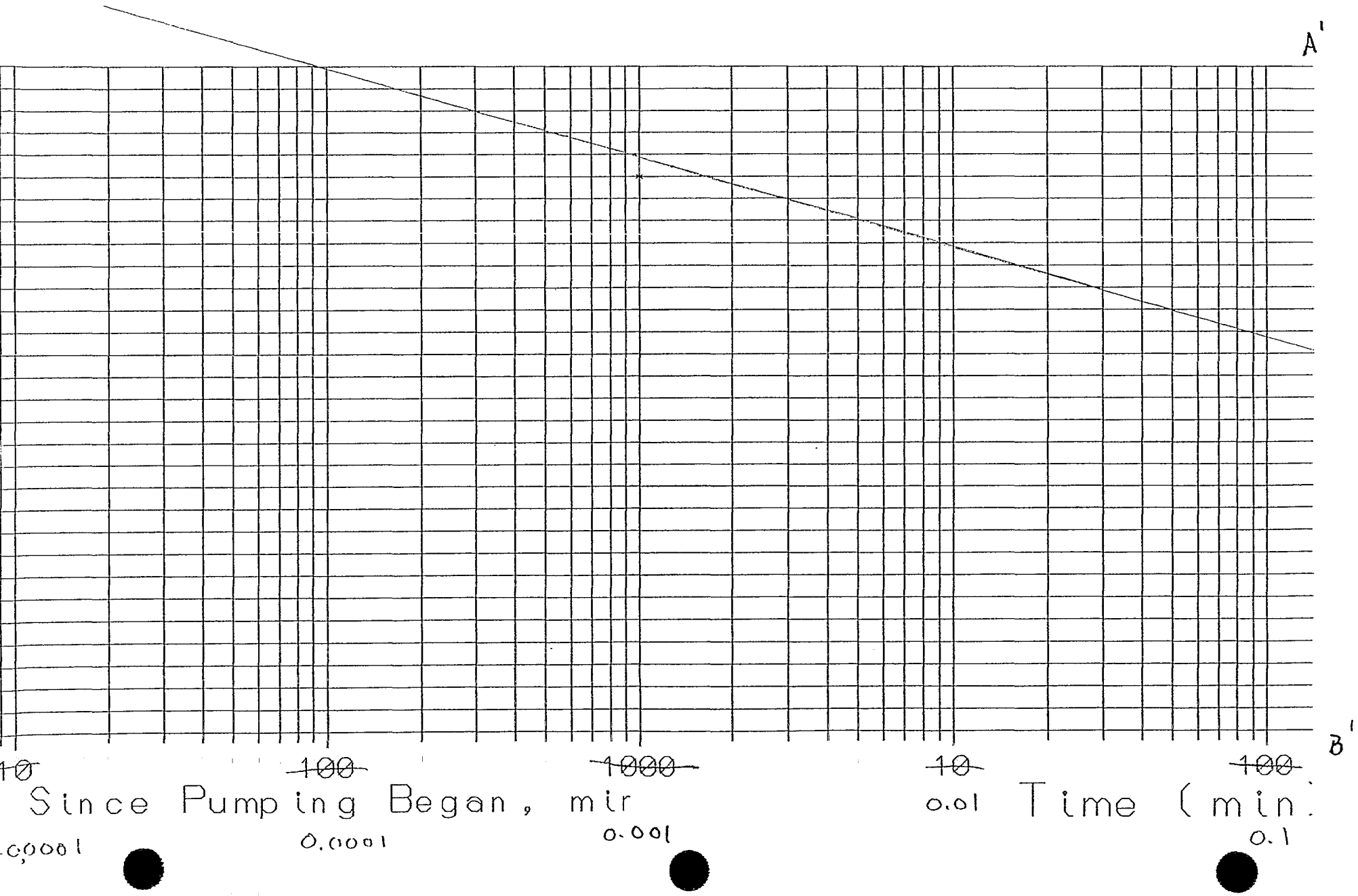
$$\underline{\underline{S = 0.123}}$$

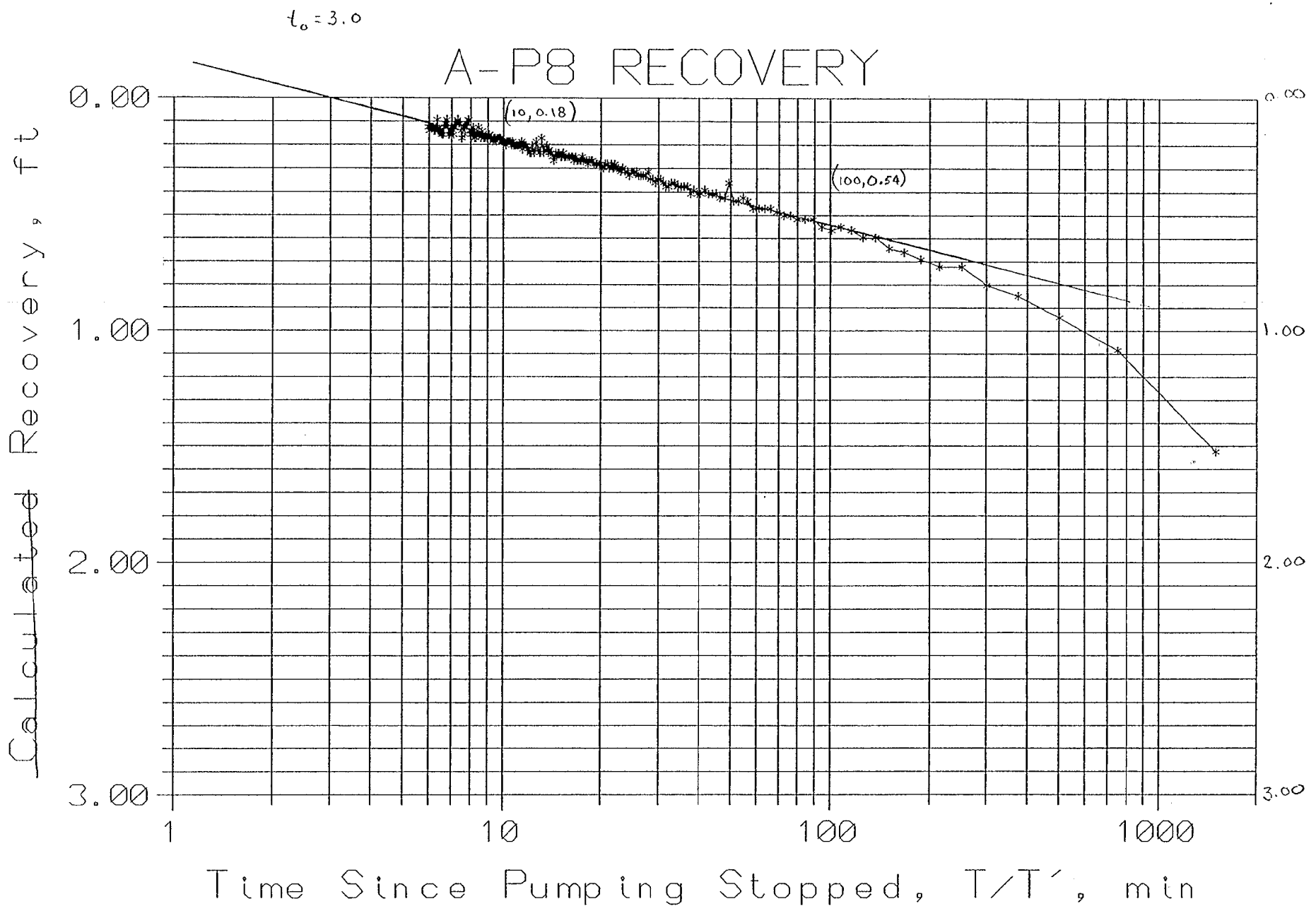
$$u = \frac{1.87 r^2 S}{T t} = \frac{1.87(11.64)^2(3.58\times10^{-6})}{24{,}468\,(25/24)} = 0.010098$$

$$= \frac{1.87(11.64)^2(0.123)}{27.867\,(25/24)} = 0.001029$$


A-P8
A
B
0.00
1.00
2.00
3.00
(10,2.04)
(100,2.45)
1
10
100
1000
Time Since Pumping Began, min

$t_o = 0.000095$


A'
B'
10
100
1000
10
100
Since Pumping Began, mir
Time (min.
0.0001
0.0001
0.001
0.01
0.1


$t_o = 3.0$
A-P8 RECOVERY
(10, 0.18)
(100, 0.54)
0.00
1.00
2.00
3.00
Calculated Recovery, ft
1
10
100
1000
Time Since Pumping Stopped, T/T', min

S.O. No. 19084-51-SRN

Subject: CAMP ALLEN LANDFILL RI/FS

25 HR PUMP TEST, MONITORING WELL A-MW9A — Sheet No. 1 of 1

JACOB'S STRAIGHT LINE METHOD — Drawing No.

Computed by MEK — Checked By — Date 19 NOV 92

Baker

RAW PUMP TEST DATA

- 0.126 WAS ADDED TO ALL OF THE DRAWDOWN READINGS TO OFFSET THE NEGATIVE VALUES.
- 0.145 IS THE READING BEFORE THE INITIATION OF THE DRAWDOWN TEST.
- T/T' WAS CALCULATED FOR PLOTTING THE RECOVERY PERIOD.
- DRAWDOWN PHASE OF THE PUMP TEST LASTED FOR 1500 MINS.
- RECOVERY PHASE OF THE PUMP TEST LASTED FOR 300 MINS.
- THE GROUNDWATER PUMPING RATE WAS 38 GPM.

CALCULATING T & S USING JACOB'S STRAIGHT LINE METHOD

A-MW9A

- DRAWDOWN & RECOVERY: A-MW9A.DAT
- RECOVERY: A-MW9A-R.DAT

- DRAWDOWN

Q = 38 GPM

r = 110.10 ft

t_0 =

=

S_1 =

S_2 =

$$T = \frac{264\,Q}{\Delta S} = \frac{264(38)}{(} \qquad T =$$

$$S = \frac{0.3\,T t_0}{r^2} = \frac{0.3(}{(110.10)^2} \qquad S =$$

- RECOVERY

Q = 38 GPM

r = 110.10 ft

t_0 =

=

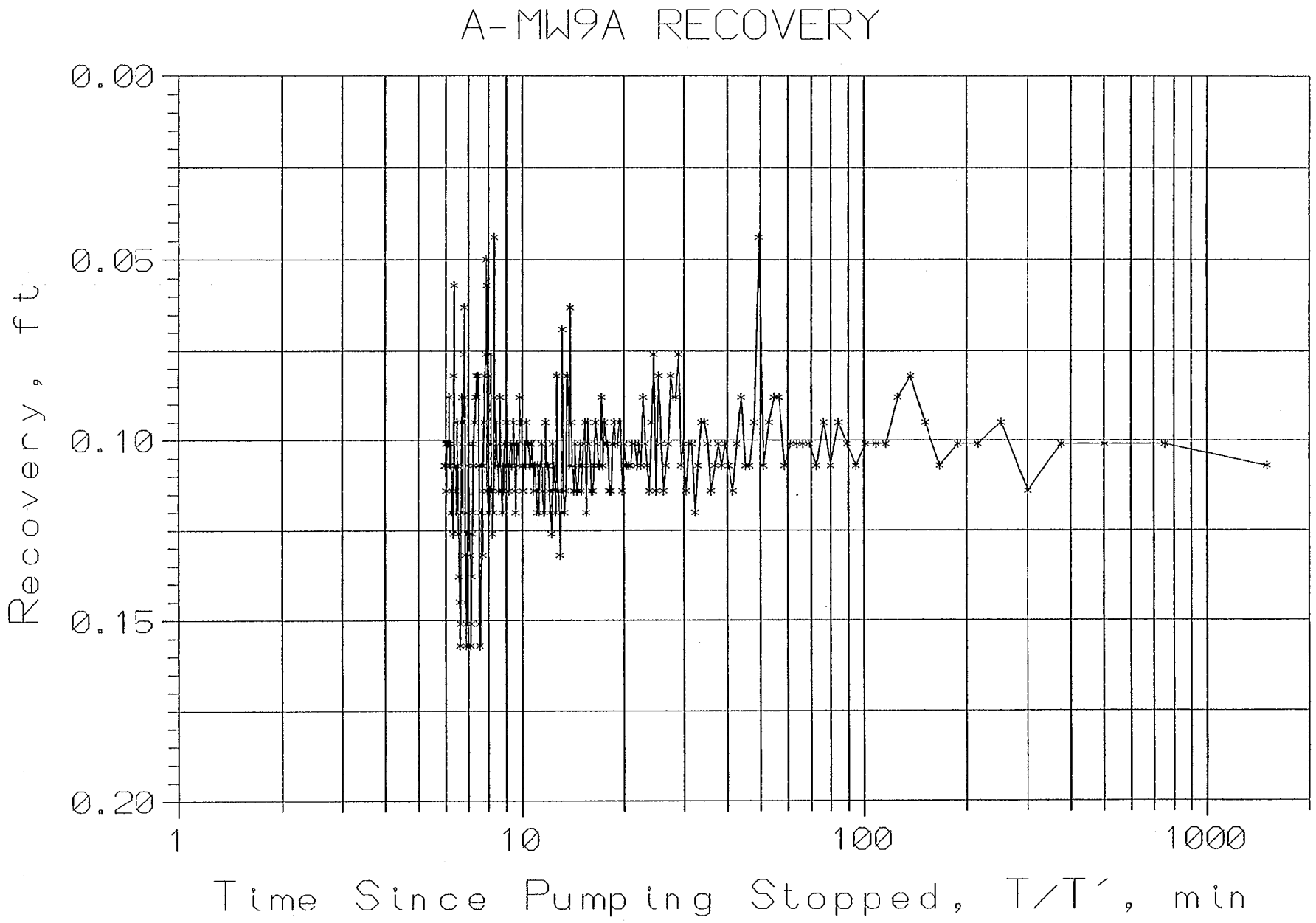
S_1 =

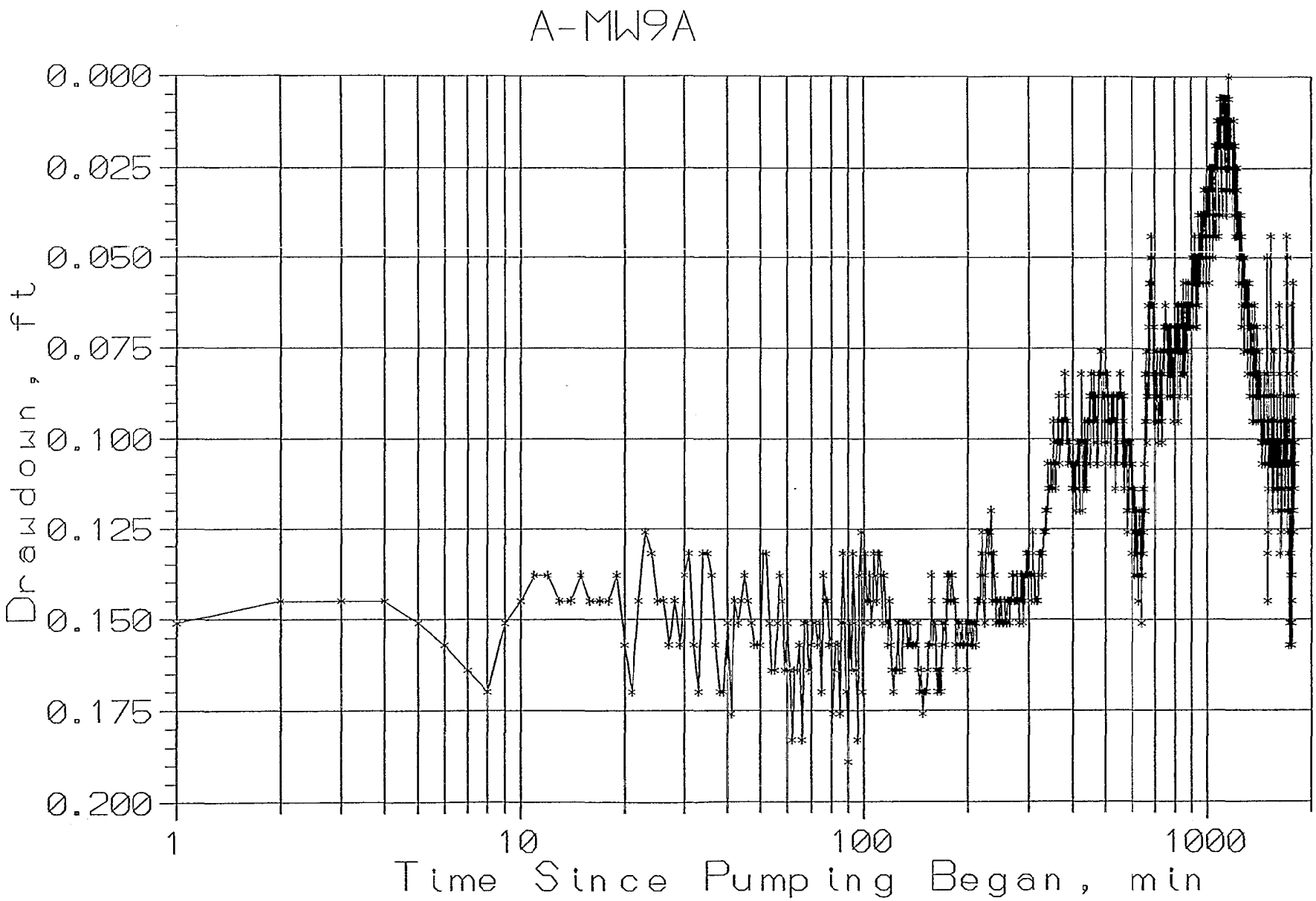
S_2 =

$$T = \frac{264\,Q}{\Delta S} = \frac{264(38)}{(} \qquad T =$$

$$S = \frac{0.3\,T t_0}{r^2} = \frac{0.3(}{(110.10)^2} \qquad S =$$

- DUE TO THE LACK OF RESPONSE AND STEADY STATE CONDITIONS, NO CALCULATIONS WERE PERFORMED USING THIS DATA


A-MW9A RECOVERY
0.00
0.05
0.10
0.15
0.20
Recovery, ft
1
10
100
1000
Time Since Pumping Stopped, T/T', min


A-MW9A
0.000
0.025
0.050
0.075
0.100
0.125
0.150
0.175
0.200
Drawdown, ft
1
10
100
1000
Time Since Pumping Began, min

S.O. No. 19084-51-SRN

Subject: CAMP ALLEN LANDFILL RI/FS

25 HR PUMP TEST, MONITORING WELL A-MW9B — Sheet No. 1 of 1

JACOB'S STRAIGHT LINE METHOD — Drawing No.

Computed by MEK — Checked By — Date 17 NOV 92

Baker

RAW PUMP TEST DATA:

- 0.015 WAS SUBTRACTED FROM ALL OF THE READINGS TO SET THE DRAWDOWN AT TIME = 0 TO ZERO.
- T/T' WAS CALCULATED FOR PLOTTING THE RECOVERY PERIOD.
- THE DRAWDOWN PHASE OF THE PUMP TEST LASTED 1500 MINS.
- THE RECOVERY PHASE OF THE PUMP TEST LASTED 300 MINS.
- THE GROUNDWATER FLOW RATE WAS 38 GPM.

CALCULATING T & S USING JACOB'S STRAIGHT LINE METHOD

A-MW9B

- DRAWDOWN & RECOVERY : A-MW9B.DAT
- RECOVERY : A-MW9B-R.DAT

- DRAWDOWN A-MW9B

$Q = 38$ GPM

$r = 117.75$ ft

$t_o = 0.15$ min

$= 1.04 \times 10^{-4}$ DAYS

$S_1 = 0.64$

$S_2 = 0.99$

$$T = \frac{264\,Q}{\Delta S} = \frac{264(38)}{(0.99-0.64)}$$

$$T = 28{,}663 \text{ GPD/ft}$$

$$S = \frac{0.3\,T\,t_o}{r^2} = \frac{0.3(28{,}663)(1.04\times10^{-4})}{(117.75)^2}$$

$$S = 6.45\times10^{-5}$$

- RECOVERY A-MW9B

$Q = 38$ GPM

$r = 117.75$ ft

$t_o = 5.0$ min

$= 3.47 \times 10^{-3}$ DAYS

$S_1 = 0.10$

$S_2 = 0.42$

$$T = \frac{264\,Q}{\Delta S} = \frac{264(38)}{(0.42-0.10)}$$

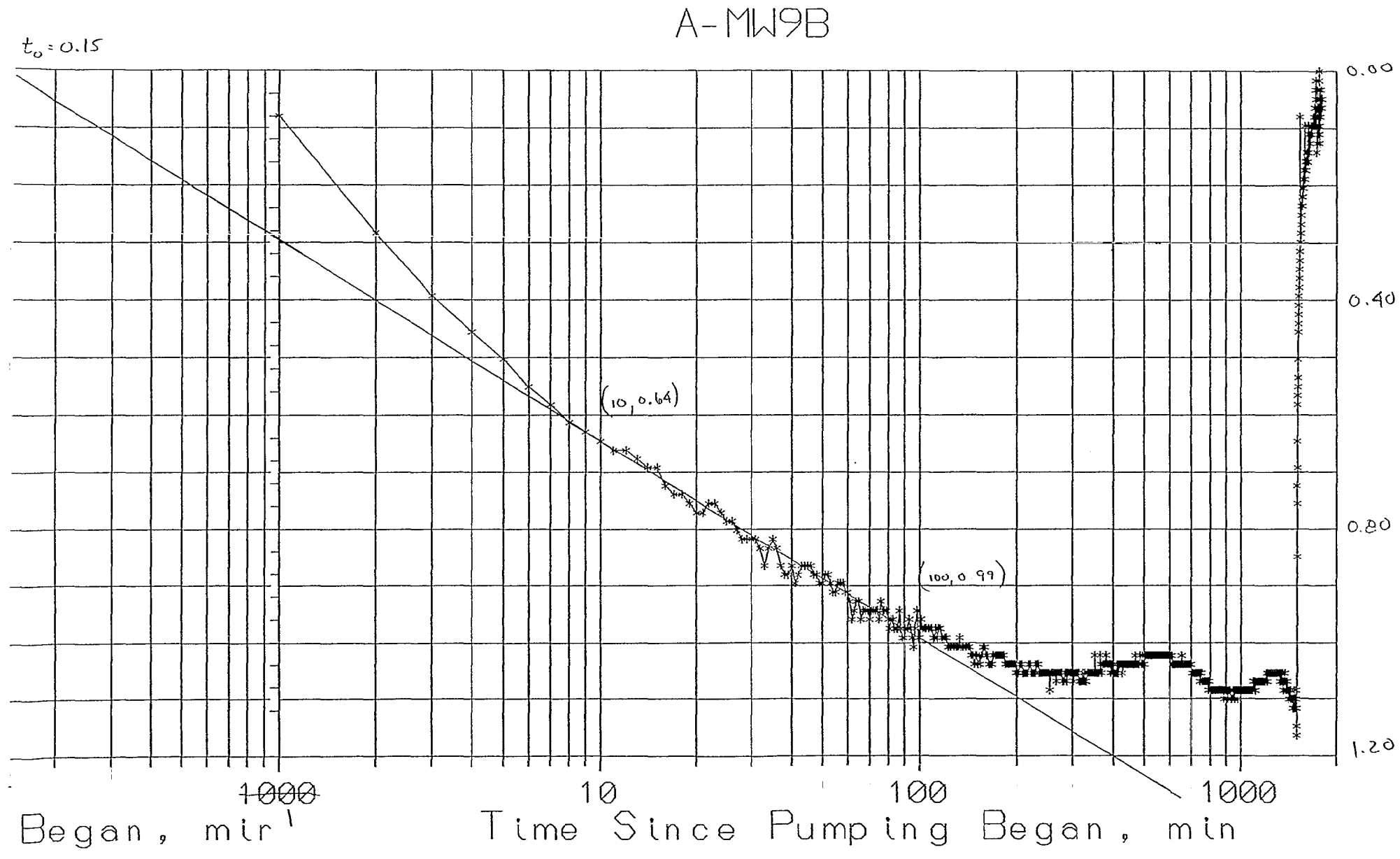
$$T = 31{,}350 \text{ GPD/ft}$$

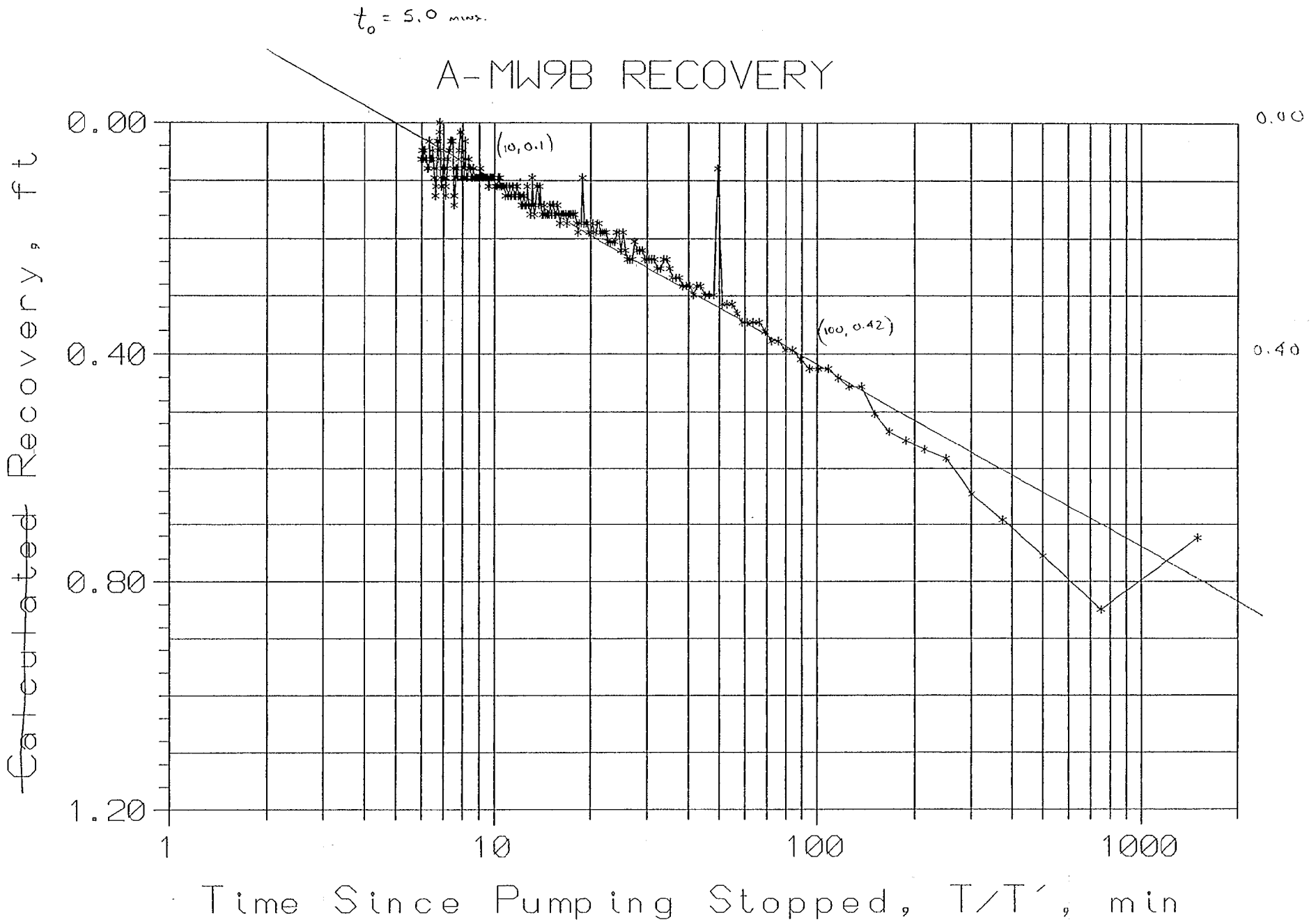
$$S = \frac{0.3\,T\,t_o}{r^2} = \frac{0.3(31{,}350)(3.47\times10^{-3})}{(117.75)^2}$$

$$S = 2.35\times10^{-3}$$

$$u = \frac{1.87\,r^2 S}{Tt} = \frac{1.87(117.75)^2\,6.45\times10^{-5}}{28663\,(25/24)} = 5.61\times10^{-5}$$

$$\frac{1.87(117.75)^2(2.35\times10^{-3})}{31350\,(25/24)} = 0.00187$$


A-MW9B
$t_o = 0.15$
0.00
0.40
0.80
1.20
(10, 0.64)
(100, 0.99)
1000
10
100
1000
Began, min
Time Since Pumping Began, min


t_o = 5.0 mins.
A-MW9B RECOVERY
(10, 0.1)
(100, 0.42)
0.00
0.40
0.80
1.20
0.00
0.40
1
10
100
1000
Calculated Recovery, ft
Time Since Pumping Stopped, T/T', min

S.O. No. 19084 - 51 - SRN

Subject: CAMP ALLEN LANDFILL RI / FS

25 HR PUMP TEST, MONITORING WELL A-MW9C — Sheet No. 1 of 1

JACOB'S STRAIGHT LINE METHOD — Drawing No.

Computed by MEK — Checked By — Date 18 Nov. 92

Baker

RAW PUMP TEST DATA

- THE INITIAL DRAWDOWN READING BEFOR THE INITIATION OF THE PUMP TEST IS 0.125 INCHES.
- THE DATA POINT AT TIME 150' FROM THE BEGINNING OF THE PUMP TEST WAS DELETED DUE TO IT'S ERRATICAL READING.
- T/T' WAS CALCULATED FOR PLOTTING THE RECOVERY PERIOD.
- THE DRAWDOWN PHASE OF THE PUMP TEST LASTED FOR 1500 MINS.
- THE RECOVERY PHASE OF THE PUMP TEST LASTED FOR 300 MINS.
- THE GROUNDWATER FLOW RATE WAS 38 GPM.

CALCULATING T & S USING JACOB'S STRAIGHT LINE METHOD.

A - MW9C

- DRAWDOWN & RECOVERY: A-MW9C.DAT
- RECOVERY: A-MW9C-R.DAT

- DRAWDOWN (EARLY)

$Q = 38$ GPM
$r = 121.16$ ft
$t_o = 27.0$ MIN
$= 1.88 \times 10^{-2}$ DAYS
$s_1 = 0.11$
$s_2 = 0.685$

$$T = \frac{264\,Q}{\Delta s} = \frac{264\,(38)}{(0.685 - 0.11)} \qquad \underline{\underline{T = 17{,}447 \text{ GPD/ft}}}$$

$$S = \frac{0.3\,T t_o}{r^2} = \frac{0.3\,(17{,}447)(1.88 \times 10^{-2})}{(121.16)^2} \qquad \underline{\underline{S = 6.70 \times 10^{-3}}}$$

- RECOVERY

$Q = 38$ GPM
$r = 121.16$ ft
$t_o = 2.75$ MIN
$= 1.91 \times 10^{-3}$ DAYS
$s_1 = 0.12$
$s_2 = 0.73$

$$T = \frac{264\,Q}{\Delta s} = \frac{264\,(38)}{(0.73 - 0.12)} \qquad \underline{\underline{T = 16{,}446 \text{ GPD/ft}}}$$

$$S = \frac{0.3\,T t_o}{r^2} = \frac{0.3\,(16{,}446)(1.91 \times 10^{-3})}{(121.16)^2} \qquad \underline{\underline{S = 6.42 \times 10^{-4}}}$$

- DRAWDOWN (LATE)

$Q = 38$ GPM
$r = 121.16$ ft
$t_o = 190$ MINS
$= 0.132$ DAYS
$s_1 = -0.235$
$s_2 = 0.625$

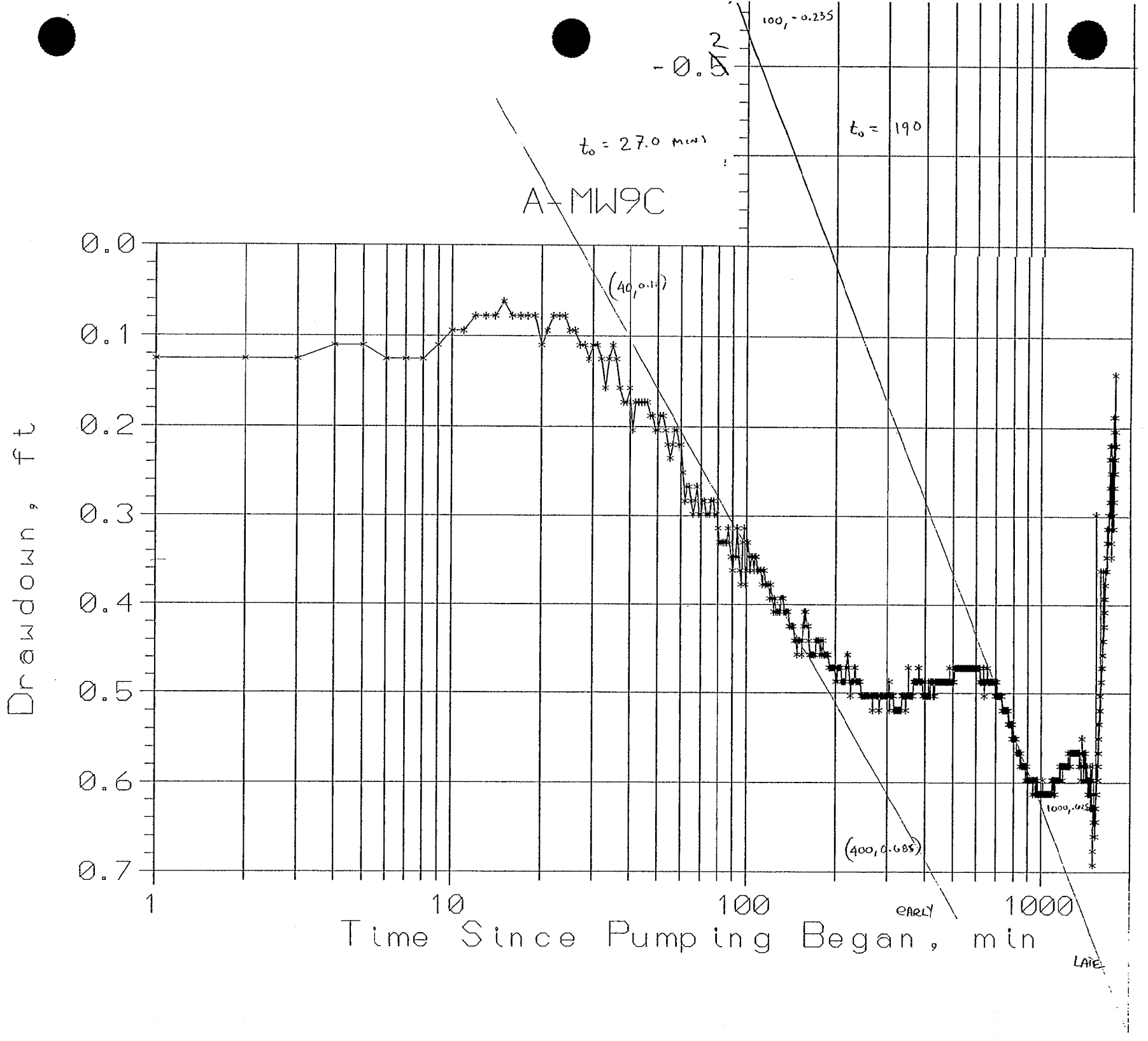
$$T = \frac{264\,Q}{\Delta s} = \frac{264\,(38)}{(0.625 + 0.235)} \; ? \qquad \underline{\underline{T = 11665 \text{ GPD/ft}}}$$

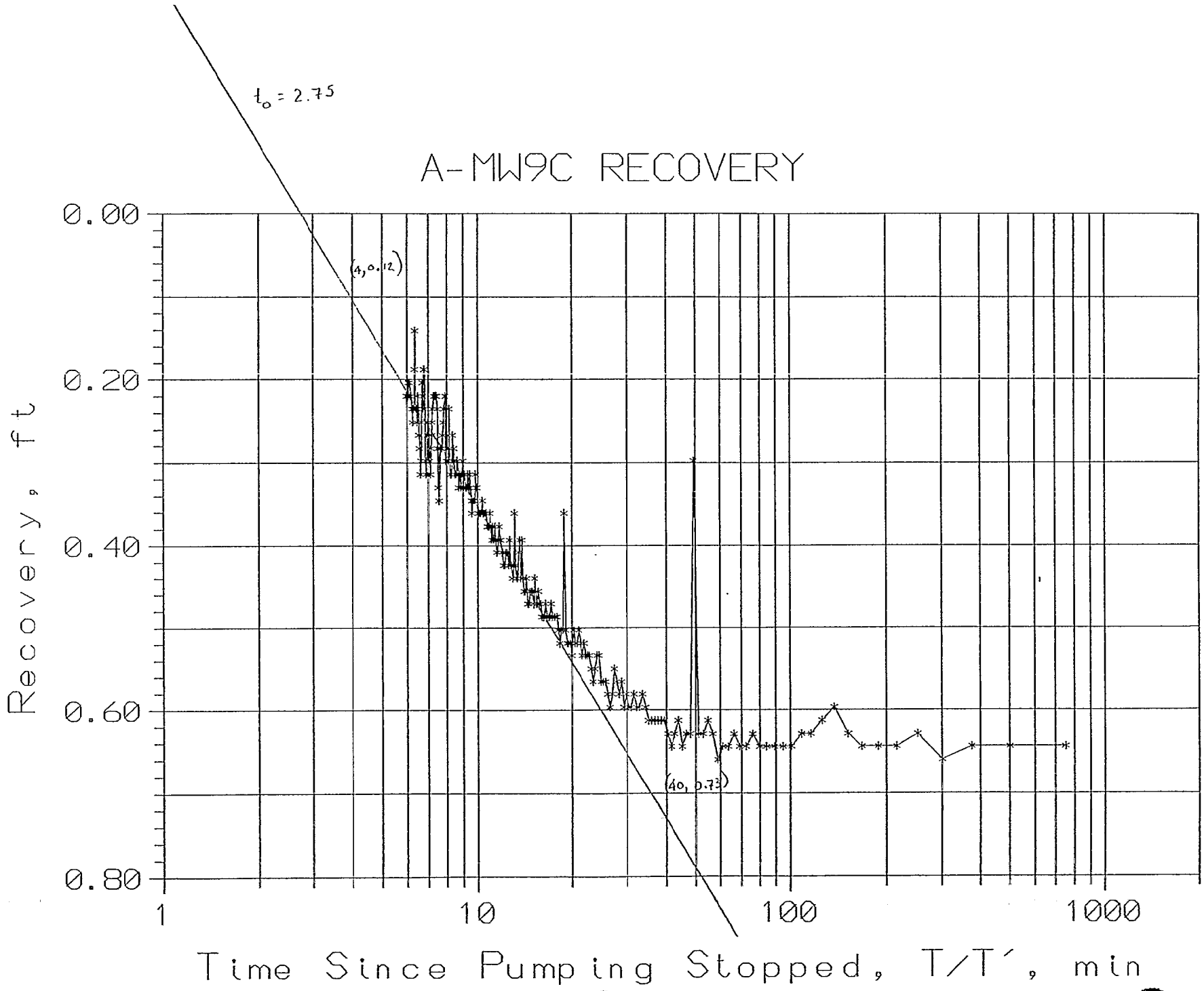
$$S = \frac{0.3\,T t_o}{r^2} = \frac{0.3\,(11665)(0.132)}{(121.16)^2} \qquad \underline{\underline{S = 0.031}}$$

$$u = \frac{1.87\,r^2 S}{T t} = \frac{1.87\,(121.16)^2\,6.70 \times 10^{-3}}{17{,}447\,(25/24)} = 0.010098$$

$$= \frac{1.87\,(121.16)^2\,(6.42 \times 10^{-4})}{16{,}446\,(25/24)} = 0.001029$$

$$= \frac{1.87\,(121.16)^2\,(0.031)}{\text{[illegible]}} = 0.70034$$


A-MW9C
t_o = 27.0 min
t_o = 190
100, -0.235
-0.5
(40, 0.11)
(400, 0.085)
1000, 0.18
EARLY
LATE
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Drawdown, ft
1
10
100
1000
Time Since Pumping Began, min


A-MW9C RECOVERY
$t_o = 2.75$
(4, 0.12)
(40, 0.73)
0.00
0.20
0.40
0.60
0.80
Recovery, ft
1
10
100
1000
Time Since Pumping Stopped, T/T', min

S.O. No. 19084-51-SRN

Subject: CAMP ALLEN LANDFILL RI/FS

25 HR PUMP TEST, MONITORING WELL A-MW10A — Sheet No. 1 of 1

JACOB'S STRAIGHT LINE METHOD — Drawing No.

Computed by MEK — Checked By — Date 19 Nov. 92

Baker

RAW PUMP TEST DATA

- 0.078 WAS ADDED TO ALL OF THE DRAWDOWN READINGS TO OFFSET THE NEGATIVE READINGS.
- THE DRAWDOWN READING BEFORE THE INITIATION OF THE PUMP TEST WAS 0.0 Ft
- T/T' WAS CALCULATED FOR PLOTTING THE RECOVERY DATA.
- THE DRAWDOWN PHASE OF THE PUMP TEST LASTED FOR 1500 MINS
- THE RECOVERY PHASE OF THE PUMP TEST LASTED FOR 328 MINS.
- THE GROUNDWATER PUMPING RATE WAS 38 GPM

CALCULATING T & S USING JACOB'S STRAIGHT LINE METHOD.

A-MW10A

- DRAWDOWN & RECOVERY: A-MW10A.DAT
- RECOVERY: A-MW10AR.DAT

- DRAWDOWN (EARLY)

$Q = 38$ GPM
$r = 236.59$ ft
$t_o = 16$ mins
$= 0.011$ DAYS
$S_1 = 0.020$
$S_2 = 0.176$

$$T = \frac{264\,Q}{\Delta S} = \frac{264(38)}{(0.176-0.02)}$$

$$\underline{\underline{T = 64{,}308}}$$

$$S = \frac{0.3\,T\,t_o}{r^2} = \frac{0.3(64{,}308)\,0.011}{(236.59)^2}$$

$$\underline{\underline{S = 3.79 \times 10^{-3}}}$$

- DRAWDOWN (LATE)

$t_o = 450$ min
$= 0.3125$ DAYS
$S_1 = -0.365$
$S_2 = 0.20$

$$T = \frac{264(38)}{(0.20+0.365)}$$

$$\underline{\underline{T = 17{,}756 \text{ GPD/ft}}}$$

$$S = \frac{0.3(17{,}756)(0.3125)}{(236.59)^2}$$

$$\underline{\underline{S = 2.97 \times 10^{-2}}}$$

- RECOVERY

$Q = 38$ GPM
$r = 236.59$ ft
$t_o = 8.9$ mins
$= 6.18 \times 10^{-3}$ DAYS
$S_1 = 0.105$
$S_2 = 0.1945$

$$T = \frac{264(Q)}{\Delta S} = \frac{264(38)}{(0.1945-0.105)}$$

$$\underline{\underline{T = 112\,089 \text{ GPD/ft}}}$$

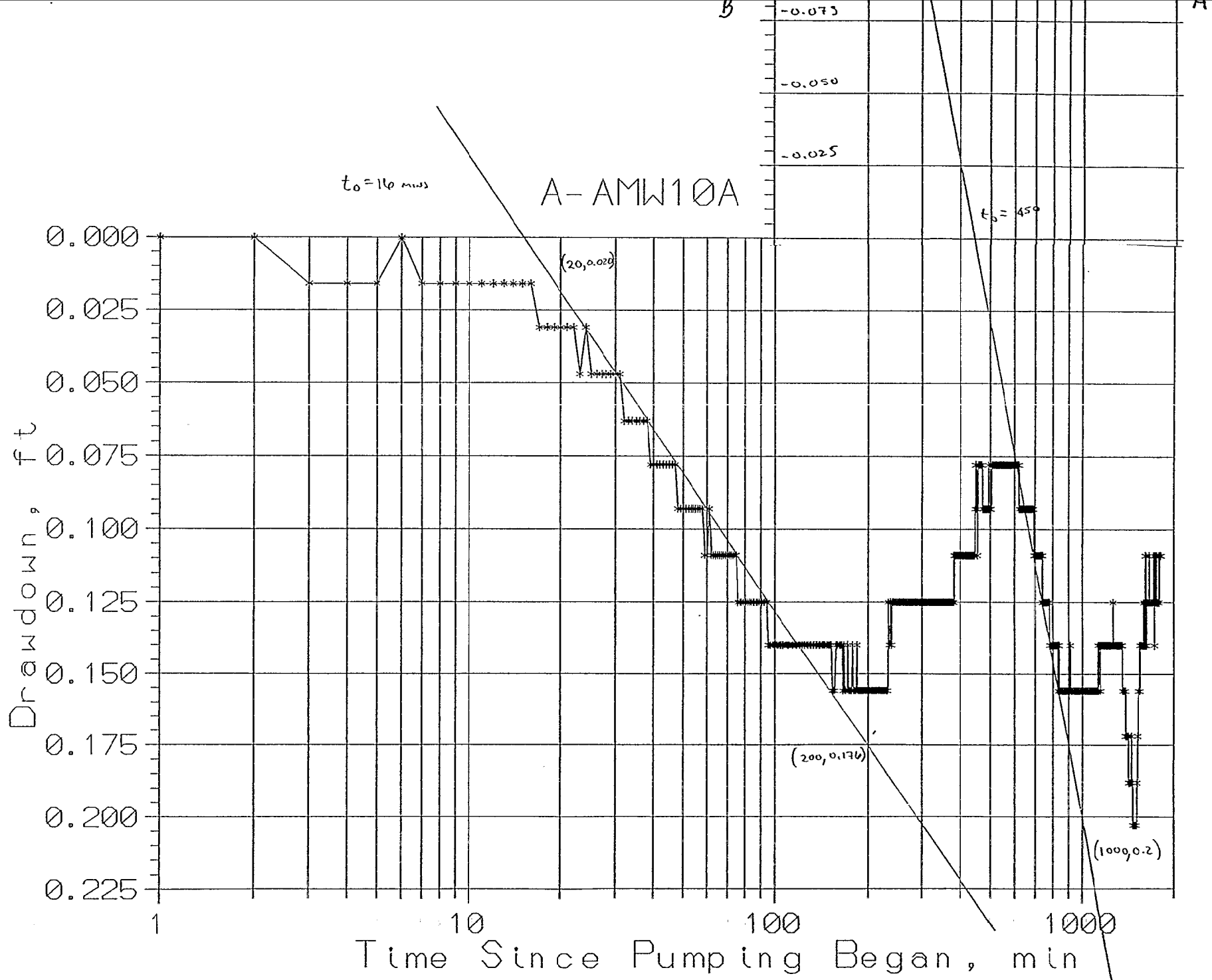
$$S = \frac{0.3\,T\,t_o}{r^2} = \frac{0.3(112089)6.18 \times 10^{-3}}{(236.59)^2}$$

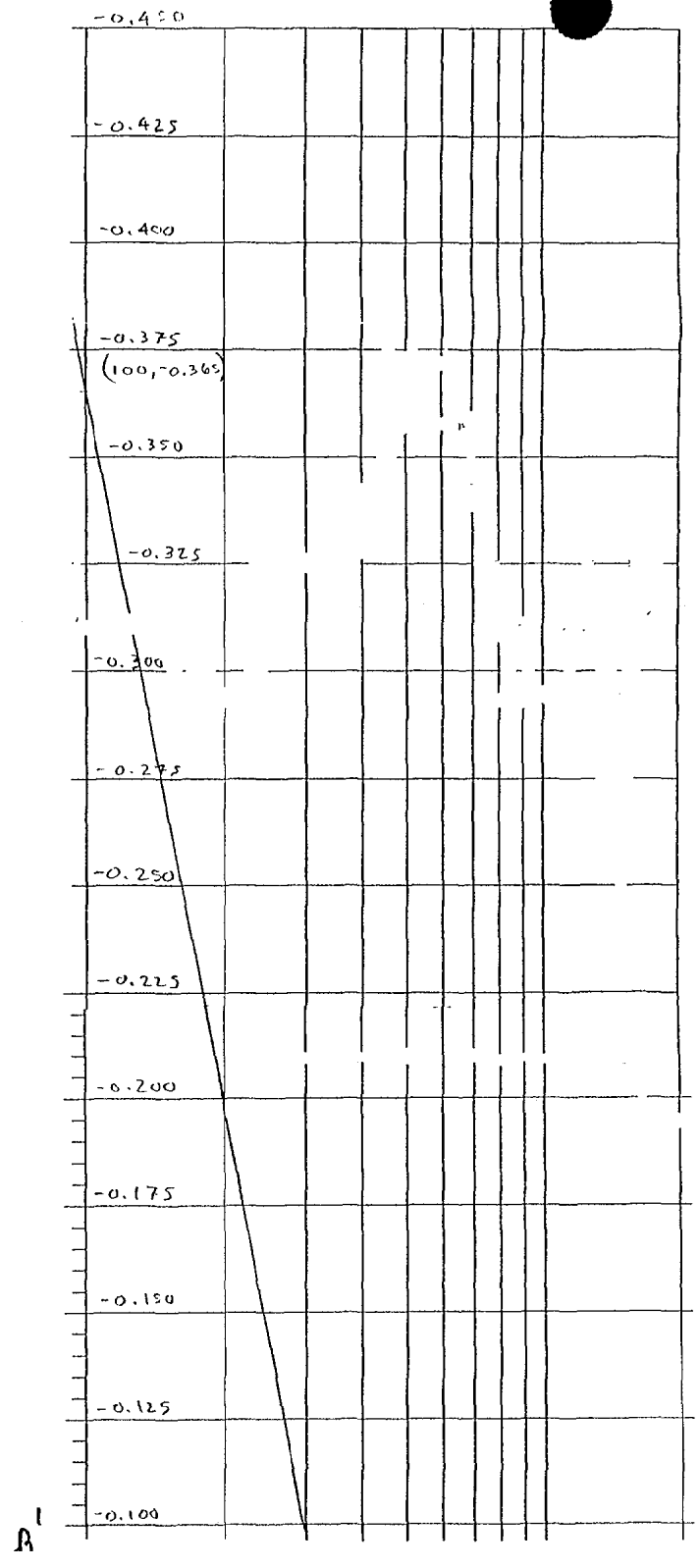
$$\underline{\underline{S = 3.7 \times 10^{-3}}}$$

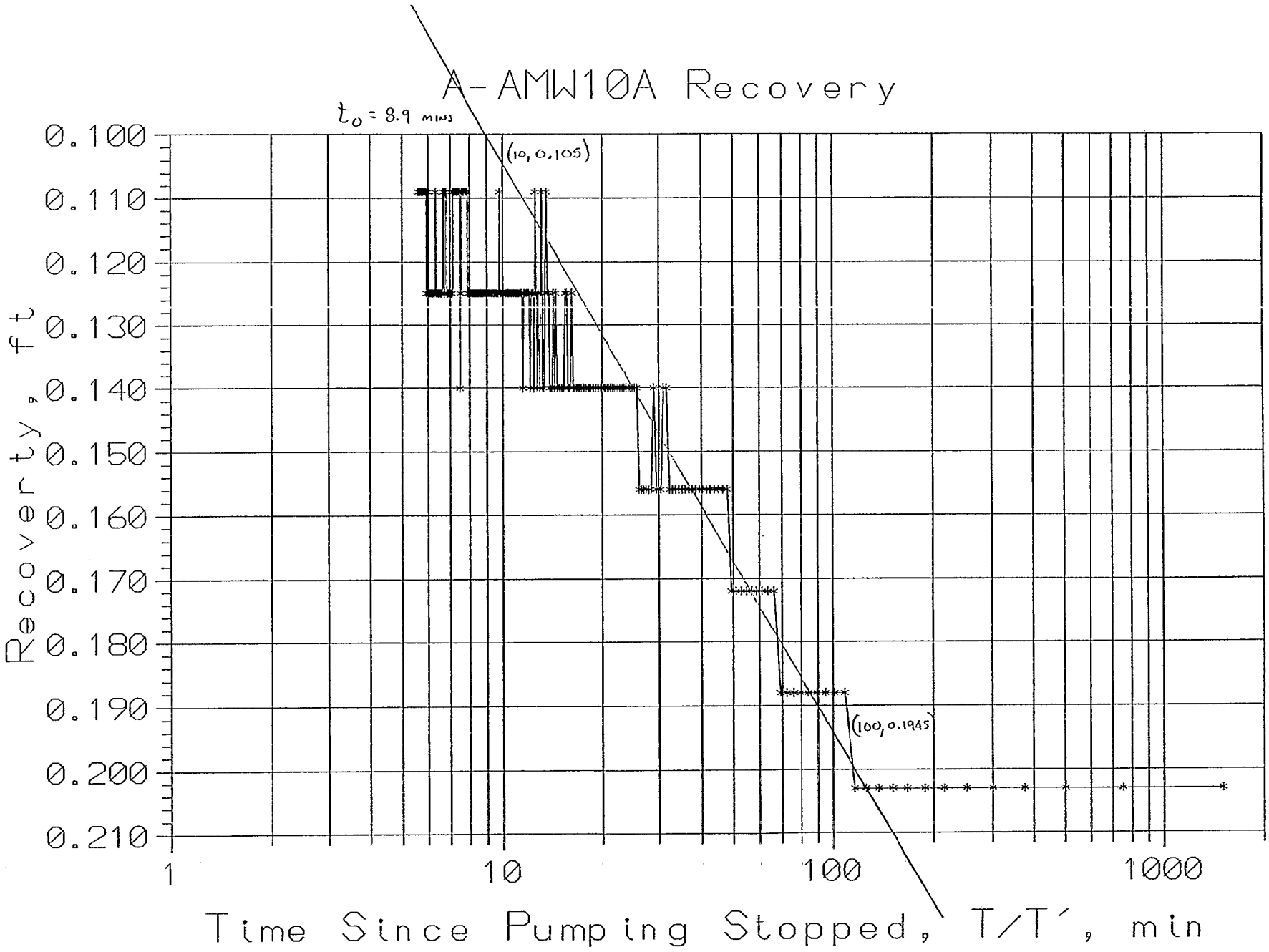
$$u = \frac{1.87\,r^2\,S}{T\,t} = \frac{1.87(236.59)^2\,3.79\times10^{-3}}{64.308\,(25/24)} = 0.005784$$

$$= \frac{1.87(236.59)^2\,2.97\times10^{-2}}{17{,}756\,(25/24)} = 0.1683$$

$$= \frac{1.87(236.59)^2\,3.7\times10^{-3}}{112{,}089\,(25/24)} = 0.003329$$


A-AMW10A
t_0=16 mins
t_0= 45°
(20,0.020)
(200,0.176)
(1000,0.2)
B
A
-0.075
-0.050
-0.025
0.000
0.025
0.050
0.075
0.100
0.125
0.150
0.175
0.200
0.225
Drawdown, ft
1
10
100
1000
Time Since Pumping Began, min


-0.450
-0.425
-0.400
-0.375
(100,-0.365)
-0.350
-0.325
-0.300
-0.275
-0.250
-0.225
-0.200
-0.175
-0.150
-0.125
-0.100
B'
A'


A-AMW10A Recovery
t_0 = 8.9 mins
(10, 0.105)
(100, 0.1945)
0.100
0.110
0.120
0.130
0.140
0.150
0.160
0.170
0.180
0.190
0.200
0.210
Recovery, ft
1
10
100
1000
Time Since Pumping Stopped, T/T', min

S.O. No. 19084-51-SRN

Subject: CAMP ALLEN LANDFILL RI/FS

25 HOUR PUMP TEST, MONITORING WELL A-MW10B — Sheet No. 1 of 1

JACOB'S STRAIGHT LINE METHOD — Drawing No.

Computed by MEK — Checked By — Date 19 NOV 92

Baker

RAW PUMP TEST DATA

- 0.454 WAS ADDED TO ALL OF THE INITIAL DRAWDOWN DATA TO SET THE INITIAL DRAWDOWN TO 0.0 INCHES BEFORE THE TEST WAS INITIATED.
- T/T' WAS CALCULATED FOR PLOTTING THE RECOVERY PERIOD.
- THE DRAWDOWN PHASE OF THE PUMP TEST LASTED FOR 1500 MINS.
- THE RECOVERY PORTION OF THE PUMP TEST LASTED FOR 328 MINS.
- THE GROUNDWATER WAS PUMPED AT 38 GPM.

CALCULATING T & S USING JACOB'S STRAIGHT LINE METHOD.

A-MW10B

- DRAWDOWN & RECOVERY: A-MW10B.DAT
- RECOVERY: A-MW10BR.DAT

- DRAWDOWN (EARLY)

$Q = 38$ GPM

$r = 243.49$ ft

$t_o = 2.75$ MIN

$= 1.91 \times 10^{-3}$ DAYS

$S_1 = 0.162$

$S_2 = 0.455$

$$T = \frac{264Q}{\Delta S} = \frac{264(38)}{(0.455-0.162)}$$

$$T = 34239 \text{ GPD/ft}$$

$$S = \frac{0.3\,T t_o}{r^2} = \frac{0.3(34239)(1.91\times10^{-3})}{(243.49)^2}$$

$$S = 3.31 \times 10^{-4}$$

- DRAWDOWN (LATE)

$t_o = 94$ MIN

$= 6.53 \times 10^{-2}$ DAYS

$S_1 = 0.015$

$S_2 = 0.545$

$$T = \frac{264(38)}{(0.545-0.015)}$$

$$T = 18928 \text{ GPD/ft}$$

$$S = \frac{0.3(18928)(6.53\times10^{-2})}{(243.49)^2}$$

$$S = 6.25 \times 10^{-3}$$

- RECOVERY

$Q = 38$ GPM

$r = 243.49$ ft

$t_o = 5.5$ MINS

$= 3.82 \times 10^{-3}$

$S_1 = 0.059$ 0.071

$S_2 = 0.341$

$$T = \frac{264Q}{\Delta S} = \frac{264(38)}{(0.341-0.059)\ 0.071}$$

0.341 − 0.071

$$T = 35{,}574 \text{ GPD/ft}$$

37,156 GPD/FT

$$S = \frac{0.3\,T t_o}{r^2} = \frac{0.3(35{,}574)(3.82\times10^{-3})}{(243.49)^2}$$

37,156

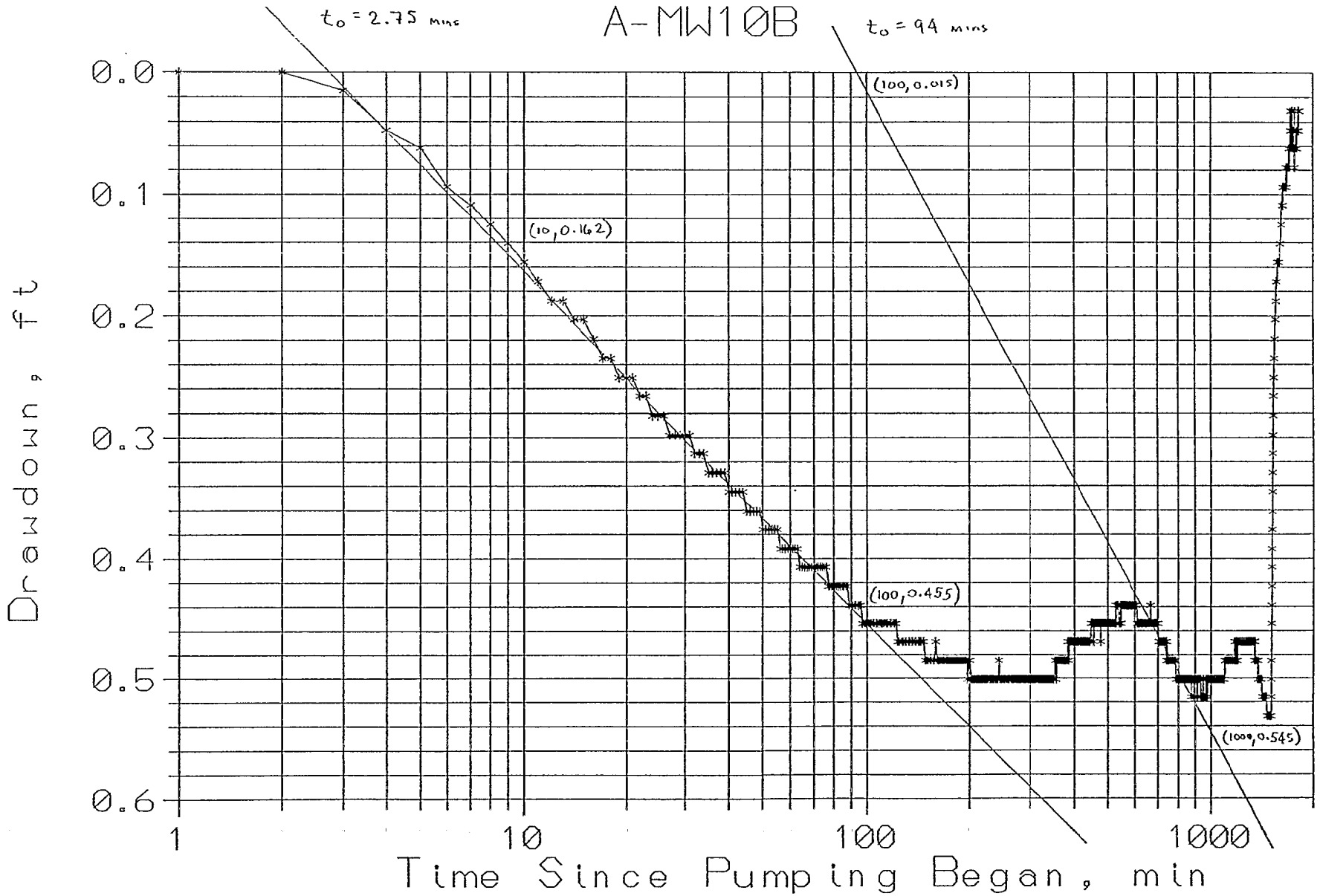
$$S = 6.88 \times 10^{-4}$$

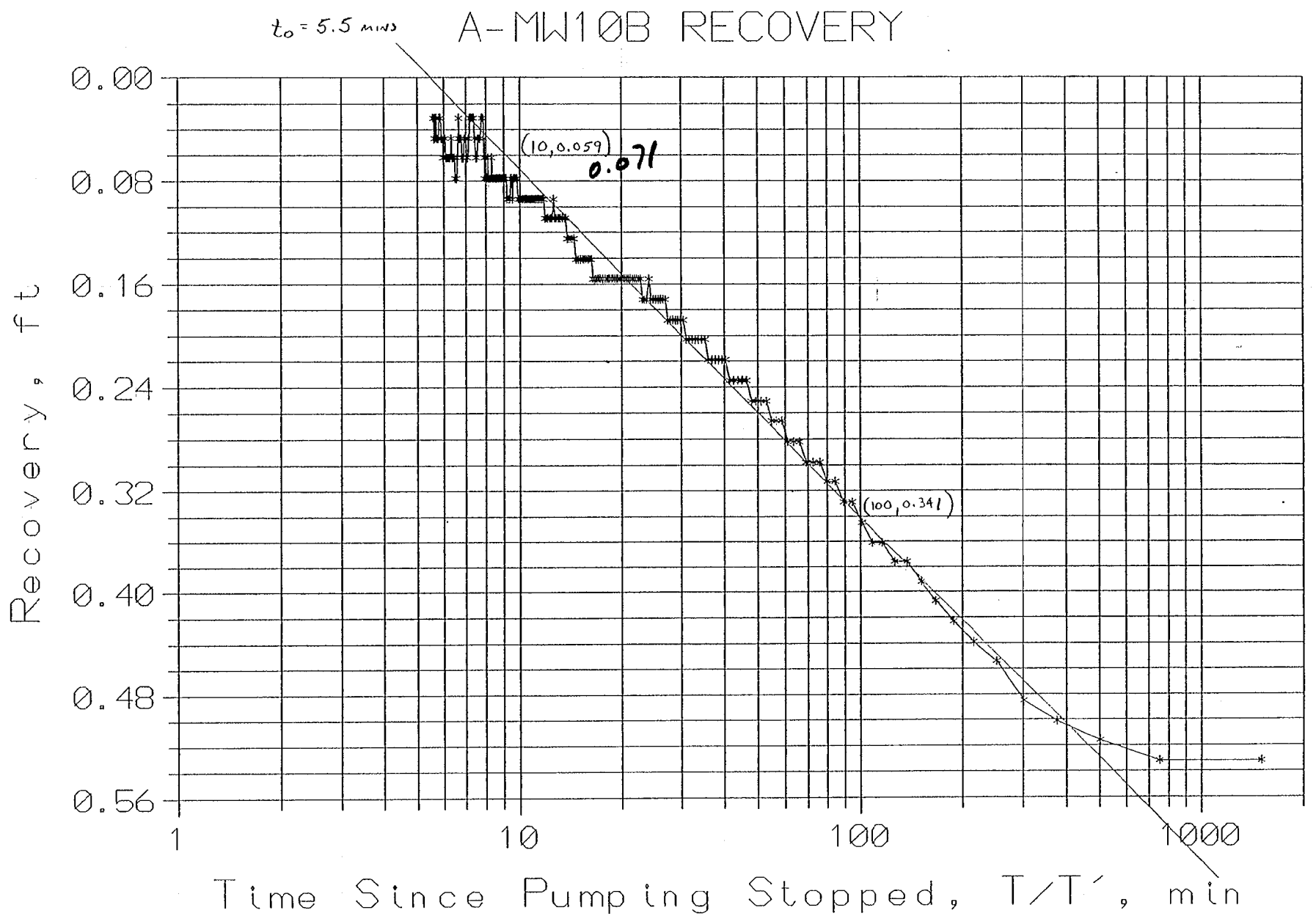
7.18×10^{-4}

$$u = \frac{1.87 r^2 S}{T t} = \frac{1.87(243.49)^2\, 3.31\times10^{-4}}{34239\,(25/24)} = 0.001029$$

$$= \frac{1.87(243.49)^2\, 6.25\times10^{-3}}{18928\,(25/24)} = 0.035156$$

$$= \frac{1.87(243.49)^2\, 7.18\times10^{-4}}{37{,}156} = 0.002057$$


A-MW10B
t_o = 2.75 mins
t_o = 94 mins
(100, 0.015)
(10, 0.162)
(100, 0.455)
(1000, 0.545)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Drawdown, ft
1
10
100
1000
Time Since Pumping Began, min


A-MW10B RECOVERY
t_o = 5.5 mins
(10,0.059)
0.071
(100,0.341)
0.00
0.08
0.16
0.24
0.32
0.40
0.48
0.56
Recovery, ft
1
10
100
1000
Time Since Pumping Stopped, T/T', min

S.O. No. 19084-51-SRN

Subject: CAMP ALLEN LANDFILL RI/FS

25 HR PUMP TEST, MONITORING WELL B-20W

JACOB'S STRAIGHT LINE METHOD

Sheet No. 1 of 1

Drawing No.

Computed by MEK Checked By

Date 20 Nov 92

Baker

RAW PUMP TEST DATA

- 0.41 WAS ADDED TO ALL OF THE DRAWDOWN READINGS TO OFFSET THE NEGATIVE READINGS. 0.401 WAS THE INITIAL DRAWDOWN READING BEFORE THE INITIATION OF THE PUMP TEST.
- T / T' WAS CALCULATED FOR PLOTTING THE RECOVERY PERIOD
- THE DRAWDOWN PHASE OF THE PUMP TEST LASTED FOR 1500 MINS.
- THE RECOVERY PHASE OF THE PUMP TEST LASTED FOR 302 MINS.
- THE GROUNDWATER WAS PUMPED AT 38 GPM.

CALCULATING T & S USING JACOB'S STRAIGHT LINE METHOD

B - 20W

- DRAWDOWN & RECOVERY: B-20W.DAT
- RECOVERY: B-20W-R.DAT

- DRAWDOWN - UNABLE TO COMPUTE DUE TO LACK OF RESPONSE TO THE PUMPING WELL.

$Q = 38$ GPM

$r = 241.10$ ft

$t_0 =$

$=$

$s_1 =$

$s_2 =$

$T = \frac{264Q}{\Delta s}$

$= \frac{264(38)}{(}$

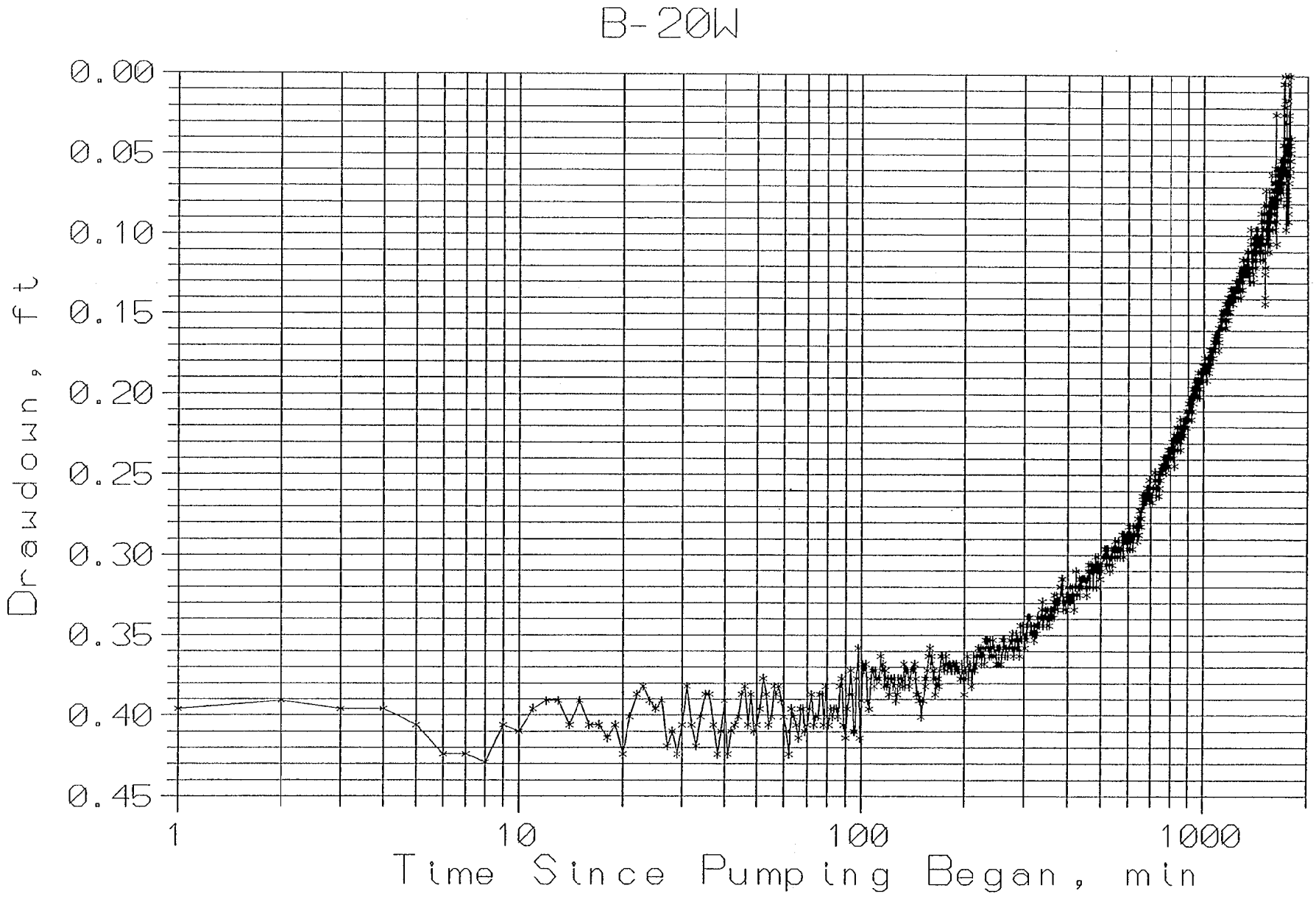
$T =$

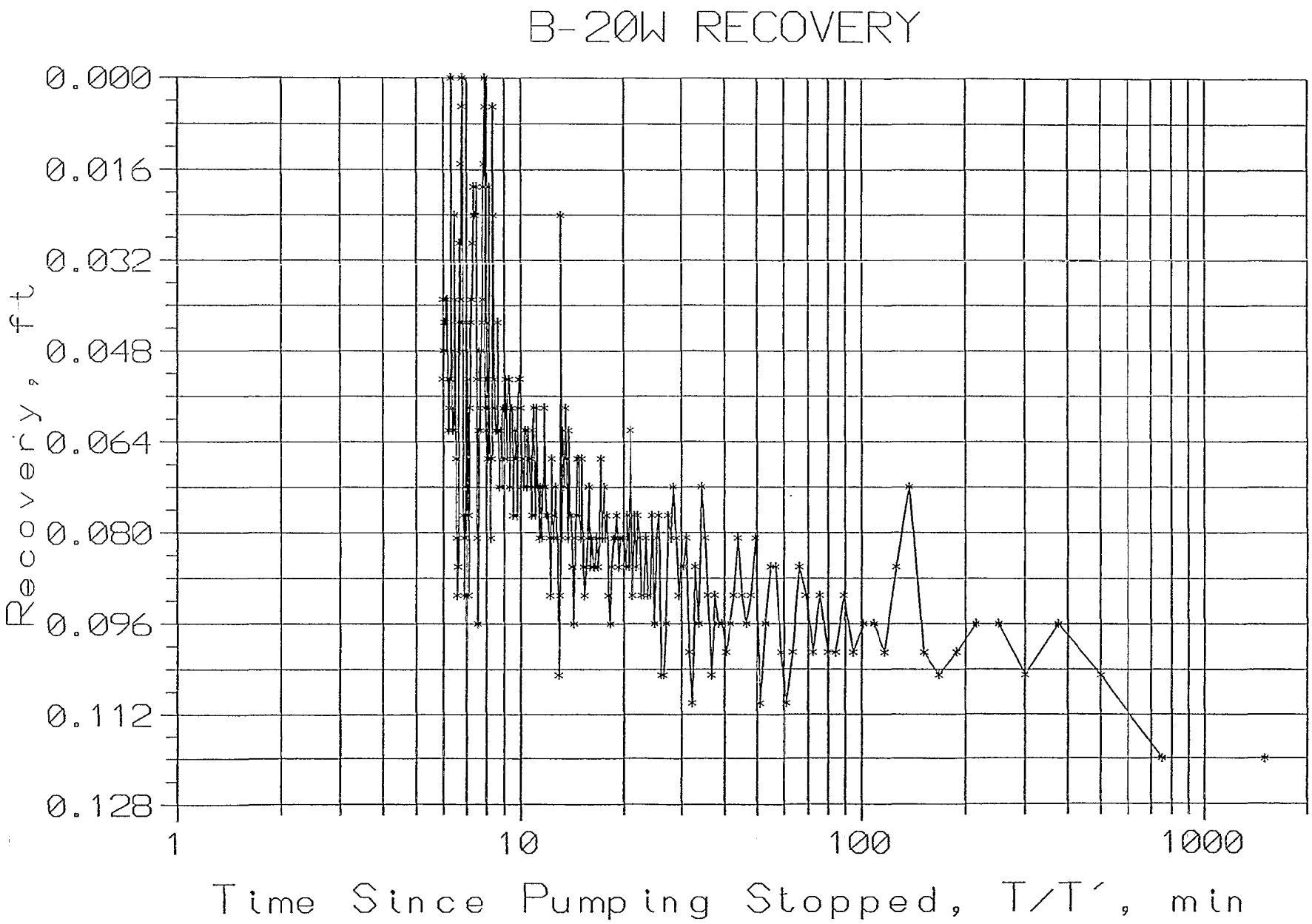
$S = \frac{0.3Tt_0}{r^2}$

$= \frac{0.3(}{(241.10)^2}$

$S =$

- RECOVERY - UNABLE TO COMPUTE DUE TO LACK OF RESPONSE TO THE PUMPING WELL


B-20W
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
Drawdown, ft
1
10
100
1000
Time Since Pumping Began, min


B-20W RECOVERY
0.000
0.016
0.032
0.048
0.064
0.080
0.096
0.112
0.128
Recovery, ft
1
10
100
1000
Time Since Pumping Stopped, T/T', min

S.O. No. 19084-51-SRN

Subject: CAMP ALLEN LANDFILL R1/FS

25 HOUR PUMP TEST, MONITORING WELL B-20WSS Sheet No. 1 of 1

JACOB STRAIGHT LINE METHOD Drawing No.

Computed by MEK Checked By Date 19 NOV. 92

Baker

RAW PUMP TEST DATA

- 0.284 WAS ADDED TO ALL OF THE DRAWDOWN READINGS TO OFFSET THE NEGATIVE VALUES. 0.28 WAS THE INITIAL DRAWDOWN READING BEFORE THE PUMP TEST WAS INITIATED.
- T/T' WAS CALCULATED FOR PLOTTING THE RECOVERY PERIOD
- THE DRAWDOWN PHASE OF THE PUMP TEST LASTED FOR 1500 MINS.
- THE RECOVERY PHASE OF THE PUMP TEST LASTED FOR 302 MINS.
- THE GROUNDWATER WAS PUMPED AT 38 GPM

CALCULATING T & S USING THE JACOB STRAIGHT LINE METHOD

B-20WSS

- DRAWDOWN & RECOVERY: B-20WSS.DAT
- RECOVERY: B-20WSSR.DAT

- DRAWDOWN

$Q = 38$ GPM

$r = 239.16$ ft

$t_0 = 150$ MIN

$= 1.04 \times 10^{-1}$ DAYS

$S_1 = -0.115$

$S_2 = 0.35$

$$T = \frac{264\,Q}{\Delta S} = \frac{264(38)}{(0.35+0.115)}$$

$$\underline{\underline{T = 21{,}574 \text{ GPD/ft}}}$$

$$S = \frac{0.3\,T t_0}{r^2} = \frac{0.3\,(21{,}574)(0.104)}{(239.16)^2}$$

$$\underline{\underline{S = 1.18 \times 10^{-2}}}$$

- RECOVERY

- UNABLE TO COMPUTE DUE TO ERATIC READINGS.

$Q = 38$ GPM

$r = 239.16$ ft

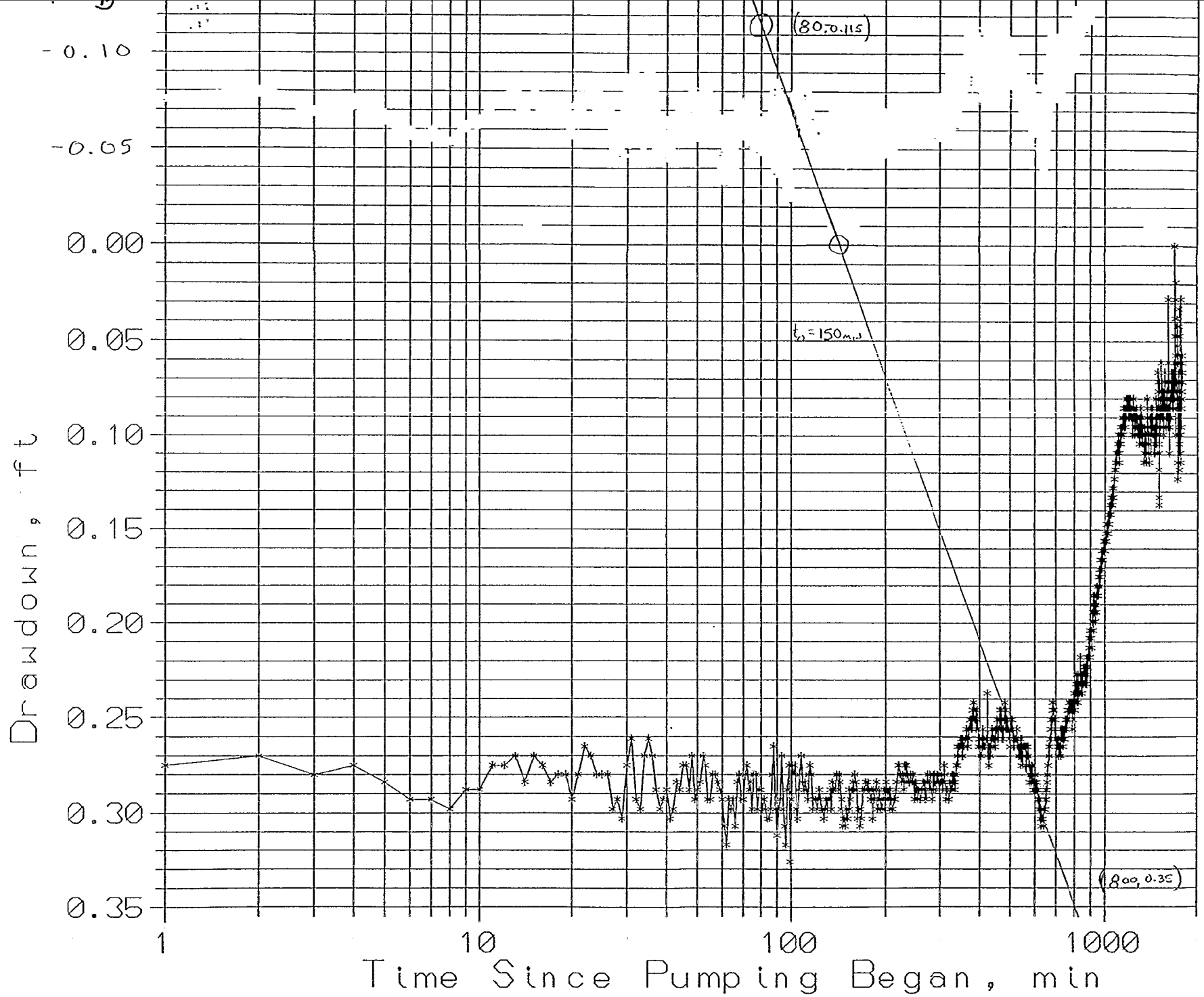
$t_0 =$

$=$

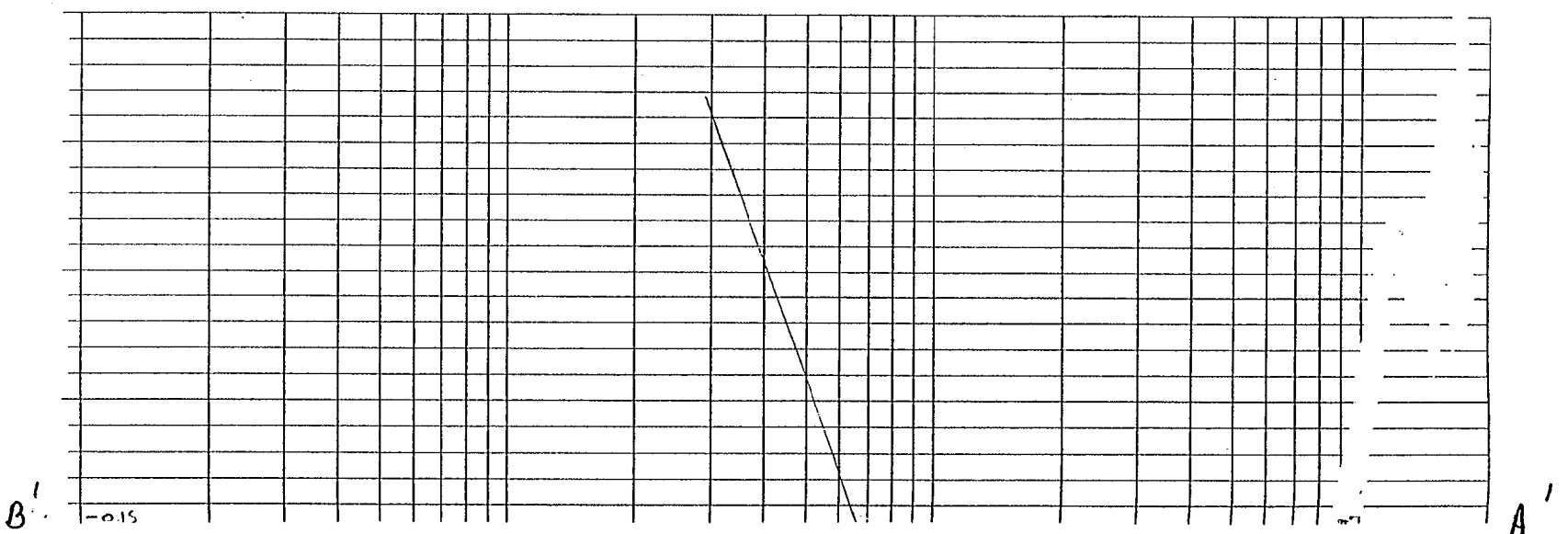
$S_1 =$

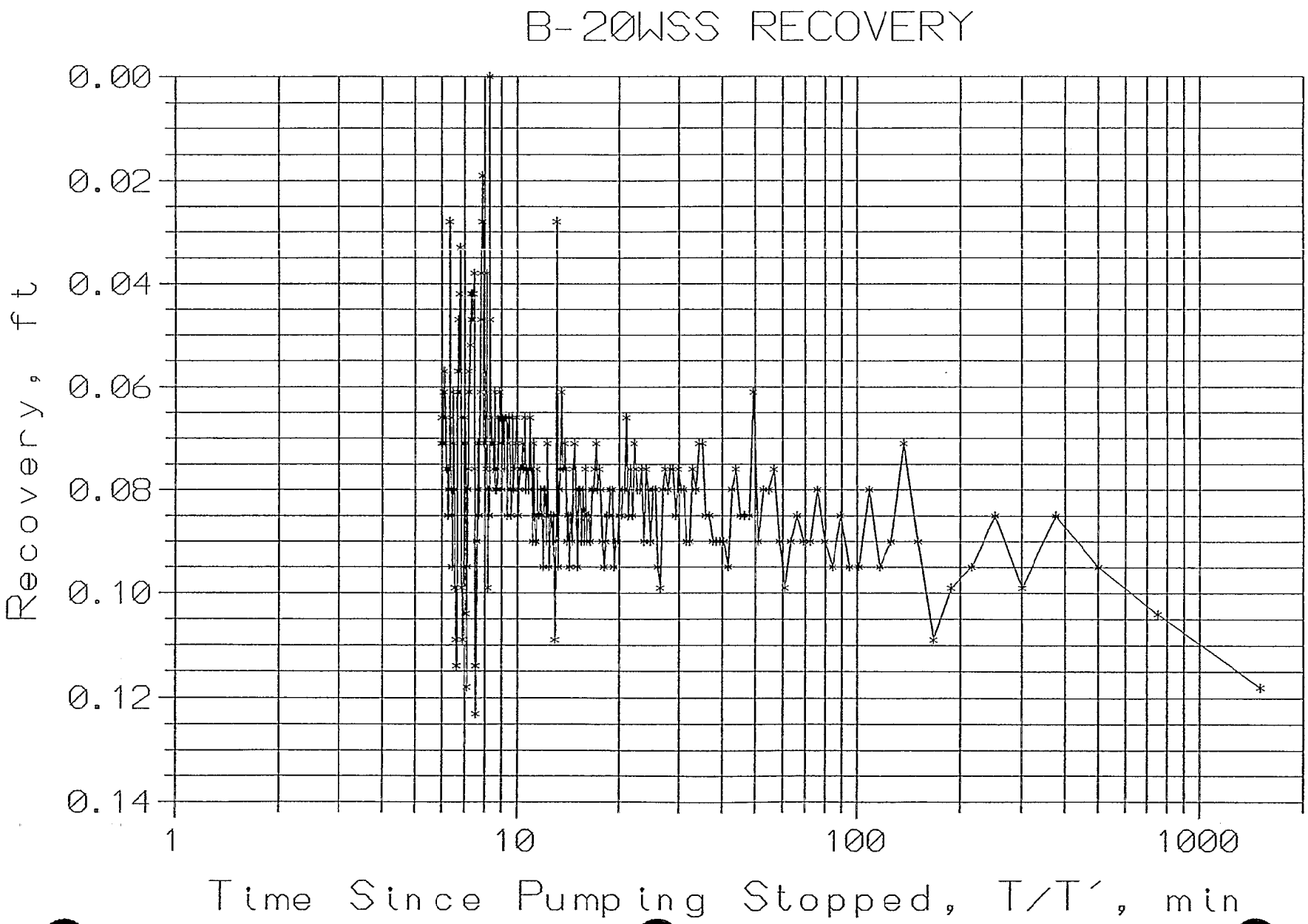
$S_2 =$

$$\mu = \frac{1.87\,r^2 S}{T t} = \frac{1.87\,(239.16)^2\,1.18 \times 10^{-2}}{21{,}574\,(25/24)} = 0.0561$$


(80, 0.115)
t_0 = 150 min
(800, 0.35)
-0.10
-0.05
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Drawdown, ft
1
10
100
1000
Time Since Pumping Began, min

B-20WSS




B-20WSS RECOVERY
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
Recovery, ft
1
10
100
1000
Time Since Pumping Stopped, T/T', min

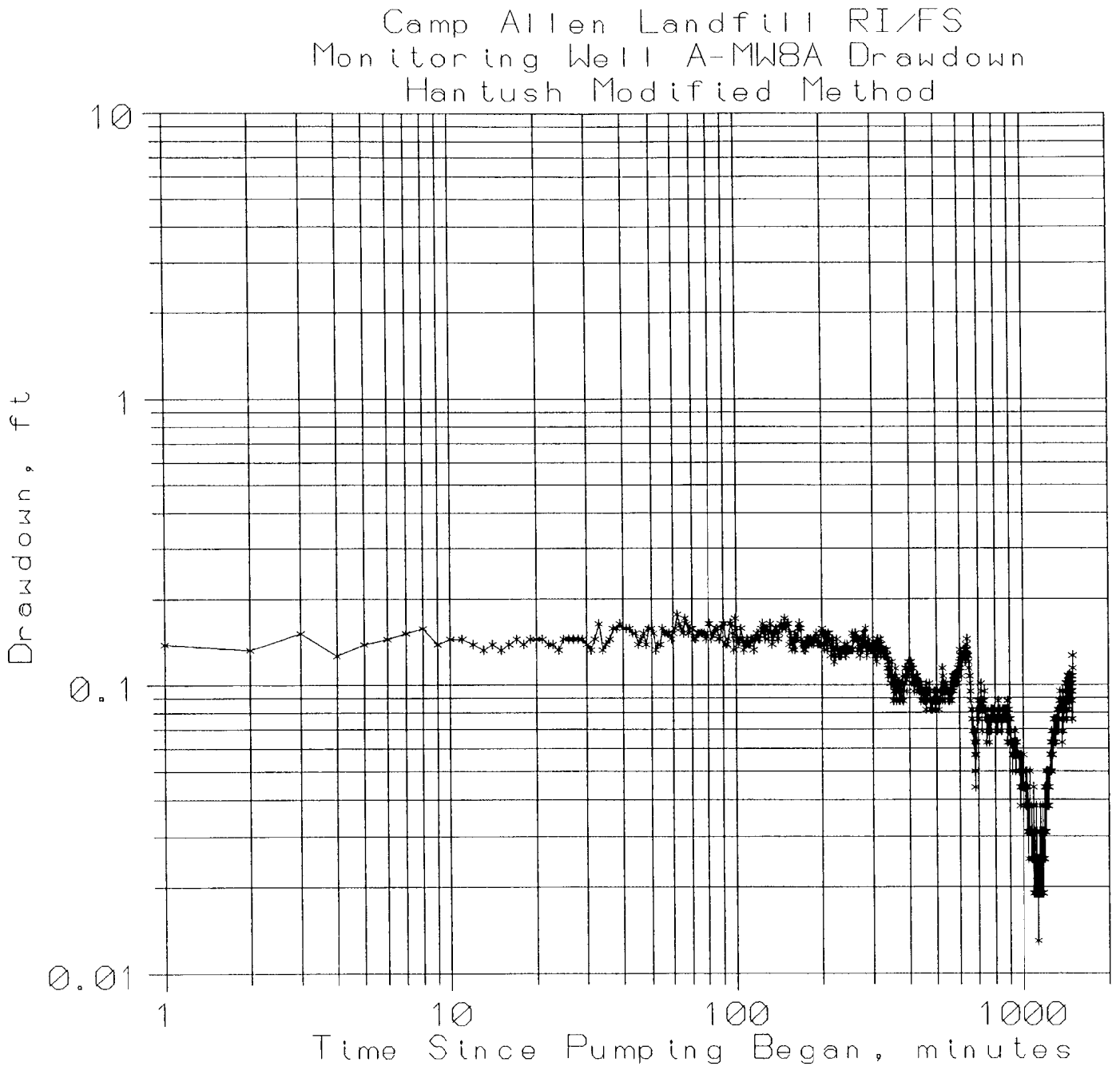
Attachment K-3

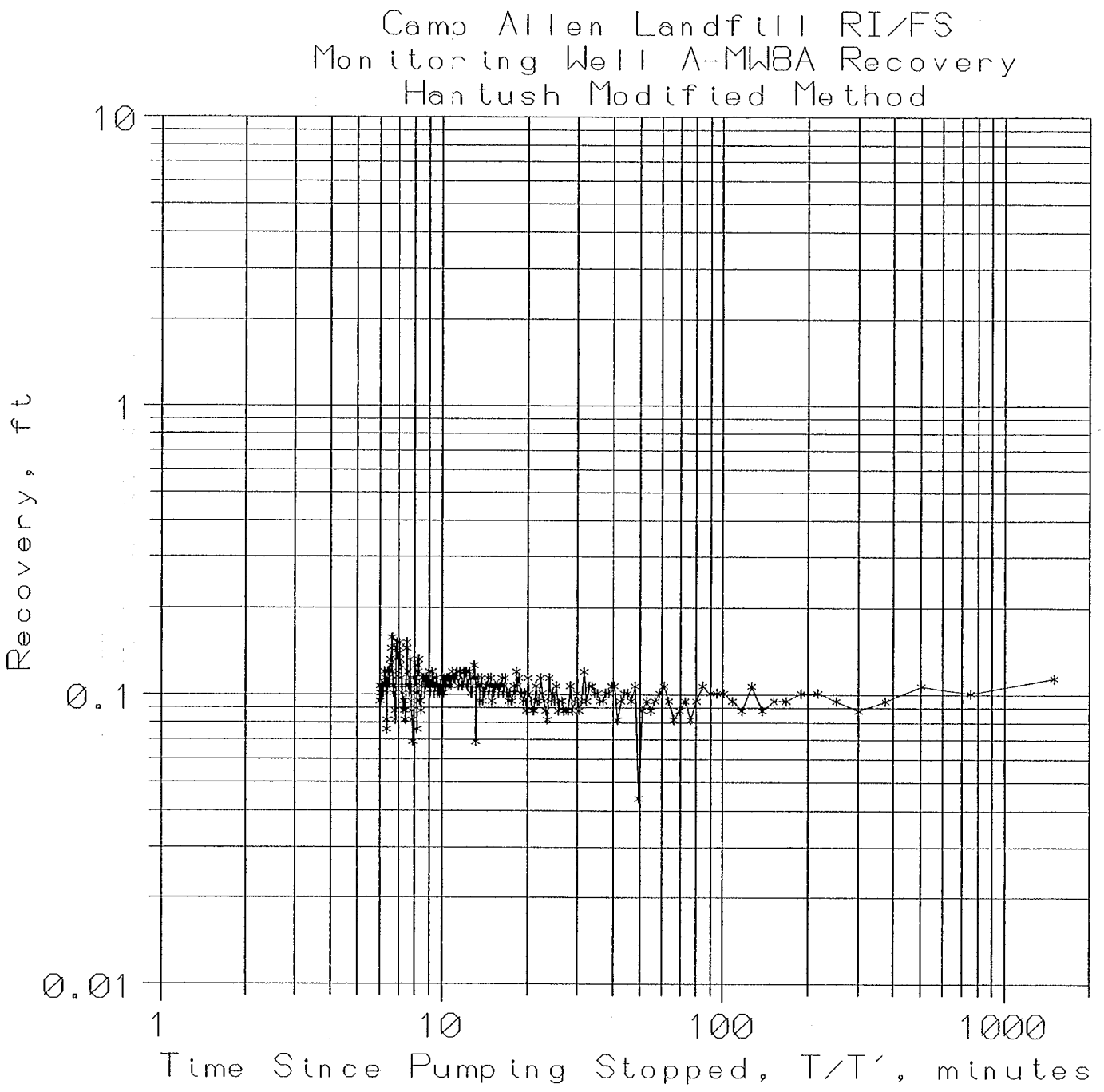
Pump Test Calculations - Hantush Modified Method

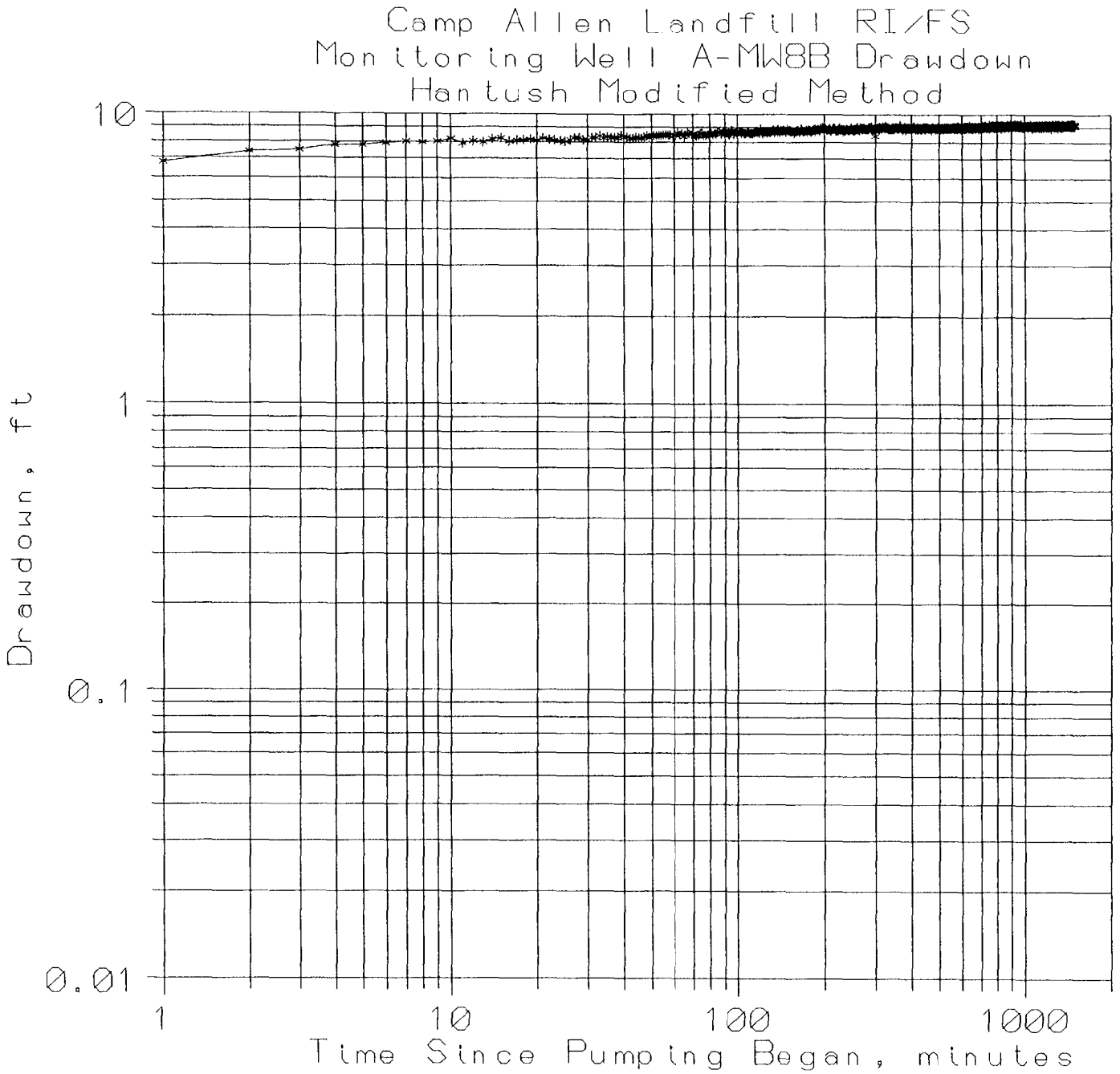
Camp Allen Landfill RI/FS
25 Hr Pump Test Calculation Results
Transmissivity and Storativity via Hantush Modified Method

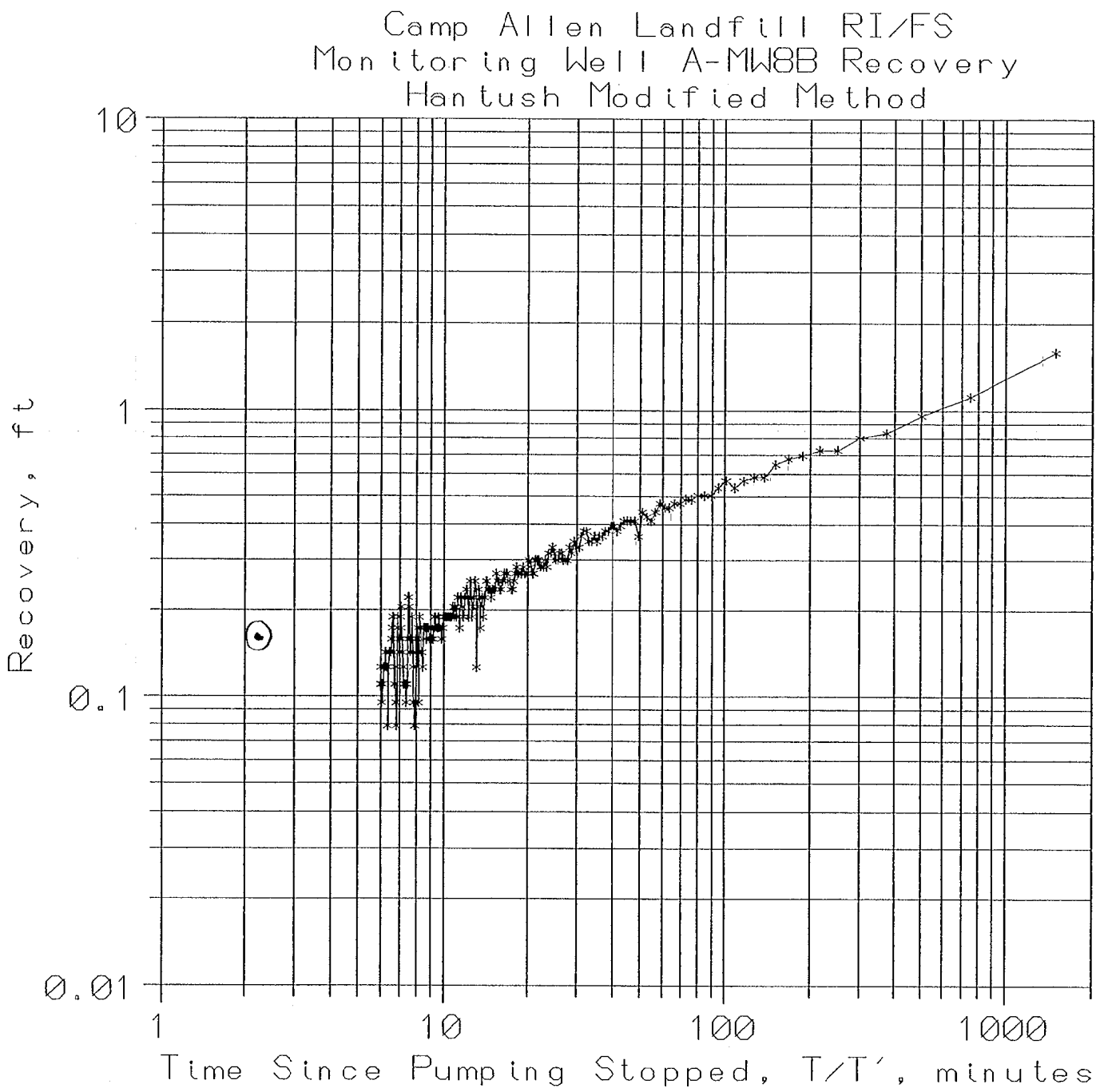
Monitoring Well #	Radial Distance From Pumping Well (ft)	Drawdown Phase			Recovery Phase		
		Transmissivity T (GPD/ft)	Storativity S	Beta B	Transmissivity T (GPD/ft)	Storativity S	Beta B
Shallow Wells - Screened in the surficial unconfined aquifer							
A-MW8A	21.76	NR	NR	NR	NR	NR	NR
A-MW9A	110.1	NR	NR	NR	NR	NR	NR
A-MW10A	236.59	34800	4.39E-03	0.05	NR	NR	NR
B-20W	241.1	NR	NR	NR	NR	NR	NR
B-20WSS	239.16	NR	NR	NR	NR	NR	NR
Middle Depth Wells - screened in the middle of the Yorktoown Aquifer							
A-MW8B **	0.167	NR	NR	NR	25600	767 *	0.00
A-P8	11.64	14500	7.96E-05	0.01	15800	1.04E-01	0.20
A-MW9B	117.75	16700	9.87E-05	0.10	24900	2.83E-03	0.00
A-MW10B	243.49	24200	4.85E-04	0.00	29000	8.91E-04	0.02
Deep Well - screened at the bottom of the Yorktown Aquifer							
A-MW9C	121.16	7600	3.26E-03	0.40	1700	6.61E-05	0.00

Notes:
NR - No response to the pumping well
N/A - Not Applicable
** - Pumping Well
* - Unrealistic result; storativity cannot be greater than one.


Camp Allen Landfill RI/FS
Monitoring Well A-MW8A Drawdown
Hantush Modified Method
10
1
0.1
0.01
Drawdown, ft
1
10
100
1000
Time Since Pumping Began, minutes


Camp Allen Landfill RI/FS
Monitoring Well A-MW8A Recovery
Hantush Modified Method
10
1
0.1
0.01
Recovery, ft
1
10
100
1000
Time Since Pumping Stopped, T/T', minutes


Camp Allen Landfill RI/FS
Monitoring Well A-MW8B Drawdown
Hantush Modified Method
10
1
0.1
0.01
Drawdown, ft
1
10
100
1000
Time Since Pumping Began, minutes



$\beta = 0$

$H(u,\beta) = 1$

$1/u = 1$

$t = 2.25$ min

$s = 0.17$ ft

$Q = 38$ GPM

$$T = \frac{Q\,H(u,\beta)}{4\pi s}$$

$$= \frac{(38\ \text{gal/min})(1440\ \text{min/day})(1)}{4\pi(0.17\ \text{ft})}$$

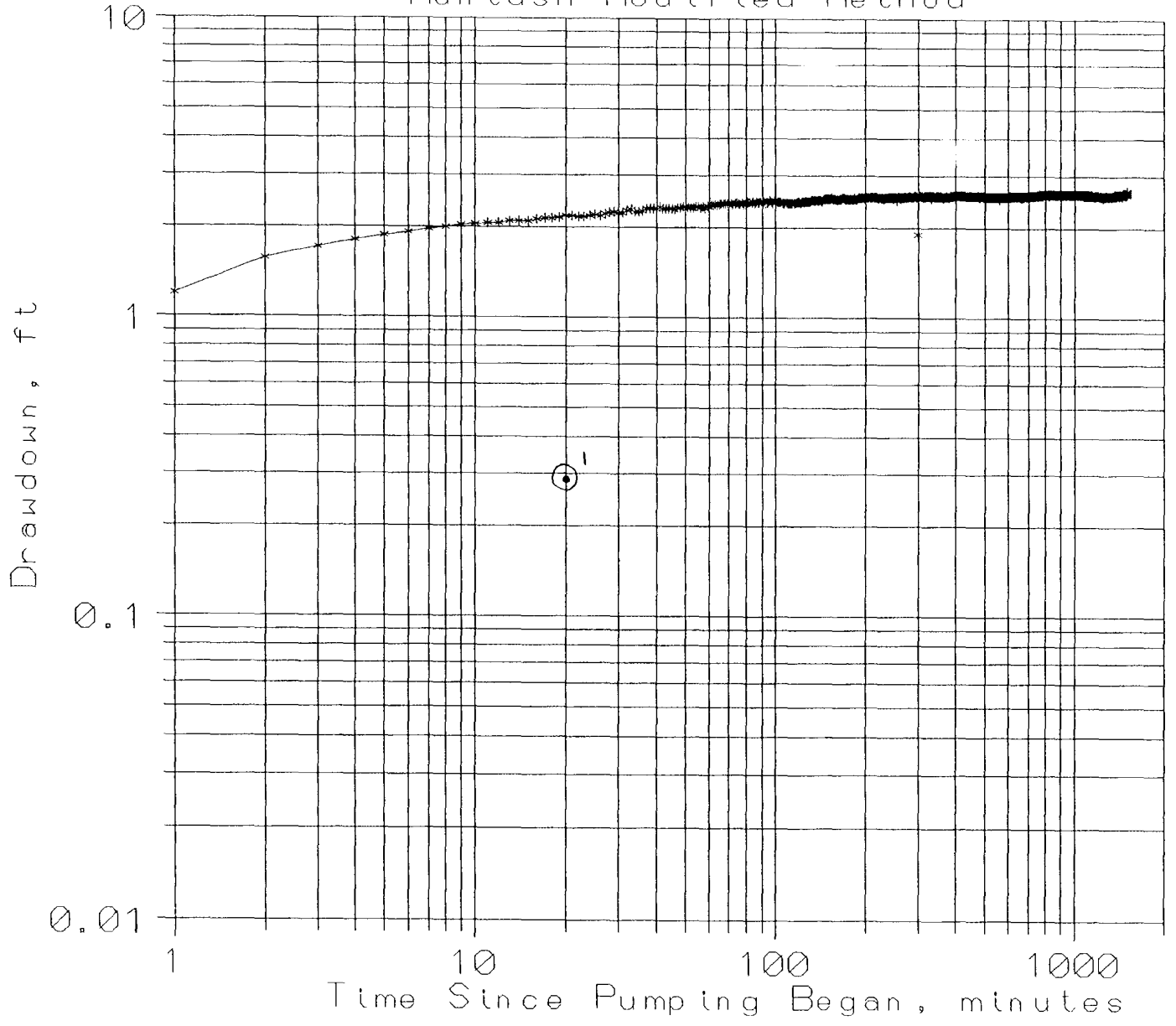
$T = 25{,}614$ GPD/ft

$$S = \frac{4Tt}{r^2(1/u)}$$ delete

$$= \frac{4(25{,}614\ \text{gal/day/ft})(2.25\ \text{min})}{(0.167\ \text{ft})^2(1)(7.48\ \text{gal/ft}^3)(1440\ \text{min/day})}$$

$S = 767$

Camp Allen Landfill RI/FS
Monitoring Well A-P8 Drawdown
Hantush Modified Method



t = 20 mins ✓

β = 0.01

$H(u,\beta)$ = 1

$1/u$ = 10000

S = 0.3 ft 0.29

Q = 38 GPM

r = 11.64 ft

$$T = \frac{Q\,H(u,\beta)}{4\pi S}$$

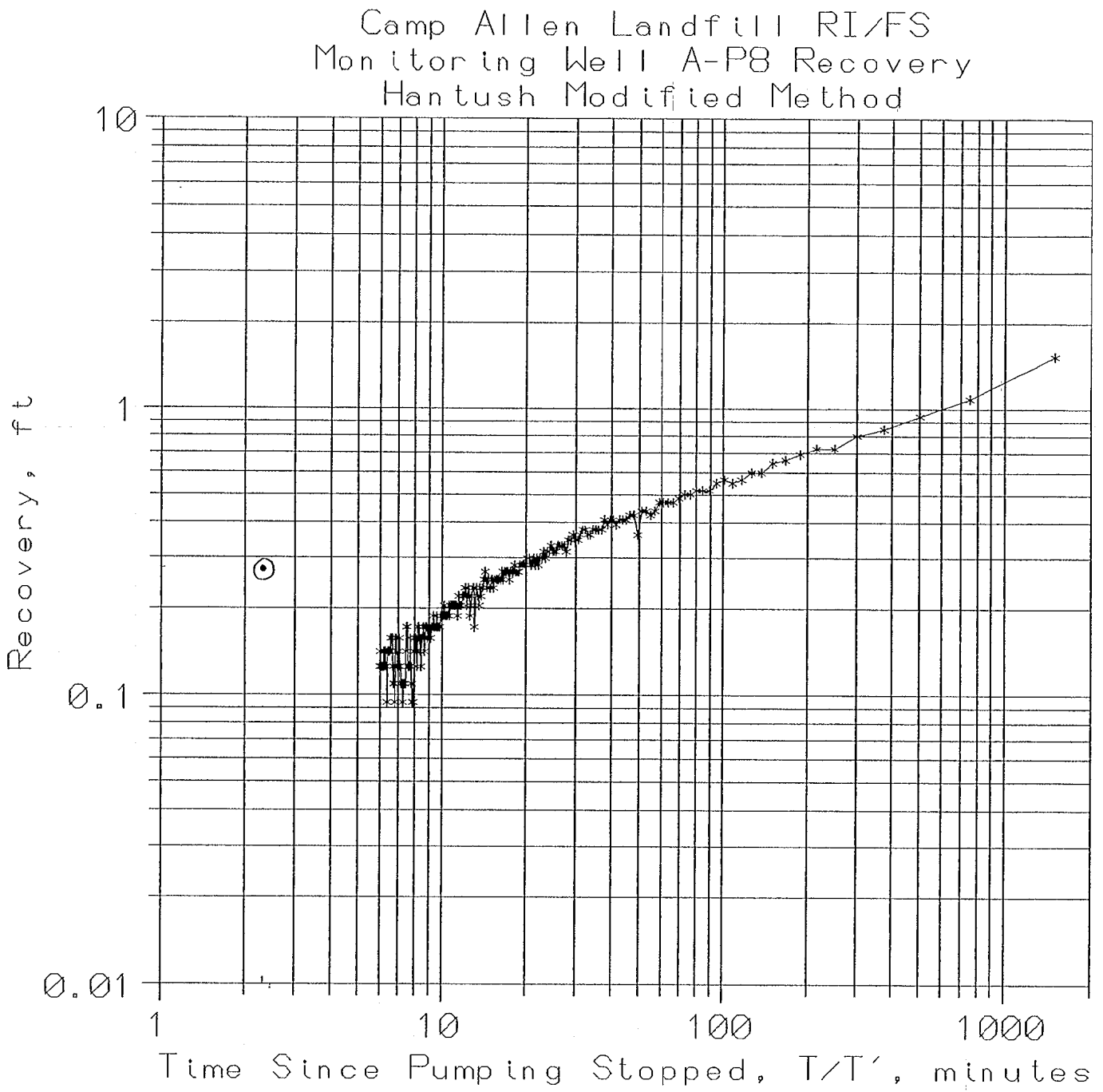
$$= \frac{(38\ \text{gal/min})(1440\ \text{min/day})(1)}{4\pi(0.3\ \text{ft})}$$

T = 14,515 GPD/ft 15000

$$S = \frac{4Tt}{r^2(1/u)}$$

$$= \frac{4(14{,}515\ \text{gal/ft})(20\ \text{min})}{(11.64\ \text{ft})^2(7.48\ \text{gal/ft}^3)(1440\ \text{min/day})(10000)}$$

$S = 7.96 \times 10^{-5}$ 8.2×10^{-6}



$\beta = 0.2$

$1/u = 1$

$W(u,\beta) = 1$

$t = 2.4$ min

$s = 0.275$ ft

$Q = 28$ GPM

$r = 11.64$ ft

$$T = \frac{Q\,W(u,\beta)}{4\pi s}$$

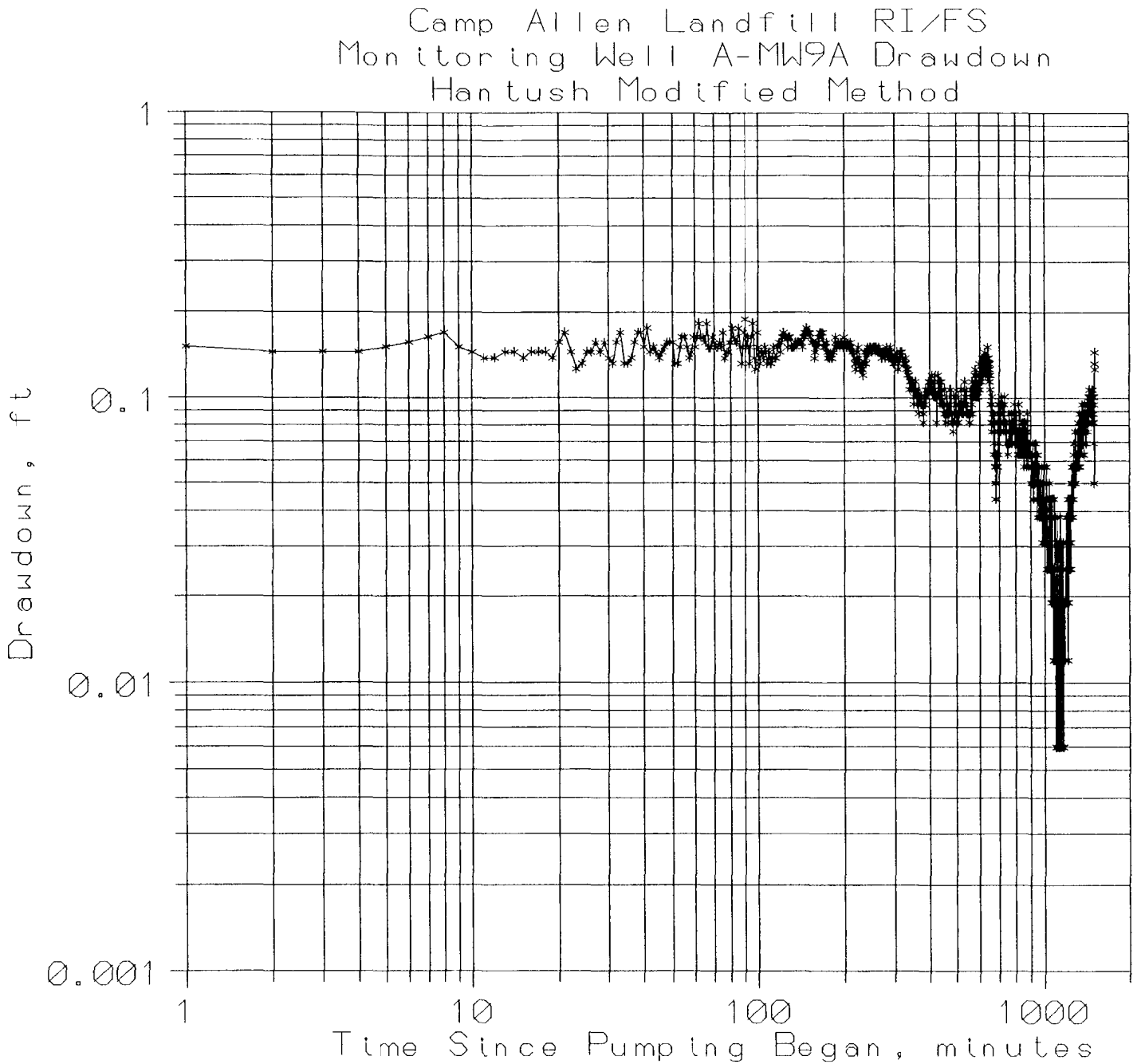
$$= \frac{(28\ \text{GAL/MIN})(1)(1440\ \text{MIN/DAY})}{4\pi(0.275\ \text{ft})}$$

$T = 15834$ GPD/ft

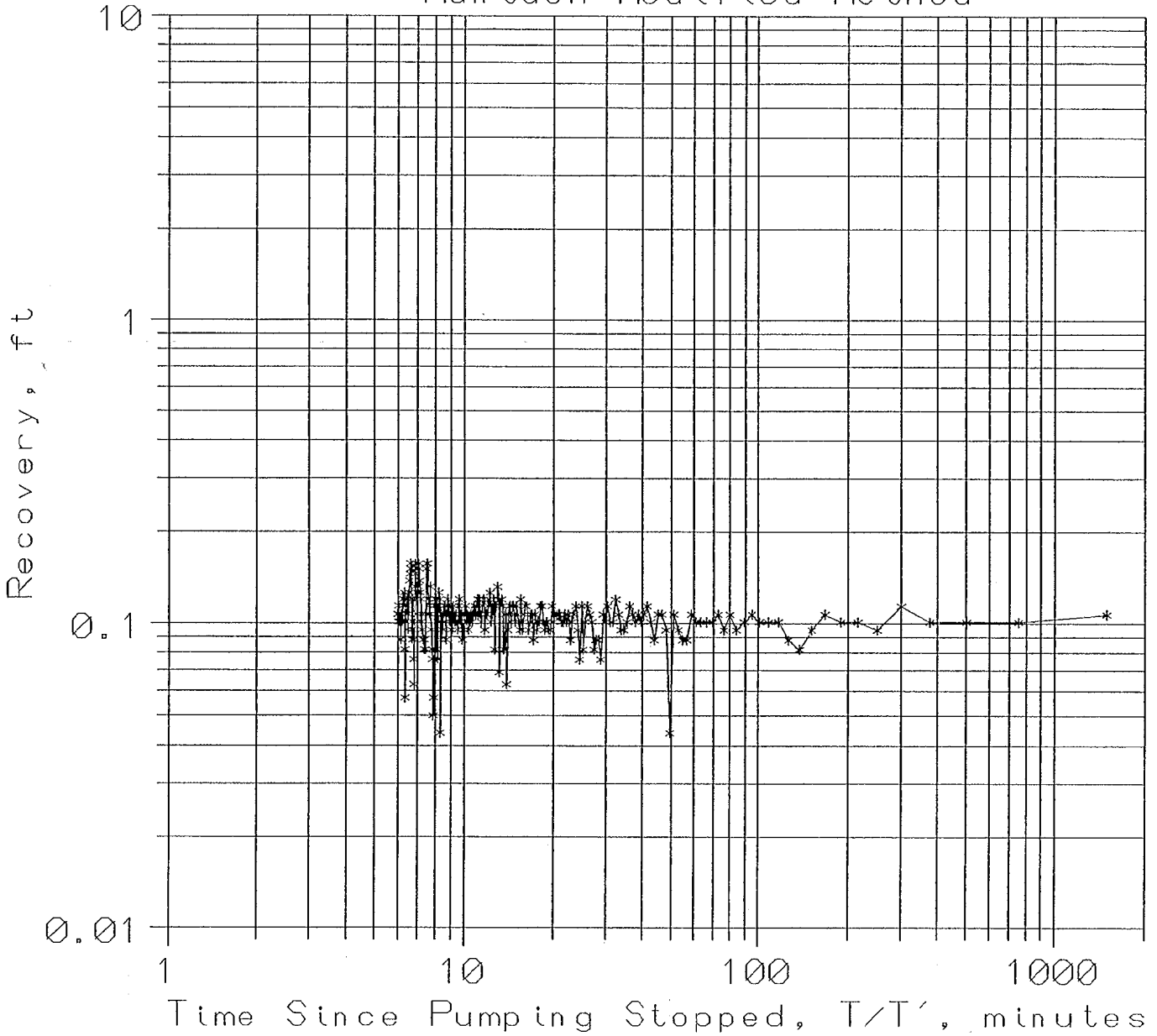
$$S = \frac{4Tt}{r^2(1/u)}$$

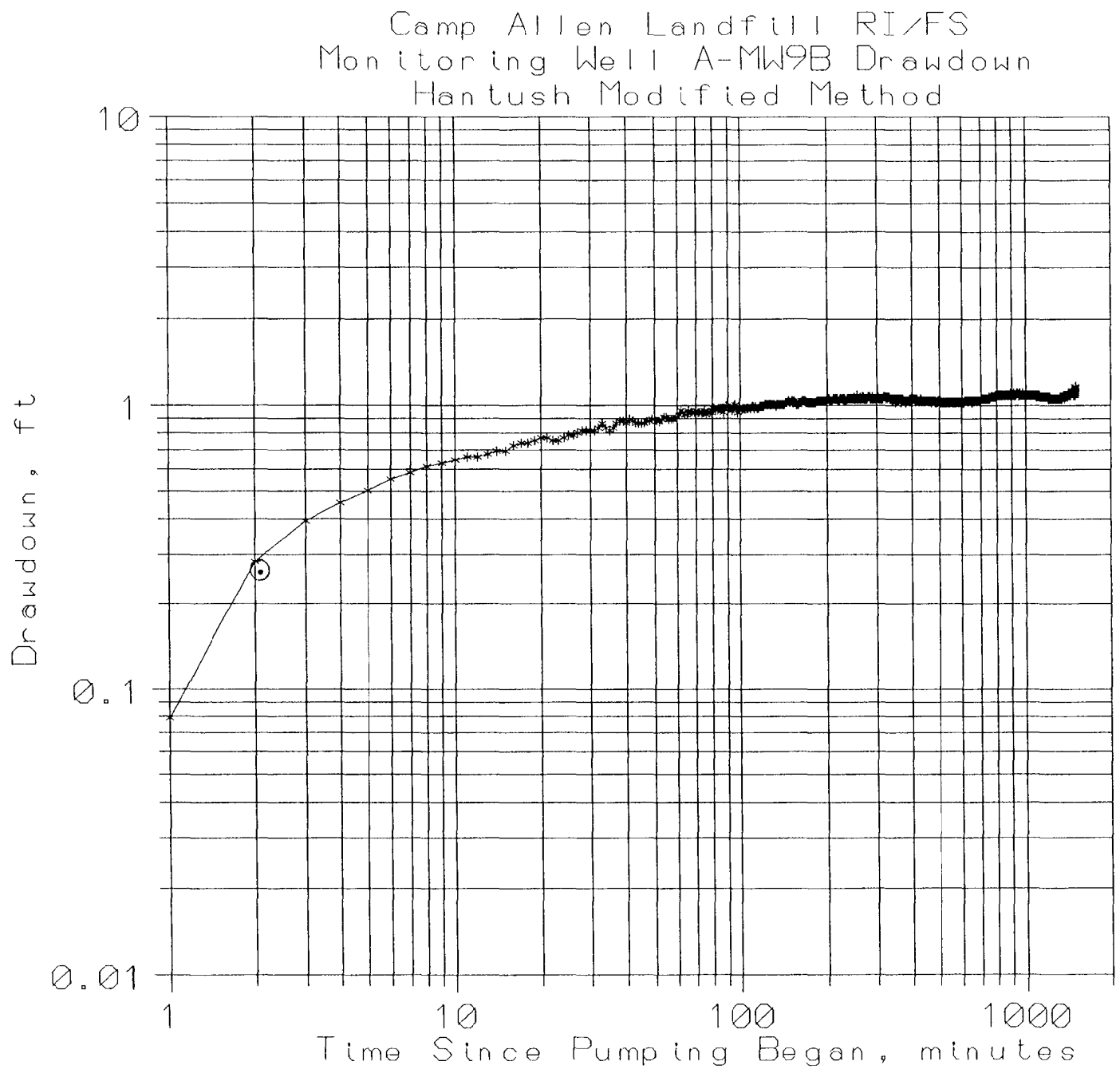
$$= \frac{4(15834\ \text{GPD/ft})(2.4\ \text{min})}{(11.64\ \text{ft})^2(1)(7.48\ \text{GAL/ft}^3)(1440\ \text{min/DAY})}$$

$S = 1.04 \times 10^{-1}$


Camp Allen Landfill RI/FS
Monitoring Well A-MW9A Drawdown
Hantush Modified Method
Drawdown, ft
1
0.1
0.01
0.001
1
10
100
1000
Time Since Pumping Began, minutes

Camp Allen Landfill RI/FS
Monitoring Well A-MW9A Recovery
Hantush Modified Method





$H(\mu, \beta) = 1$

$1/\mu = 10$

$\beta = 0.1$

$t = 2.2$ min

$s = 0.26$ ft

$Q = 38$ gpm

$r = 117.75$ ft

$$T = \frac{Q\,H(\mu,\beta)}{4\pi s}$$

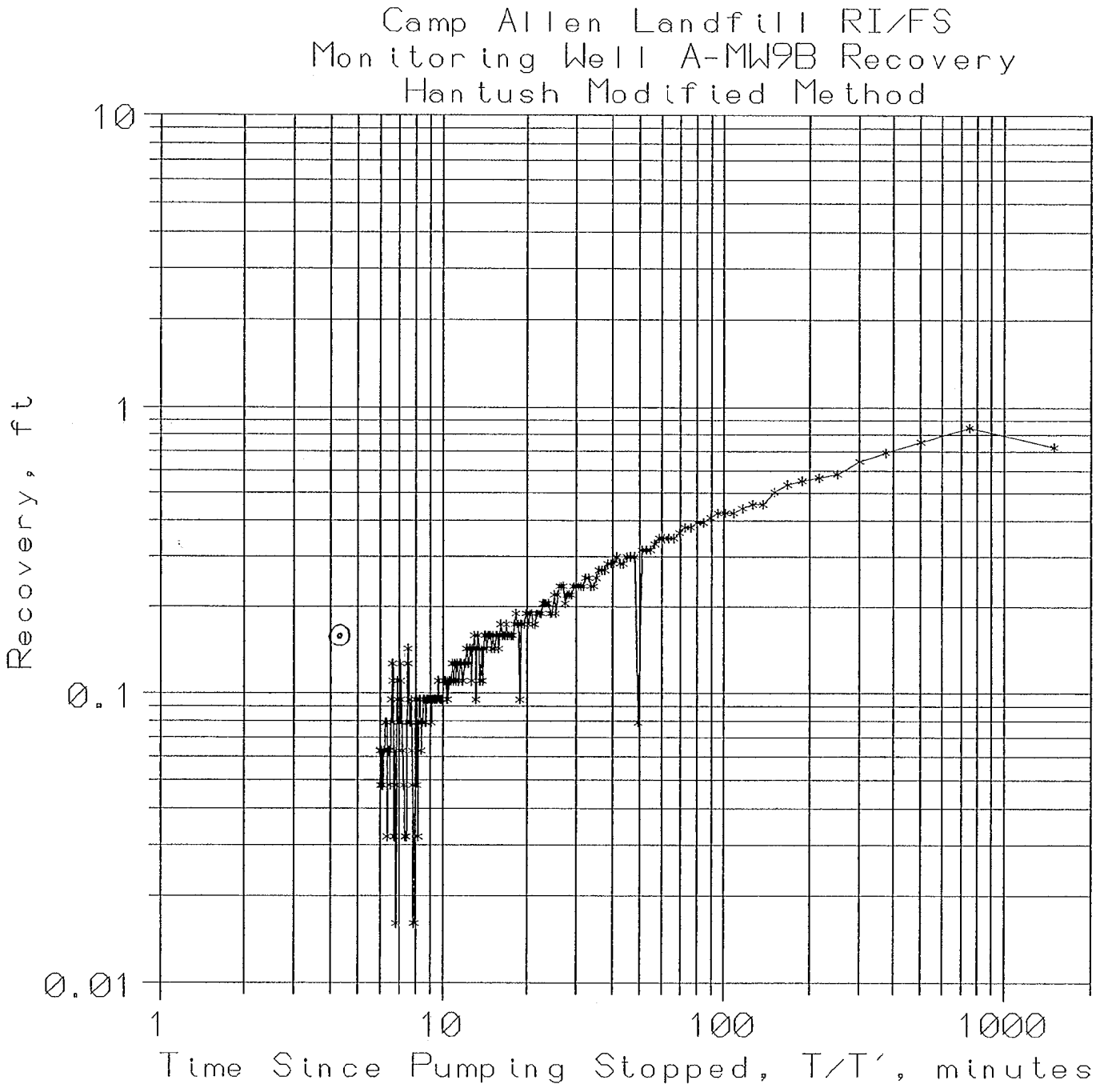
$$= \frac{(38\ \text{gal/min})(1)(1440\ \text{min/day})}{4\pi(0.26\ \text{ft})}$$

$$T = 16{,}748\ \text{gal/ft}$$

$$S = \frac{4\,T\,t}{r^2\,(1/\mu)}$$

$$= \frac{4\,(16{,}748\ \text{gal/ft})(2.2\ \text{min})}{(117.75\ \text{ft})^2\,(10)(7.48\ \text{gal/ft}^3)(1440\ \text{min/day})}$$

$$S = 9.87 \times 10^{-5}$$



$H(u,\beta) = 1$

$\beta = 0$

$1/u = 1$

$t = 4.25$ min

$s = 0.175$ ft

$Q = 38$ GPM

$r = 117.75$ ft

$$T = \frac{Q\,H(u,\beta)}{4\pi s}$$

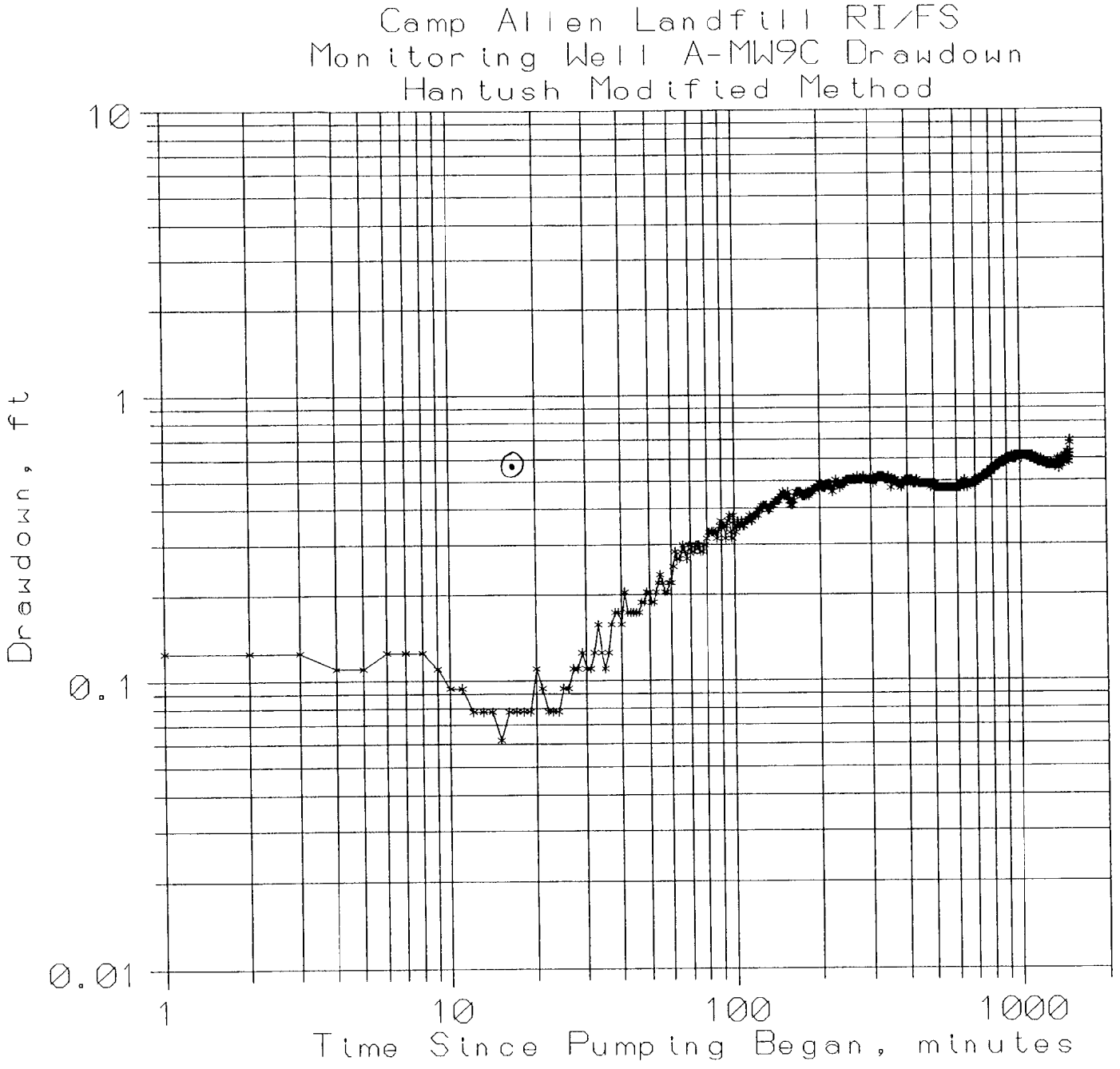
$$= \frac{(38\ \text{gal/min})(1)(1440\ \text{min/day})}{4\pi(0.175\ \text{ft})}$$

$$T = 24{,}883\ \text{GPD/ft}$$

$$S = \frac{4Tt}{r^2(1/u)}$$

$$= \frac{4(24{,}883\ \text{GPD/ft})(4.25\ \text{min})}{(117.75\ \text{ft})^2(1)(7.48\ \text{gal/ft}^3)(1440\ \text{min/day})}$$

$$S = 2.83 \times 10^{-3}$$



$\beta = 0.4$

$1/\mu = 1$

$H(\mu, \beta) = 1$

$t = 17$ min

$s = 0.573$ ft

$Q = 388$ GPM

$r = 121.16$ ft

$$T = \frac{Q\,H(\mu,\beta)}{4\pi s}$$

$$= \frac{(388\ \text{gal/min})(1)(1440\ \text{min/day})}{4\pi\,(0.573\ \text{ft})}$$

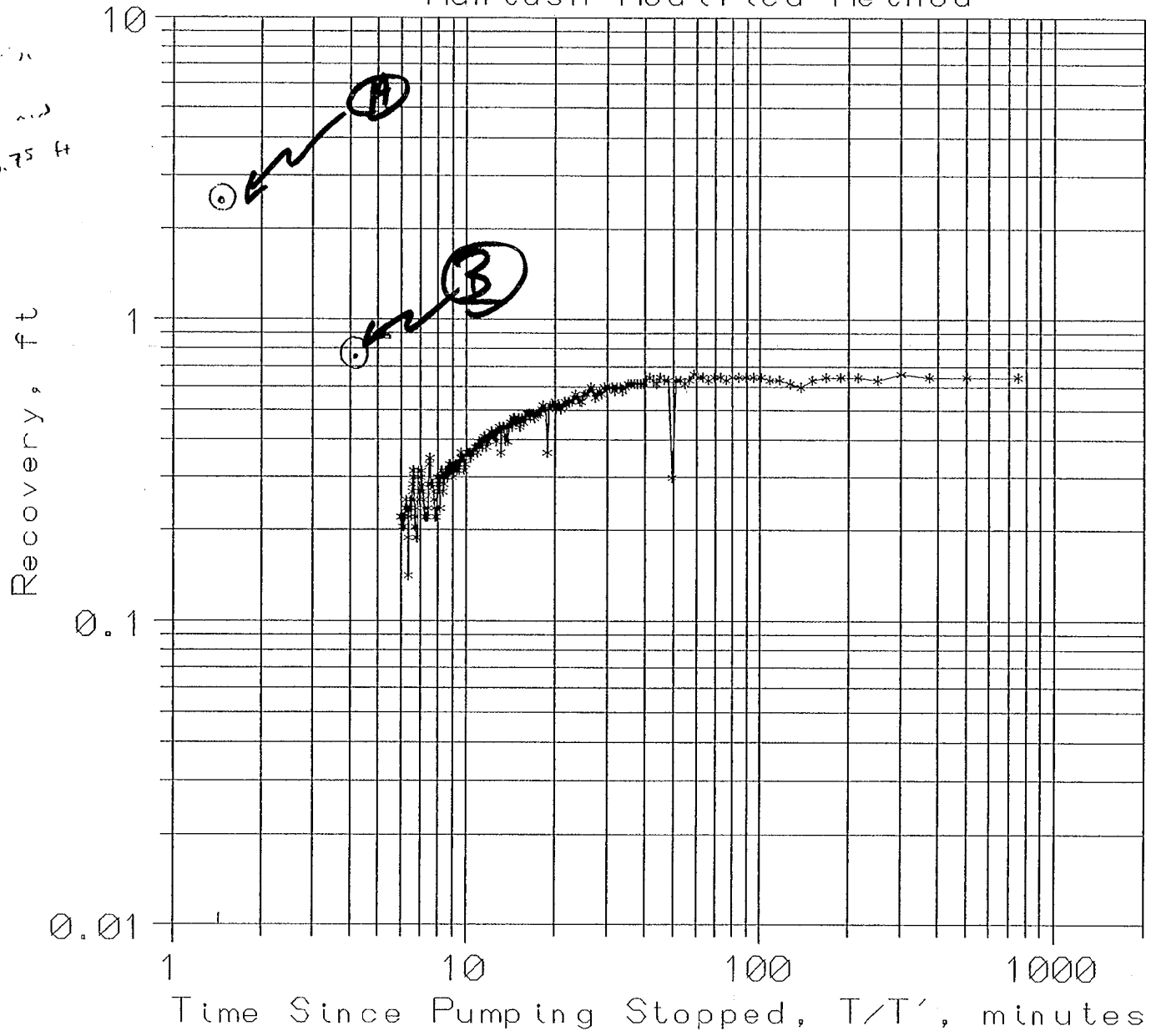
$$T = 7573\ \text{GPD/ft}$$

$$S = \frac{4\,T\,t}{r^2(1/\mu)}$$

$$= \frac{4\,(7573\ \text{GPD/ft})(17\ \text{min})}{(121.16\ \text{ft})^2\,(1)(7.48\ \text{gal/ft}^3)(1440\ \text{min/day})}$$

$$S = 3.26 \times 10^{-3}$$

Camp Allen Landfill RI/FS
Monitoring Well A-MW9C Recovery
Hantush Modified Method



t = 4.25 min
s = 0.75 ft

$\beta = 0$

$1/u = 1$

$H(u,\beta) = 1$ (A)

$s = 2.5$ ft (A)

$t = 1.5$ min

$Q = 38$ GPM

$r = 121.16$ ft

$$T = \frac{Q\,H(u,\beta)}{4\pi s}$$

$$= \frac{(38\ \text{GPM})(1)(1440\ \text{min/DAY})}{4(\pi)(2.5\ \text{ft})}$$

$T = 1742$ GPD/ft (A)

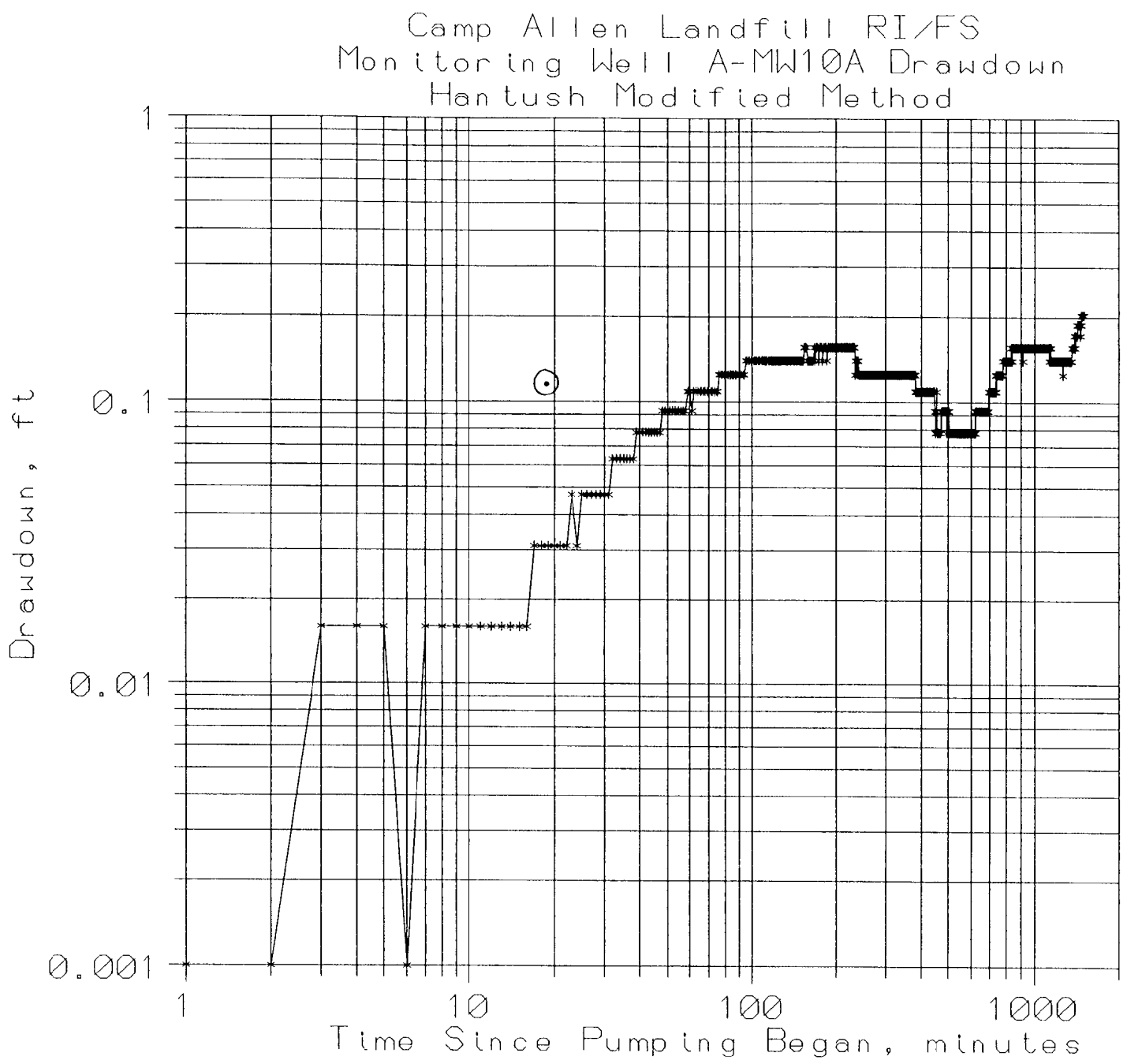
5806 (B)

$$S = \frac{4\,t}{r^2(1/u)}$$

$$= \frac{4(1742\ \text{GPD/ft})(1.5\ \text{min})}{(121.16\ \text{ft})^2(1)(7.48\ \text{GAL/ft}^3)(1440\ \text{min/DAY})}$$

$S = 6.61 \times 10^{-5}$ (A)

6.2×10^{-4} (B)



$\beta = 0.05$

$1/u = 1$

$H(u,\beta) = 1$

$t = 19$ min

$s = 0.125$ ft

$Q = 38$ GPM

$r = 236.59$ ft

$$T = \frac{Q\,H(u,\beta)}{4\pi s}$$

$$= \frac{38\ \text{GPM}\,(1)(1440\ \text{min/day})}{4\pi\,(0.125\ \text{ft})}$$

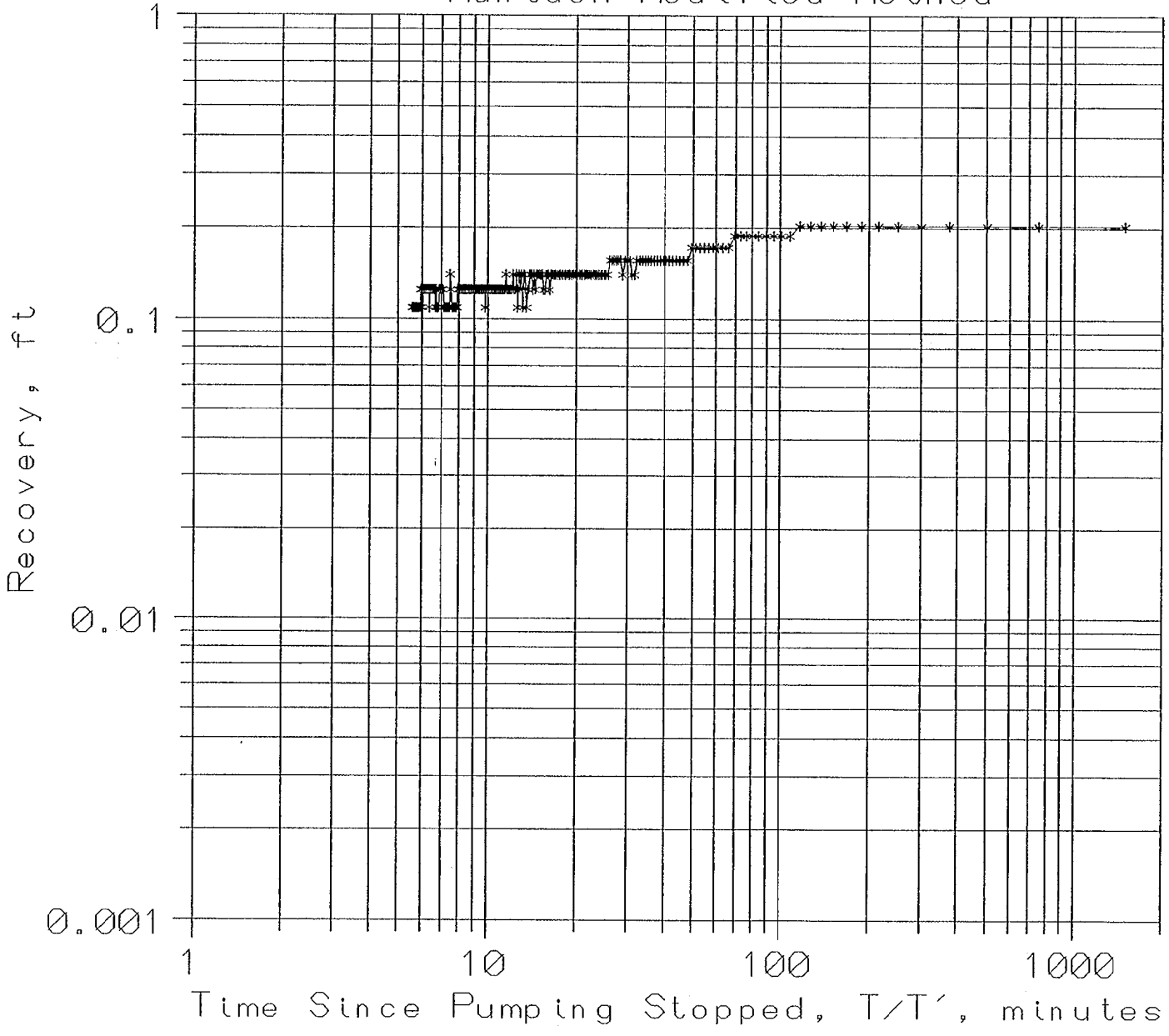
$$T = 34836\ \text{GPD/ft}$$

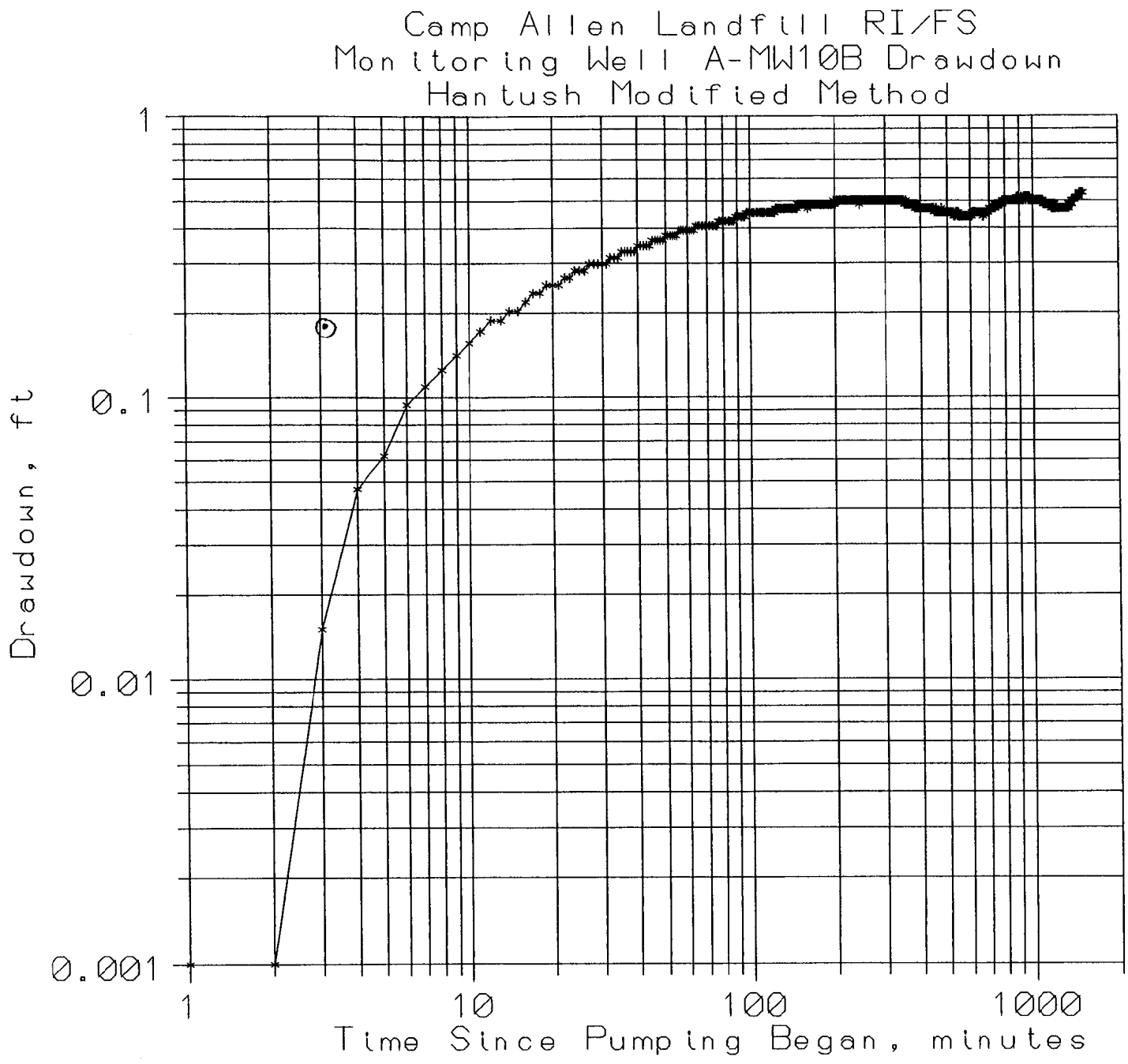
$$S = \frac{4Tt}{r^2\,(1/u)}$$

$$= \frac{4\,(34836\ \text{GPD/ft})(19\ \text{min})}{(236.59\ \text{ft})^2\,(1)(7.48\ \text{GAL/ft}^3)(1440\ \text{min/day})}$$

$$S = 4.39 \times 10^{-3}$$

Camp Allen Landfill RI/FS
Monitoring Well A-MW10A Recovery
Hantush Modified Method





$\beta = 0$

$1/u = 1$

$H(u,\beta) = 1$

$t = 3.2$ min

$s = 0.18$ ft

$Q = 38$ GPM

$r = 243.49$ ft

$$T = \frac{Q\,H(u,\beta)}{4\pi s}$$

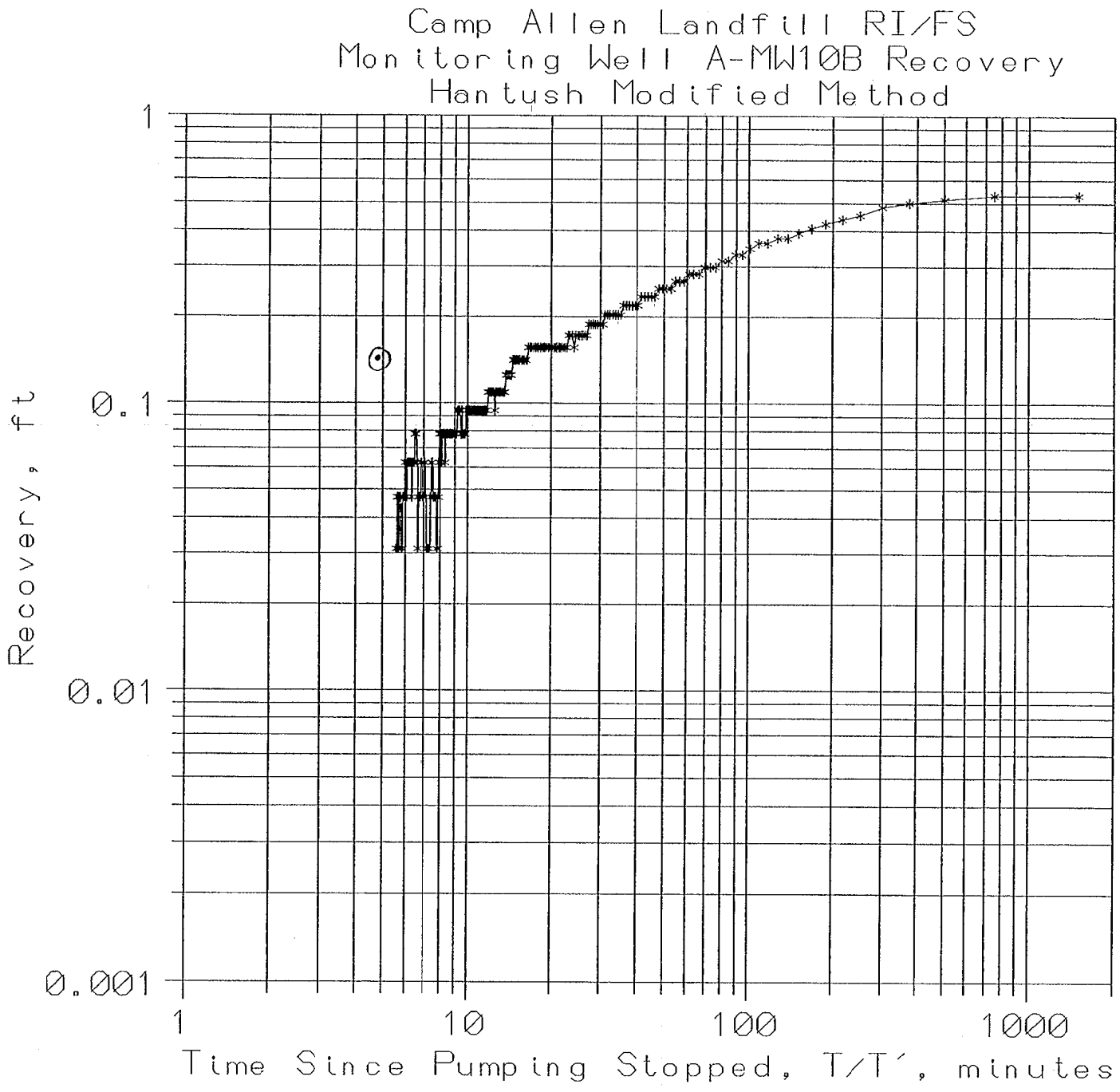
$$= \frac{38\ \text{GPM}\,(1)\,(1440\ \text{min/DAY})}{4\pi\,(0.18\ \text{ft})}$$

$$T = 24{,}192\ \text{GPD/ft}$$

$$S = \frac{4\,T\,t}{r^2\,(1/u)}$$

$$= \frac{4\,(24{,}192\ \text{GPD/ft})\,(3.2\ \text{min})}{(243.49\ \text{ft})^2\,(1)\,(7.48\ \text{GAL/ft}^3)\,(1440\ \text{min/DAY})}$$

$$S = 4.85 \times 10^{-4}$$



$\beta = 0.02$

$1/u = 1$

$H(u,\beta) = 1$

$t = 4.9$ min

$s = 0.15$ ft

$Q = 38$ GPM

$r = 243.49$ ft

$$T = \frac{Q\,H(u,\beta)}{4\pi s}$$

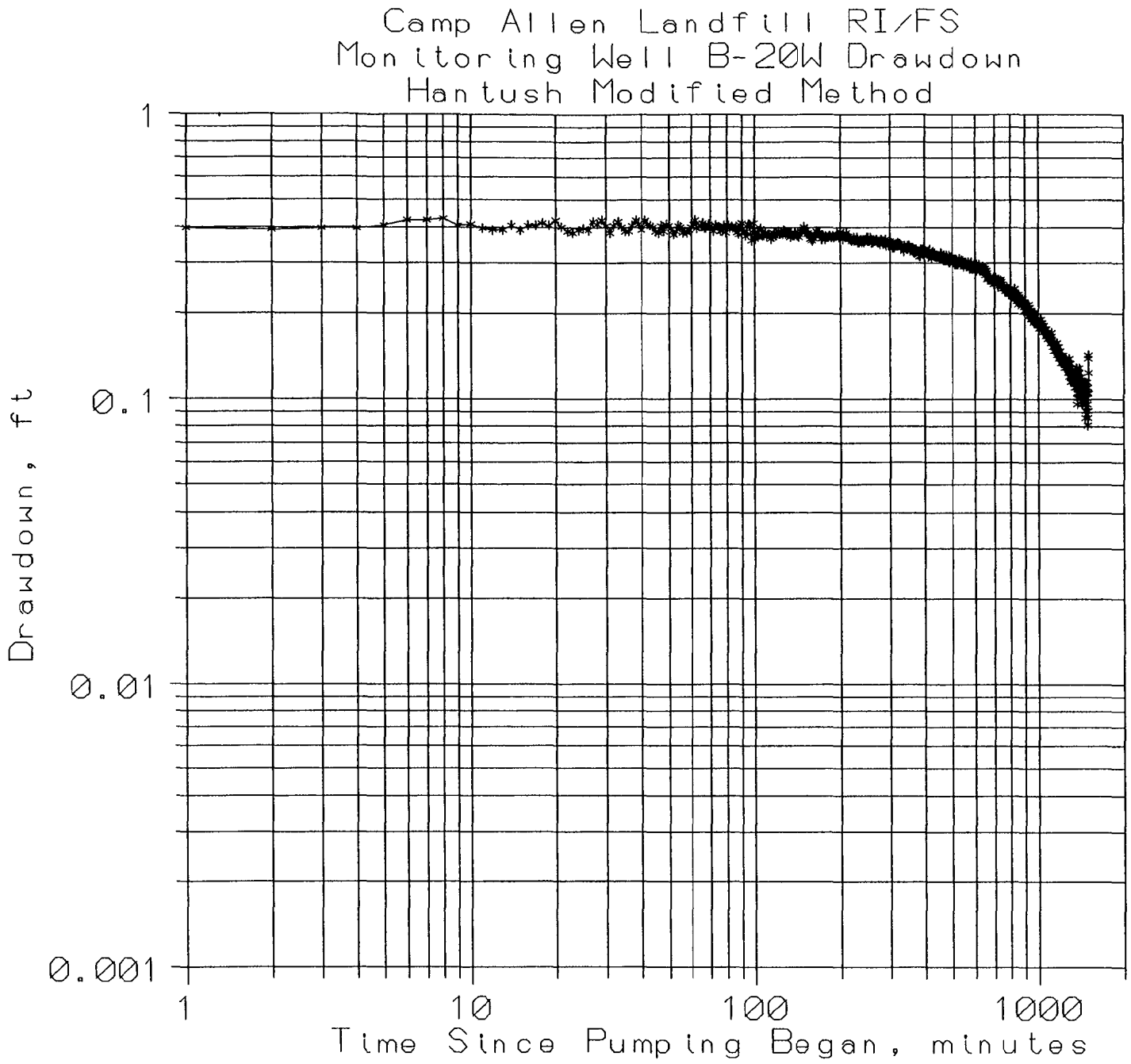
$$= \frac{38\ \text{GPM}(1)(1440\ \text{min/DAY})}{4\pi(0.15\ \text{ft})}$$

$$T = 29030\ \text{GPD/ft}$$

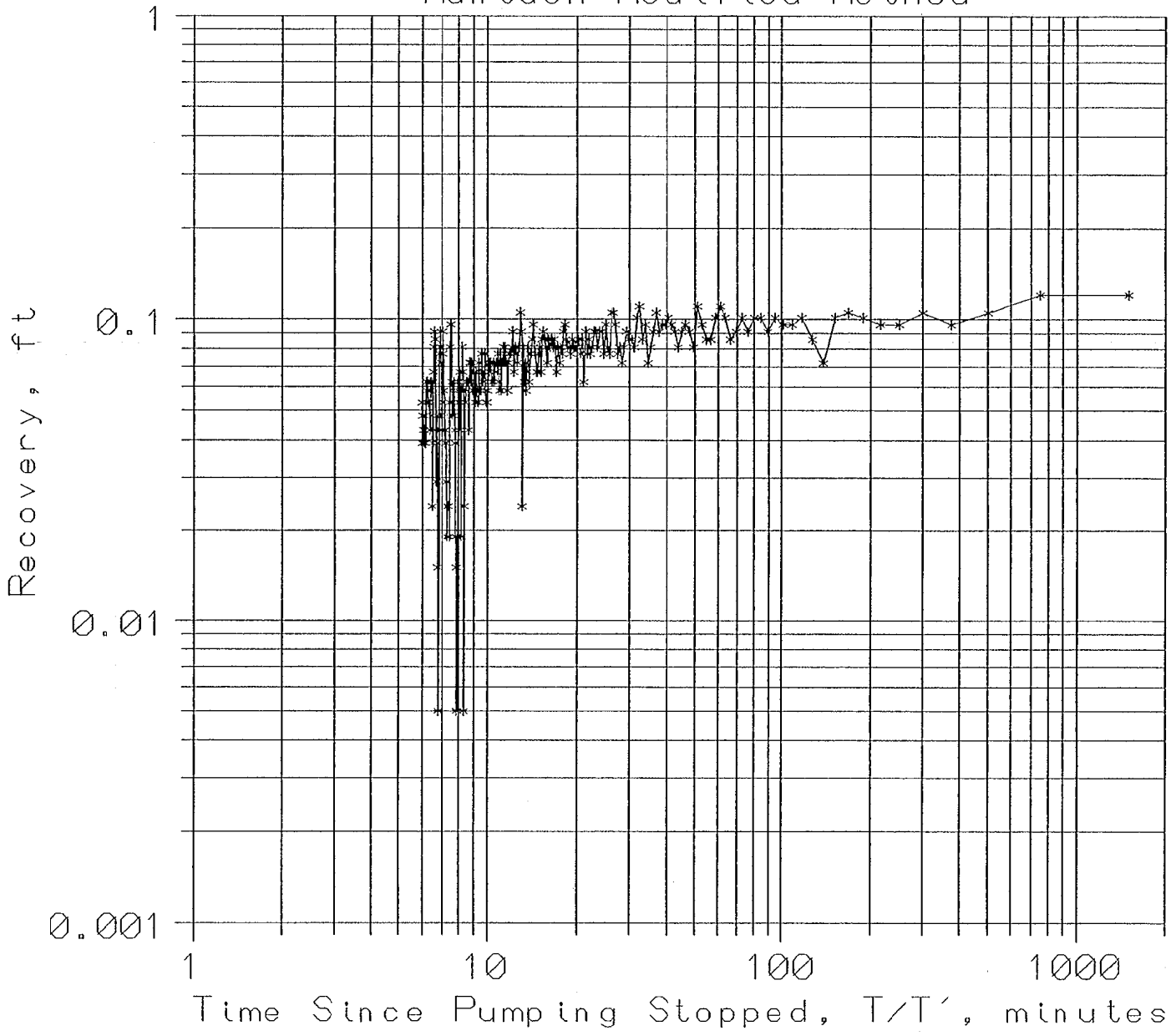
$$S = \frac{4\,T\,t}{r^2\,(1/u)}$$

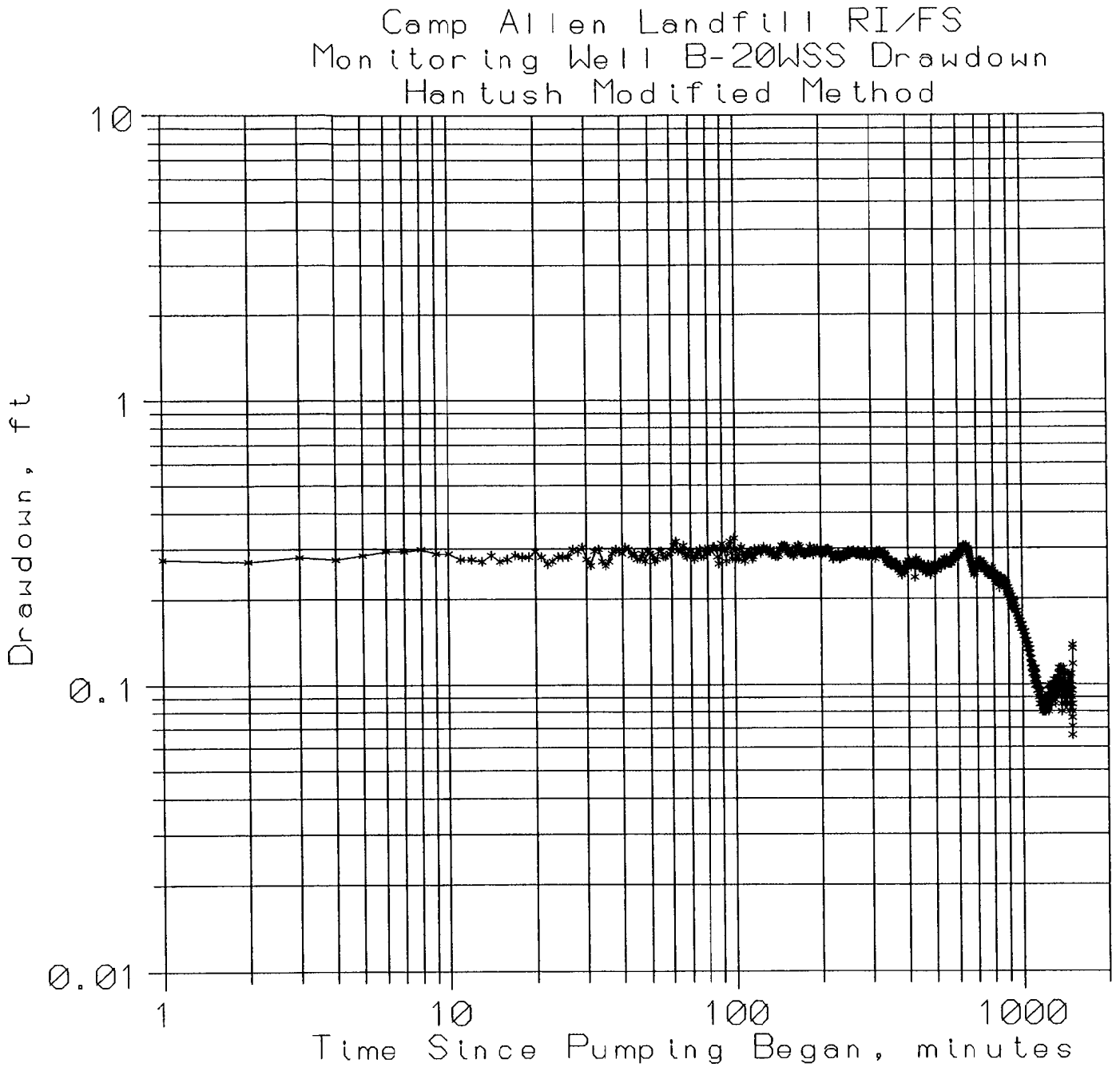
$$= \frac{4(29030\ \text{GPD/ft})(4.9\ \text{min})}{(243.49\ \text{ft})^2(1)(7.48\ \text{GAL/ft}^3)(1440\ \text{min/DAY})}$$

$$S = 8.91 \times 10^{-4}$$

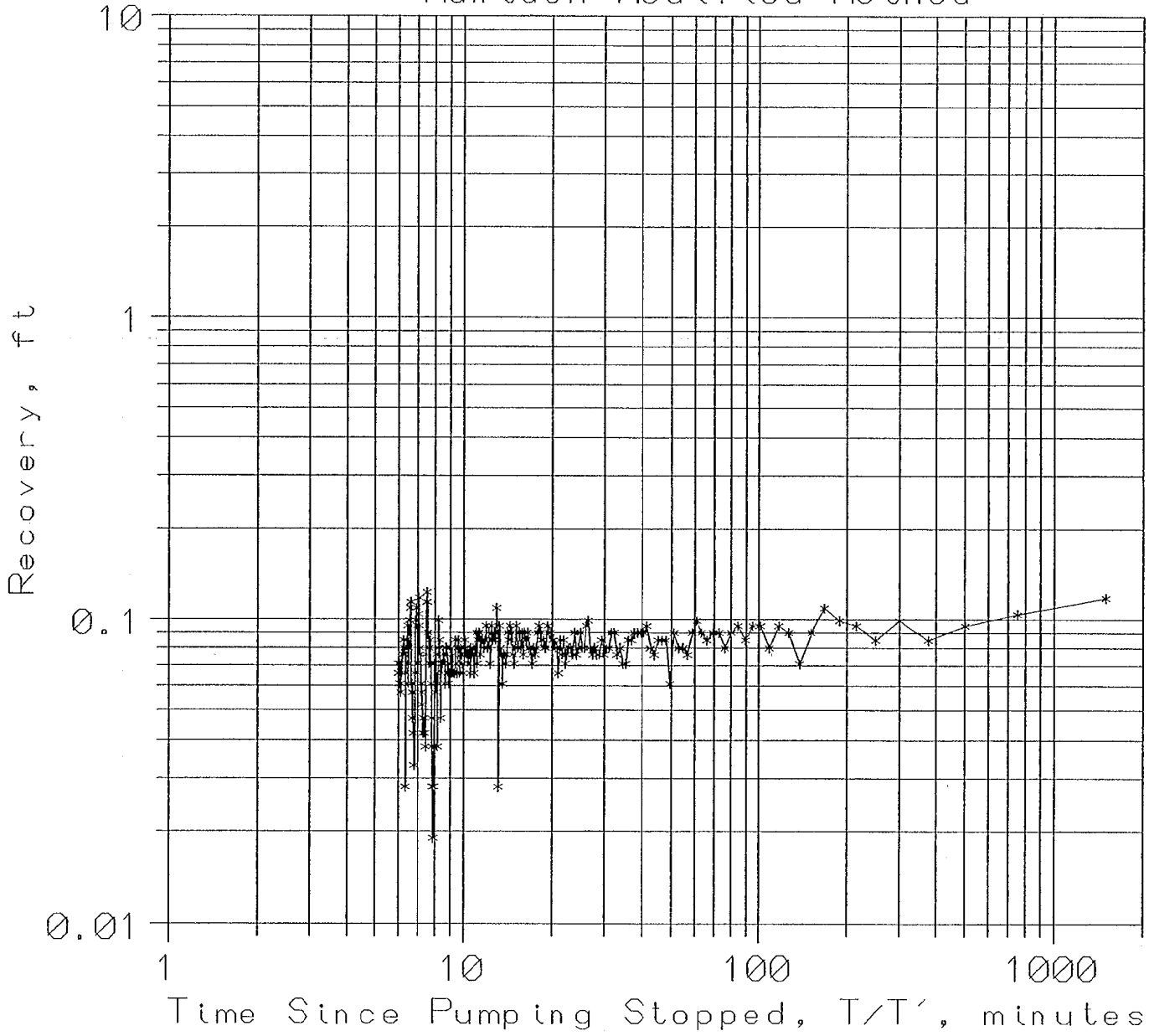

Camp Allen Landfill RI/FS
Monitoring Well B-20W Drawdown
Hantush Modified Method
Drawdown, ft
1
0.1
0.01
0.001
1
10
100
1000
Time Since Pumping Began, minutes

Camp Allen Landfill RI/FS
Monitoring Well B-20W Recovery
Hantush Modified Method




Camp Allen Landfill RI/FS
Monitoring Well B-20WSS Drawdown
Hantush Modified Method
10
1
0.1
0.01
Drawdown, ft
1
10
100
1000
Time Since Pumping Began, minutes

Camp Allen Landfill RI/FS
Monitoring Well B-20WSS Recovery
Hantush Modified Method



Attachment K-4
Pump Test Calculations -
Walton's Type Curve Method for Leaky Aquifers

Camp Allen Landfill RI/FS

25 Hr Pump Test Calculation Results

Transmissivity and Storativity via Walton's Type Curve Method for Leaky Aquifers

Monitoring Well #	Radial Distance From Pumping Well (ft)	Drawdown Phase			Recovery Phase		
		T (GPD/ft)	S	Leakance (Days)	T (GPD/ft)	S	Leakance (Days)
Shallow Wells - Screened in the surficial unconfined aquifer							
A-MW8A	21.76	NR	NR	NR	NR	NR	NR
A-MW9A	110.1	NR	NR	NR	NR	NR	NR
A-MW10A	236.59	27215	4.06E-03	3.214	128073	1.70E-04	0
B-20W	241.1	NR	NR	NR	NR	NR	NR
B-20WSS	239.16	NR	NR	NR	NR	NR	NR
Middle Depth Wells - screened in the middle of the Yorktown Aquifer							
A-MW8B **	0.167	NR	NR	NR	25615	7.7E+02	0
A-P8	11.64	6967	1.53E-03	0.486	24883	1.64E-01	0
A-MW9B	117.75	21772	1.22E-04	113	25615	3.02E-03	0
A-MW10B	243.49	22918	5.17E-04	28.74	27215	8.86E-04	96.82
Deep Well - screened at the bottom of the Yorktown Aquifer							
A-MW9C	121.16	12807	6.48E-03	4.585	11612	6.17E-04	5.057

Notes:

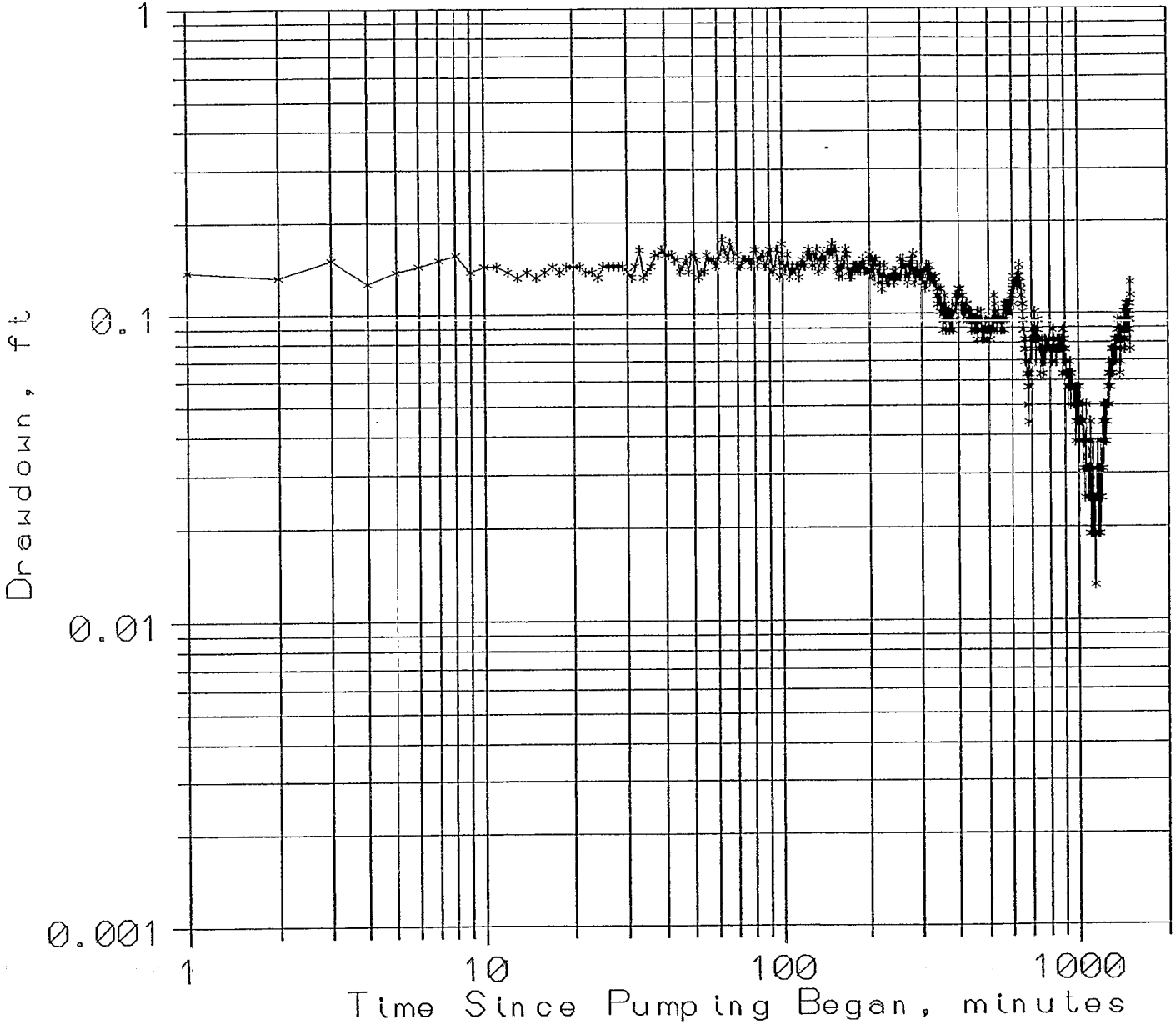
NR - No response to the pumping well

N/A - Not Applicable

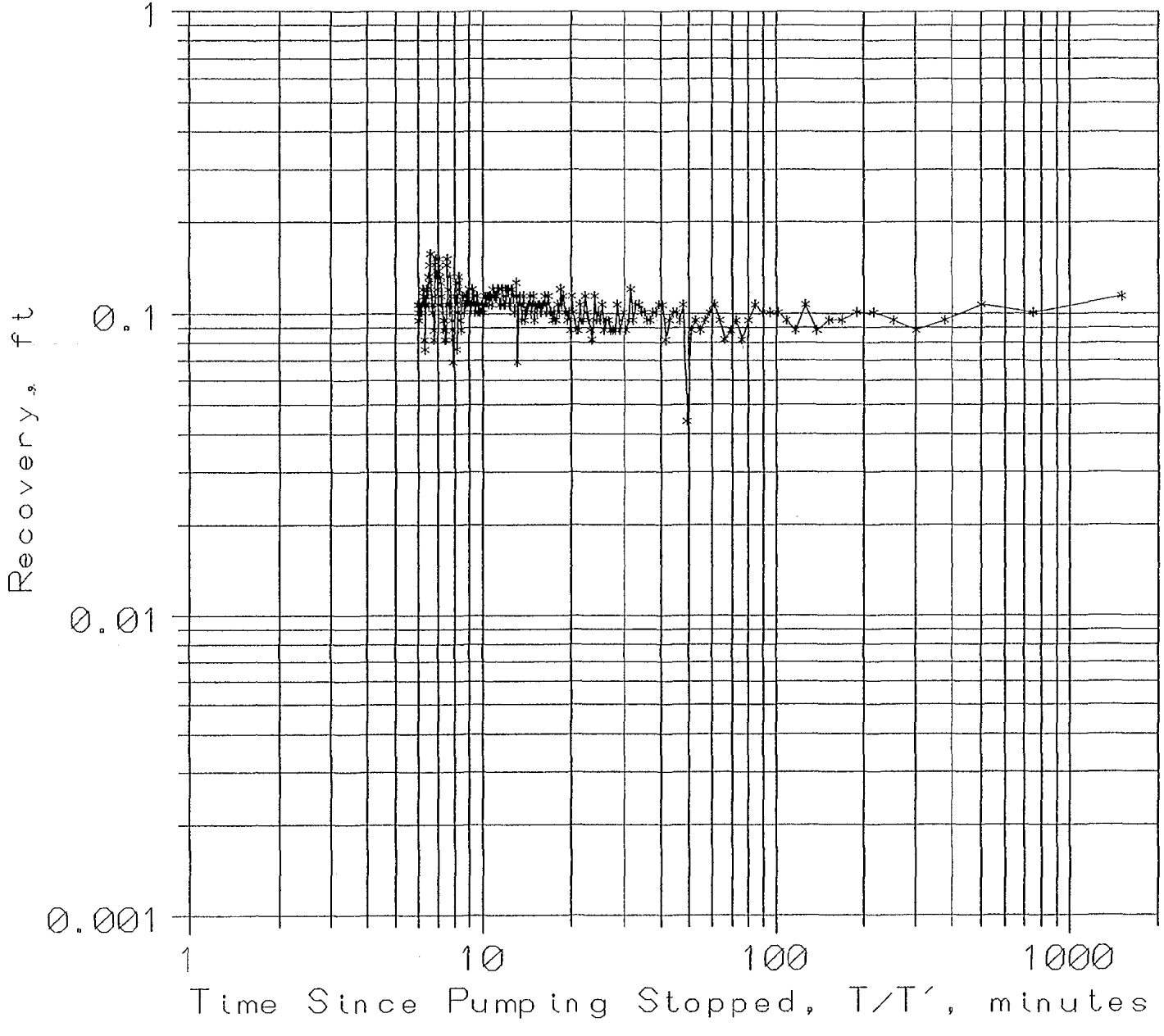
** - Pumping Well

* - Unrealistic result; storativity cannot be greater than one.

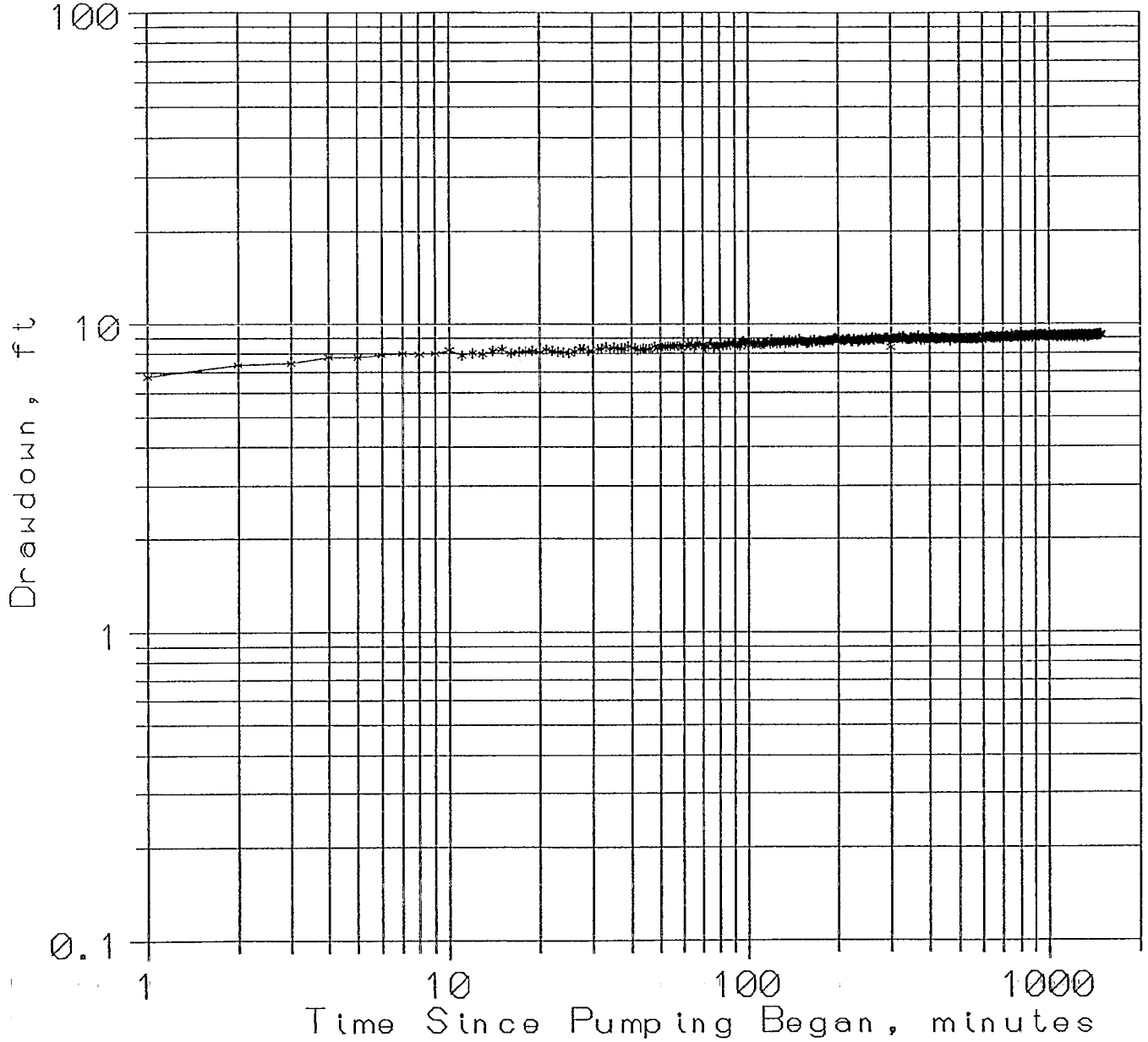
Camp Allen Landfill RI/FS
Monitoring Well A-MW8A Drawdown
Walton's Type Curve Method for Leaky Aquifers



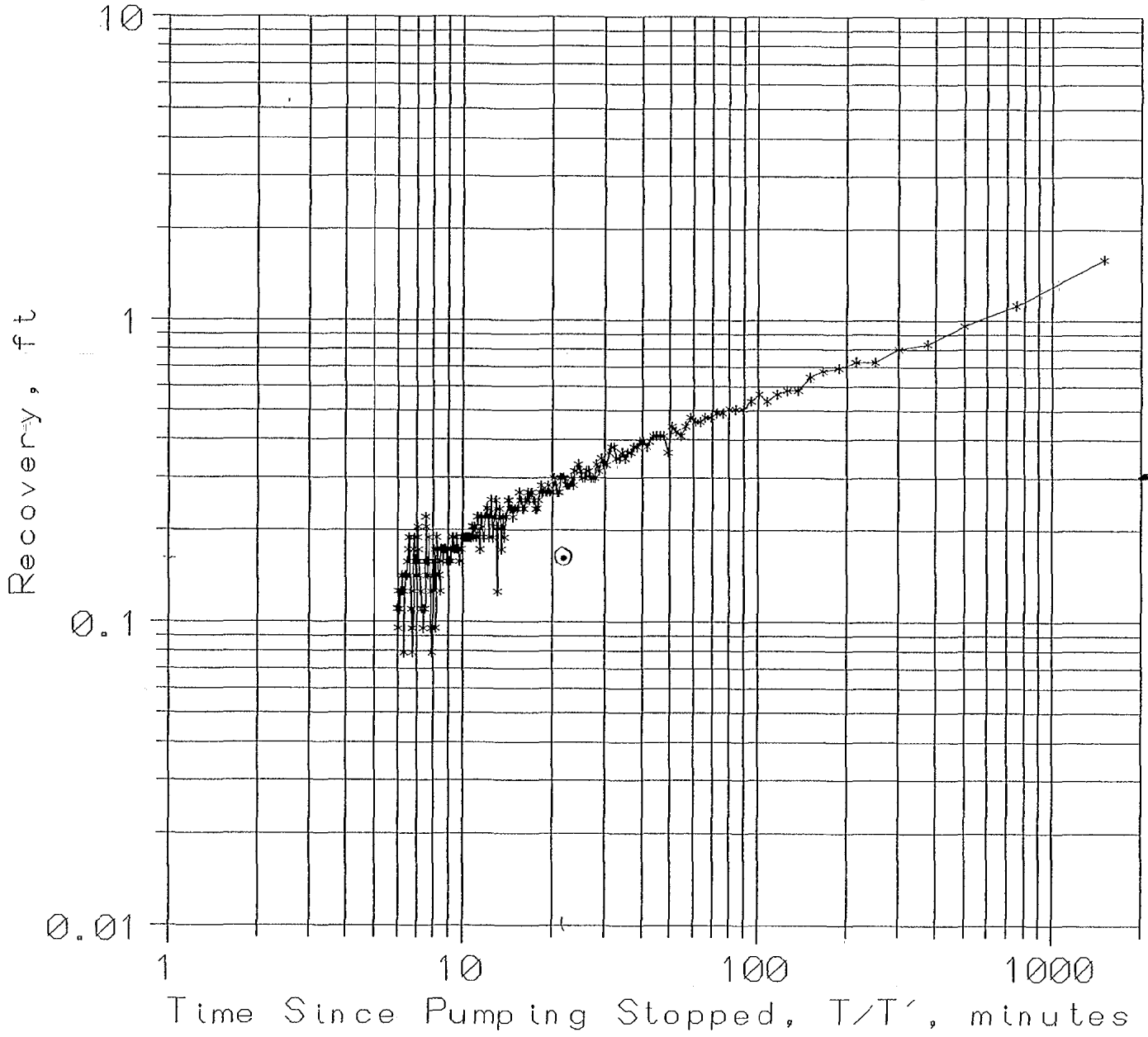
Camp Allen Landfill RI/FS
Monitoring Well A-MW8A Recovery
Walton's Type Curve Method for Leaky Aquifers



Camp Allen Landfill RI/FS
Monitoring Well A-MW8B Drawdown
Walton's Type Curve Method for Leaky Aquifers



Camp Allen Landfill RI/FS
Monitoring Well A-MW8B Recovery
Walton's Type Curve Method for Leaky Aquifers



$r/B = 0$

$W(u, r/B) = 1.0$

$1/u = 10$

$t = 22.5$ mins

$s = 0.17$ ft

$Q = 38$ GPM

$r = 0.167$ ft

$$T = \frac{Q\,W(u, r/B)}{4\pi s}$$

$$= \frac{38\ \text{GPM}\,(1440\ \text{min/DAY})(1.0)}{4\pi\,(0.17\ \text{ft})}$$

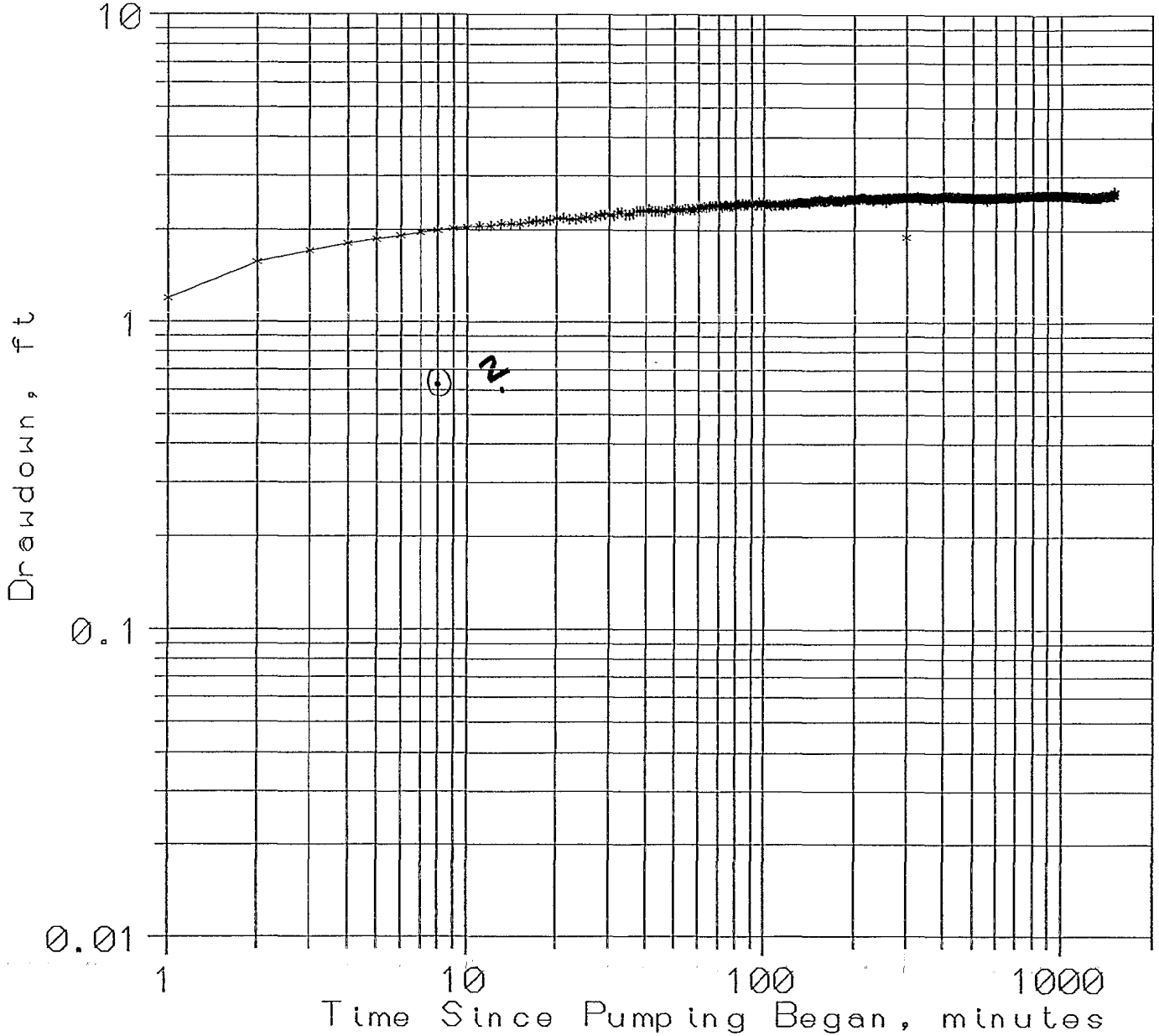
$$T = 25{,}615\ \text{GPD/ft}$$

$$S = \frac{4Tt}{r^2\,(1/u)}$$

$$= \frac{4\,(25{,}615\ \text{GPD/ft})(22.5\ \text{min})}{(0.167\ \text{ft})^2\,(10)(1440\ \text{min/DAY})(7.48\ \text{GPD/ft}^3)}$$

$$S = 767$$

Camp Allen Landfill RI/FS
Monitoring Well A-P8 Drawdown
Walton's Type Curve Method for Leaky Aquifers



$r/B = 0.2$

$W(u, r/B) = 1.0$

$1/u = 100$

$t = 8$ min

$s = 0.625$ ft

$Q = 38$ GPM

$r = 11.64$ ft

$$T = \frac{Q\,W(u, r/B)}{4\pi s}$$

$$= \frac{(38\ \text{GPM})(1.0)(1440\ \text{min/day})}{4\pi(0.625\ \text{ft})}$$

$$T = 6967\ \text{GPD/ft}$$

$$S = \frac{4Tt}{r^2(1/u)}$$

$$= \frac{4(6967\ \text{GPD/ft})(8\ \text{min})}{(11.64\ \text{ft})^2(100)(7.48\ \text{gal/ft}^3)(1440\ \text{min/day})}$$

$$S = 1.53 \times 10^{-3}$$

$$\frac{r}{B} = 0.2$$

$$B = \frac{11.64\ \text{ft}}{0.2}$$

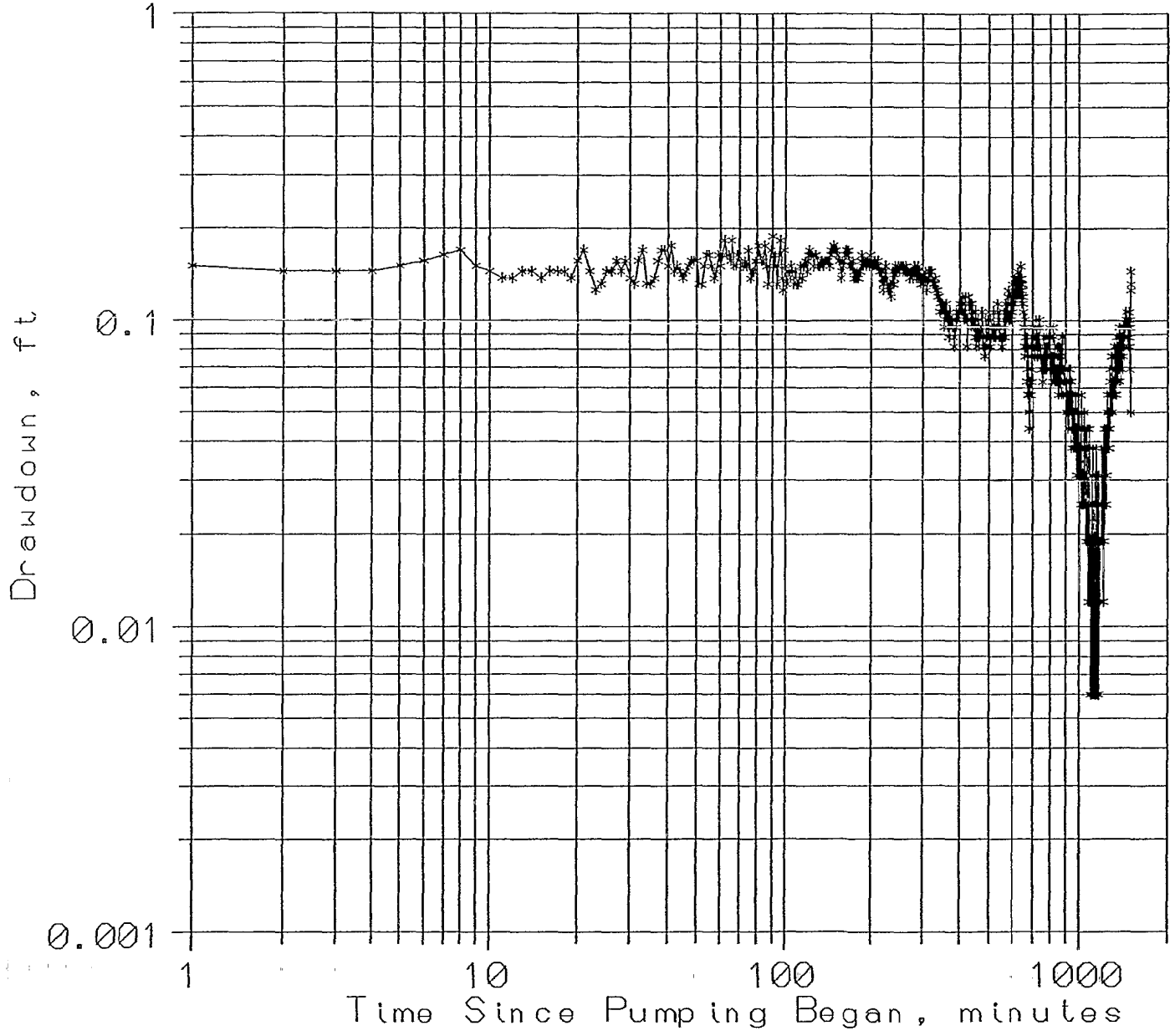
$$B = 58.2$$

$$\text{LEAKANCE} = \frac{B^2}{T}$$

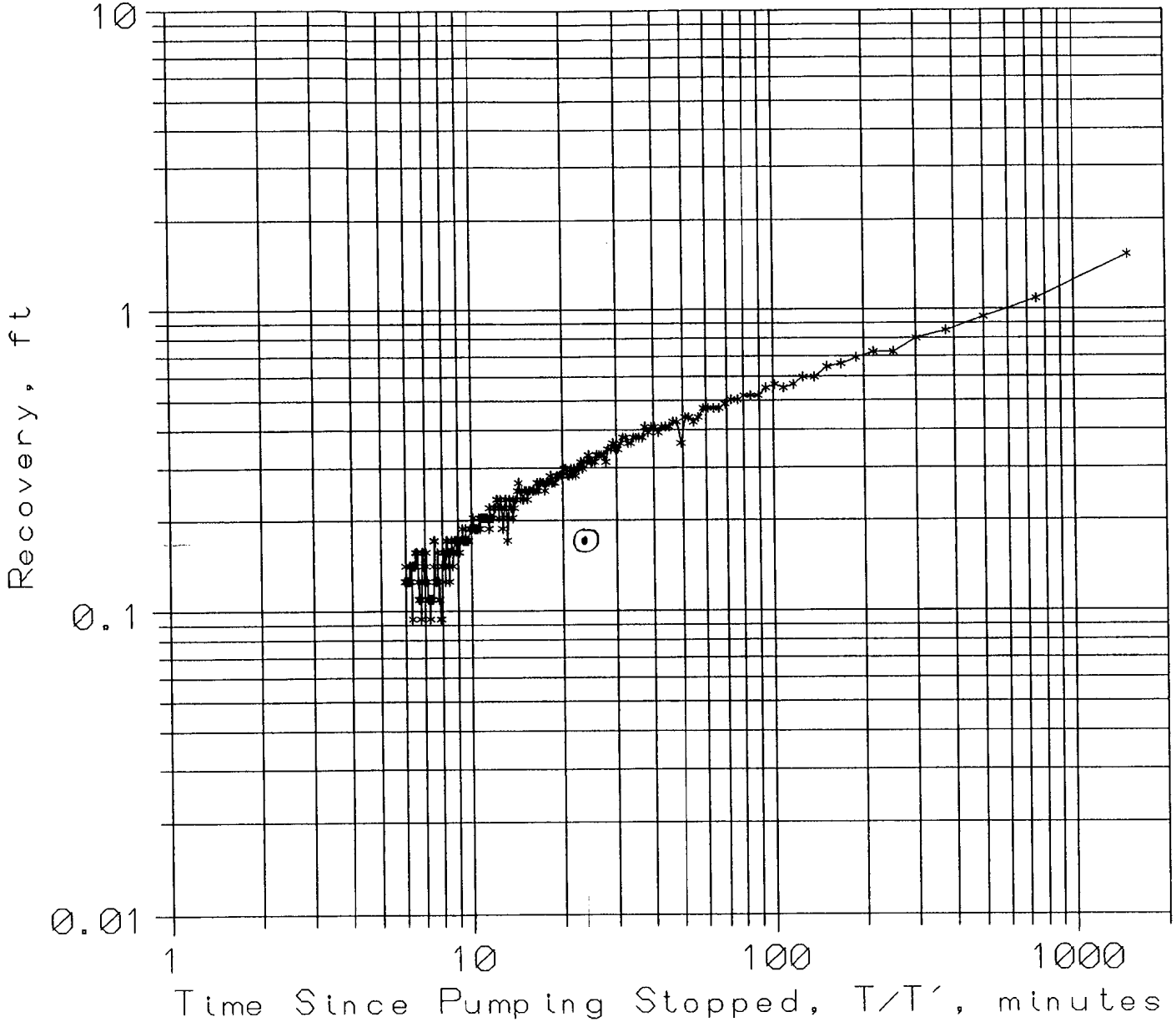
$$= \frac{(58.2)^2}{6967}$$

$$= 0.486\ \text{DAYS}$$

Camp Allen Landfill RI/FS
Monitoring Well A-MW9A Drawdown
Walton's Type Curve Method for Leaky Aquifers



Camp Allen Landfill RI/FS
Monitoring Well A-P8 Recovery
Walton's Type Curve Method for Leaky Aquifers



$r/B = 0$

$W(u, r/B) = 1$

$1/u = 10$

$t = 24$ mins

$s = 0.175$ ft

$Q = 38$ GPM

$r = 11.64$ ft

$$T = \frac{Q\,W(u, r/B)}{4\pi s}$$

$$= \frac{38\ \text{gpm}\,(1)(1440\ \text{min/day})}{4\pi(0.175\ \text{ft})}$$

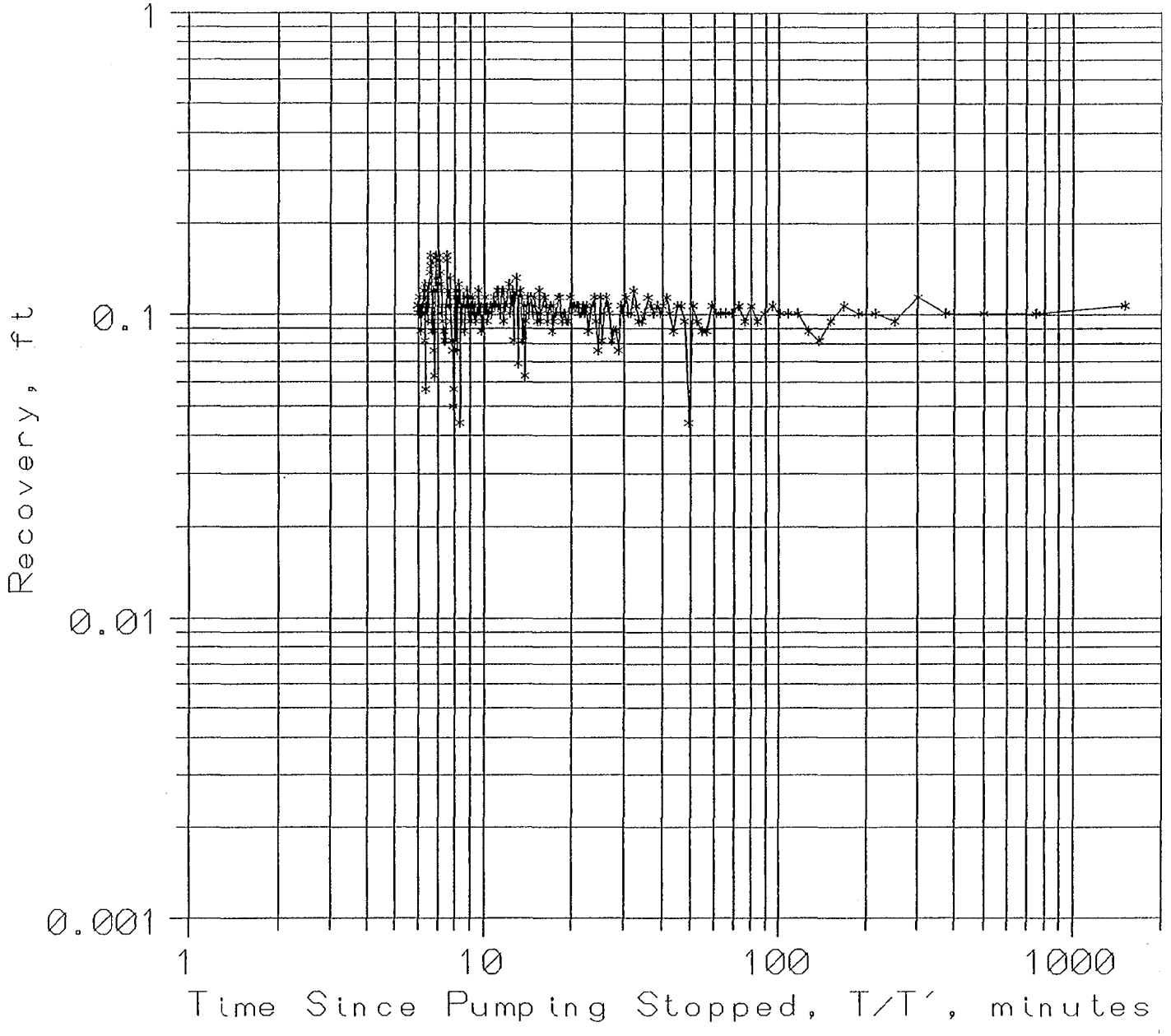
$$T = 24{,}883\ \text{gpd/ft}$$

$$S = \frac{4Tt}{r^2(1/u)}$$

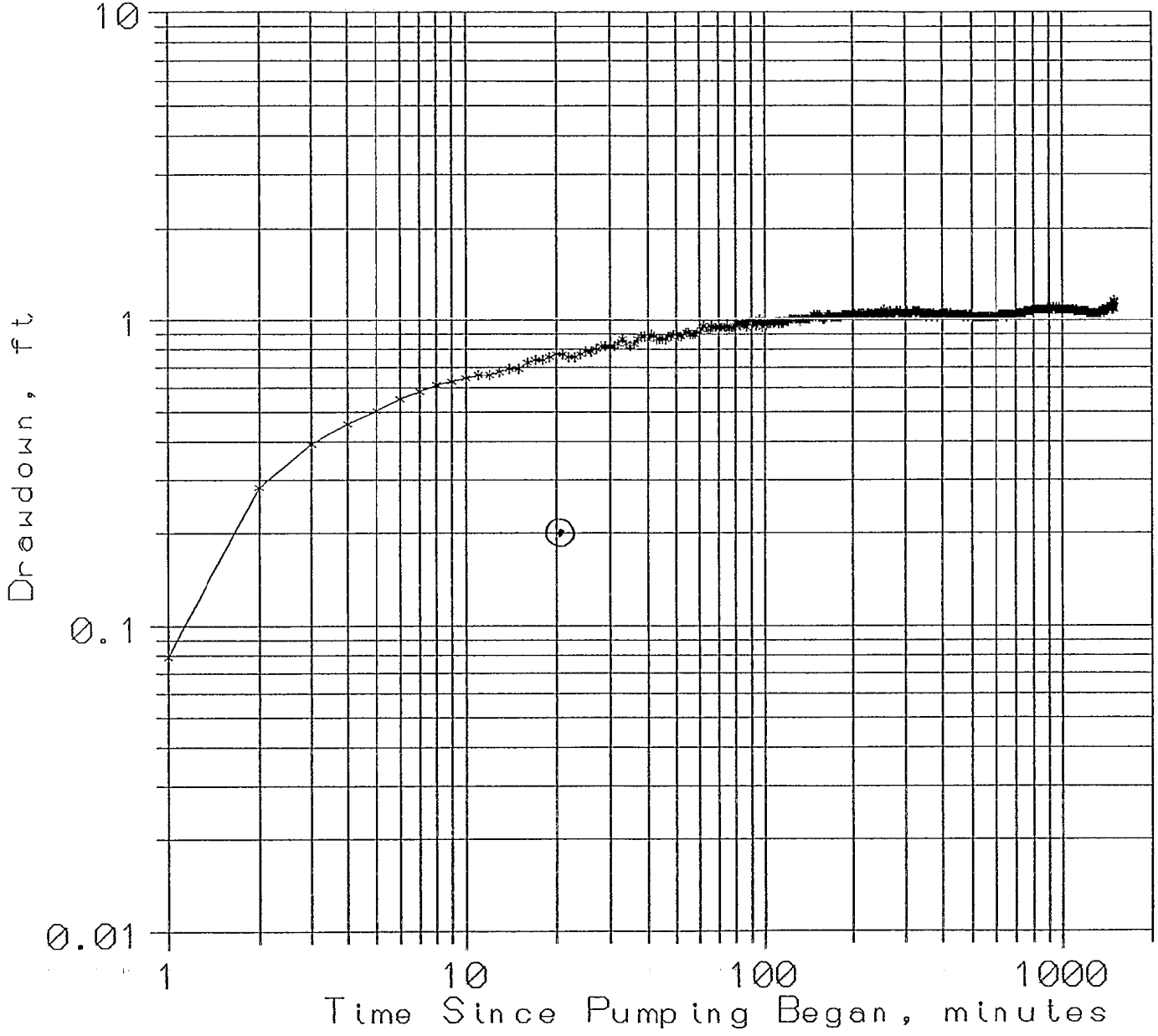
$$= \frac{4(24{,}883\ \text{gpd/ft})(24\ \text{min})}{(11.64\ \text{ft})^2(10)(7.48\ \text{gal/ft}^3)(1440\ \text{min/day})}$$

$$S = 1.64 \times 10^{-1}$$

Camp Allen Landfill RI/FS
Monitoring Well A-MW9A Recovery
Walton's Type Curve Method for Leaky Aquifers



Camp Allen Landfill RI/FS
Monitoring Well A-MW9B Drawdown
Walton's Type Curve Method for Leaky Aquifers



$r/B = 0.075$

$W(u, r/B) = 1.0$

$1/u = 100$

$t = 21$ mins.

$s = 0.2$ ft

$Q = 38$ GPM

$r = 117.75$ ft

$$T = \frac{QW(u, r/B)}{4\pi s}$$

$$= \frac{(38\ \text{gpm})(1.0)(1440\ \text{min/day})}{4(\pi)(0.2\ \text{ft})}$$

$$T = 21{,}772\ \text{GPD/ft}$$

$$S = \frac{4Tt}{r^2(1/u)}$$

$$= \frac{4(21.772\ \text{gpd/ft})(21\ \text{mins})}{(117.75\ \text{ft})^2(100)(7.48\ \text{gal/ft}^3)(1440\ \text{min/day})}$$

$$S = 1.22 \times 10^{-4}$$

$$\frac{r}{B} = 0.075$$

$$B = \frac{117.75}{0.075}$$

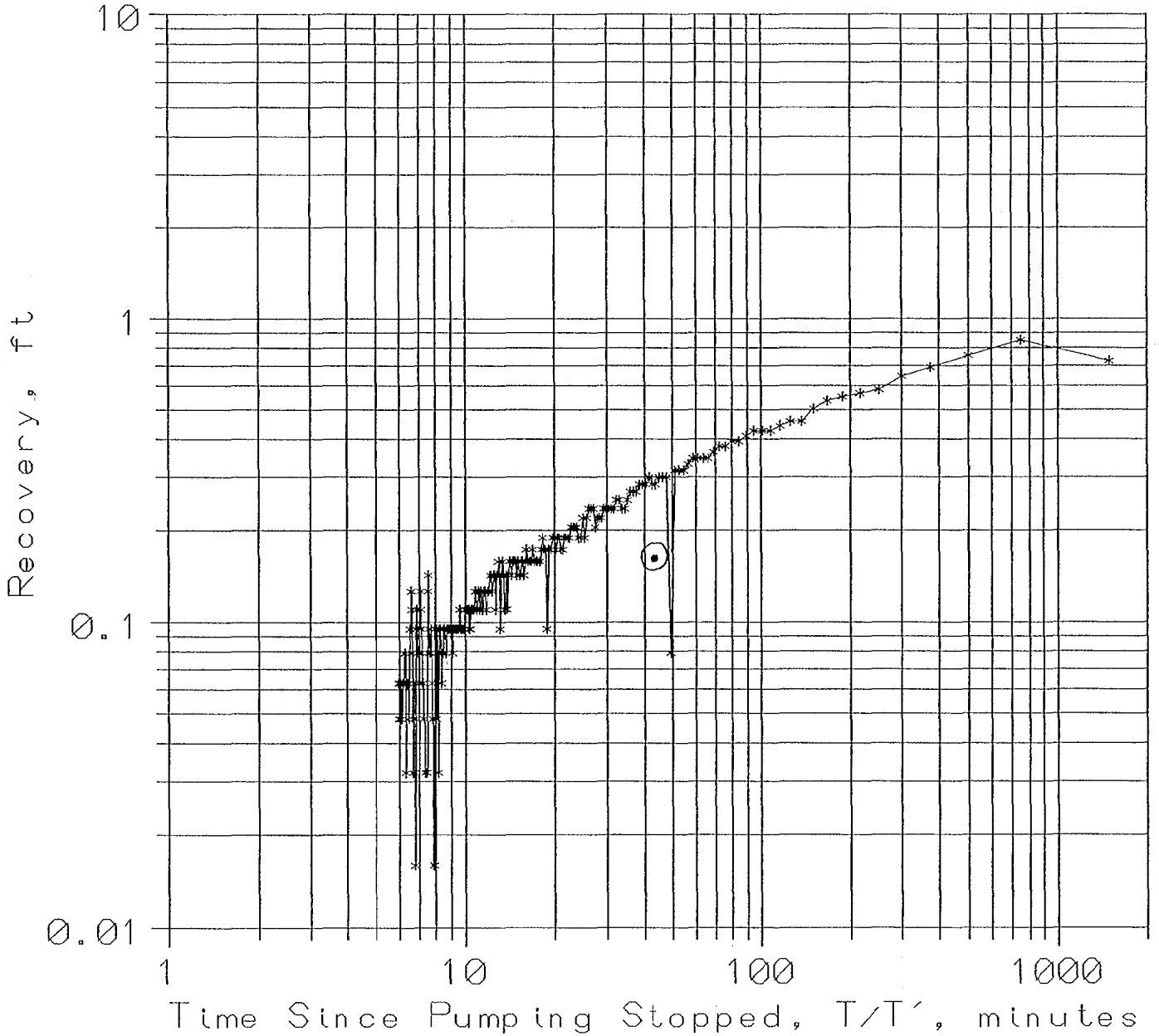
$$B = 1570$$

$$\text{LEAKANCE} = \frac{B^2}{T}$$

$$= \frac{(1570)^2}{21\,772}$$

$$= 113\ \text{DAYS}$$

Camp Allen Landfill RI/FS
Monitoring Well A-MW9B Recovery
Walton's Type Curve Method for Leaky Aquifers



$r/B = 0$

$W(u, r/B) = 1.0$

$1/u = 10$

$t = 44$ mins

$s = 0.17$ ft

$Q = 38$ GPM

$r = 117.75$ ft

$$T = \frac{QW(u, r/B)}{4\pi s}$$

$$= \frac{(38\ \text{GPM})(1.0)(1440\ \text{min/day})}{4(\pi)(0.17\ \text{ft})}$$

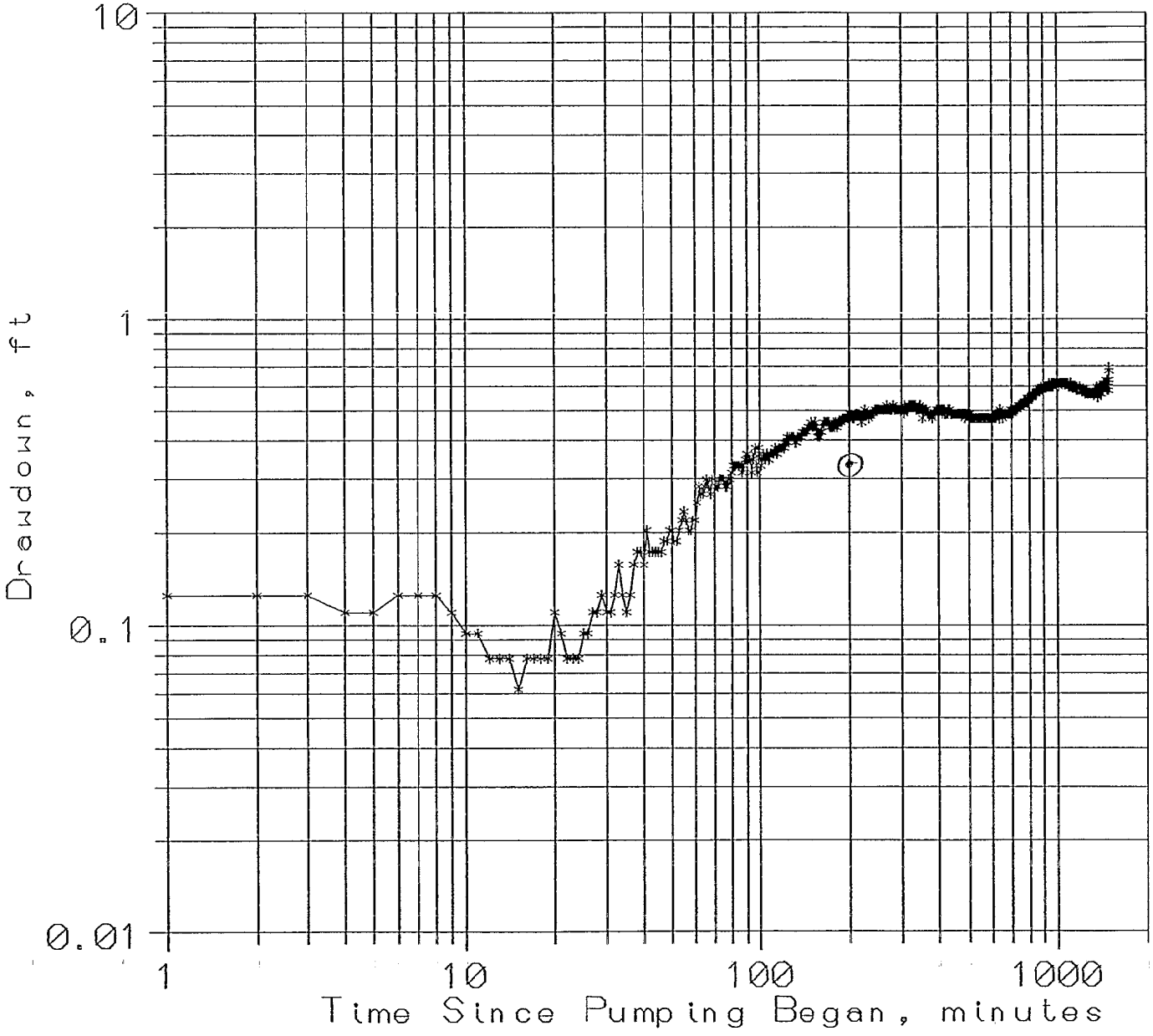
$$T = 25{,}615\ \text{GPD/ft}$$

$$S = \frac{4Tt}{r^2(1/u)}$$

$$= \frac{4(25{,}615\ \text{GPD/ft})(44\ \text{mins})}{(117.75\ \text{ft})^2(10)(7.48\ \text{GAL/ft}^3)(1440\ \text{min/DAY})}$$

$$S = 3.02 \times 10^{-3}$$

Camp Allen Landfill RI/FS
Monitoring Well A-MW9C Drawdown
Walton's Type Curve Method for Leaky Aquifers



$r/B = 0.5$

$W(u, r/B) = 1.0$

$1/u = 10$

$t = 200$ mins

$s = 0.34$ ft 0.33

$Q = 38$ GPM

$r = 121.16$ ft

$$T = \frac{QW(u, r/B)}{4\pi s}$$

$$= \frac{38 \text{ GPM}(1.0)(1440 \text{ min/day})}{4\pi(0.34 \text{ ft})}$$

$$T = 12{,}807 \text{ GPD/ft}$$

$$S = \frac{4Tt}{r^2(1/u)}$$

$$= \frac{4(12{,}807 \text{ GPD/ft})(200 \text{ min})}{(121.16 \text{ ft})^2(10)(7.48 \text{ GAL/ft}^3)(1440 \text{ min/day})}$$

$$S = 6.48 \times 10^{-3}$$

$$\frac{r}{B} = 0.5$$

$$B = \frac{121.16}{0.5}$$

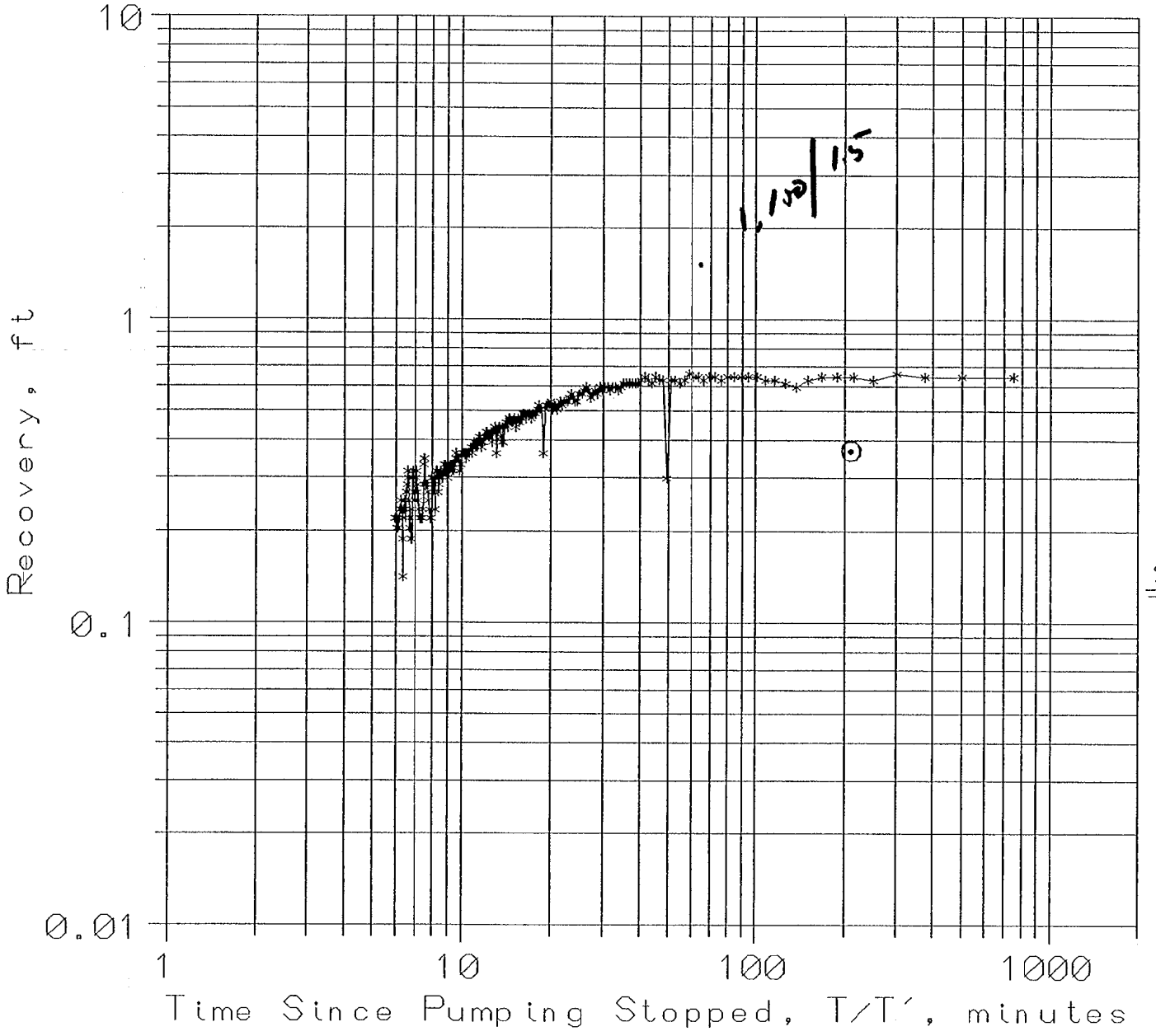
$$B = 242.32$$

$$\text{LEAKANCE} = \frac{B^2}{T}$$

$$= \frac{(242.32)^2}{12{,}807}$$

$$= 4.585 \text{ DAYS}$$

Camp Allen Landfill RI/FS
Monitoring Well A-MW9C Recovery
Walton's Type Curve Method for Leaky Aquifers



$r/B = 0.5$

$W(u, r/B) = 1.0$

$1/u = 100$

$t = 210$ min

$s = 0.375$ ft

$r = 121.16$ ft

$$T = \frac{Q\,W(u, r/B)}{4\pi s}$$

$$= \frac{(38\ \text{GPM})(1.0)(1440\ \text{min/DAY})}{4(\pi)(0.375\ \text{ft})}$$

$$T = 11{,}612\ \text{GPD/ft}$$

$$S = \frac{4Tt}{r^2(1/u)}$$

$$= \frac{4(11{,}612\ \text{gpd/ft})(210\ \text{min})}{(121.16\ \text{ft})^2(100)(7.48\ \text{gal/ft}^3)(1440\ \text{min/day})}$$

$$S = 6.17 \times 10^{-4}$$

$$\frac{r}{B} = 0.5$$

$$B = \frac{121.16}{0.5}$$

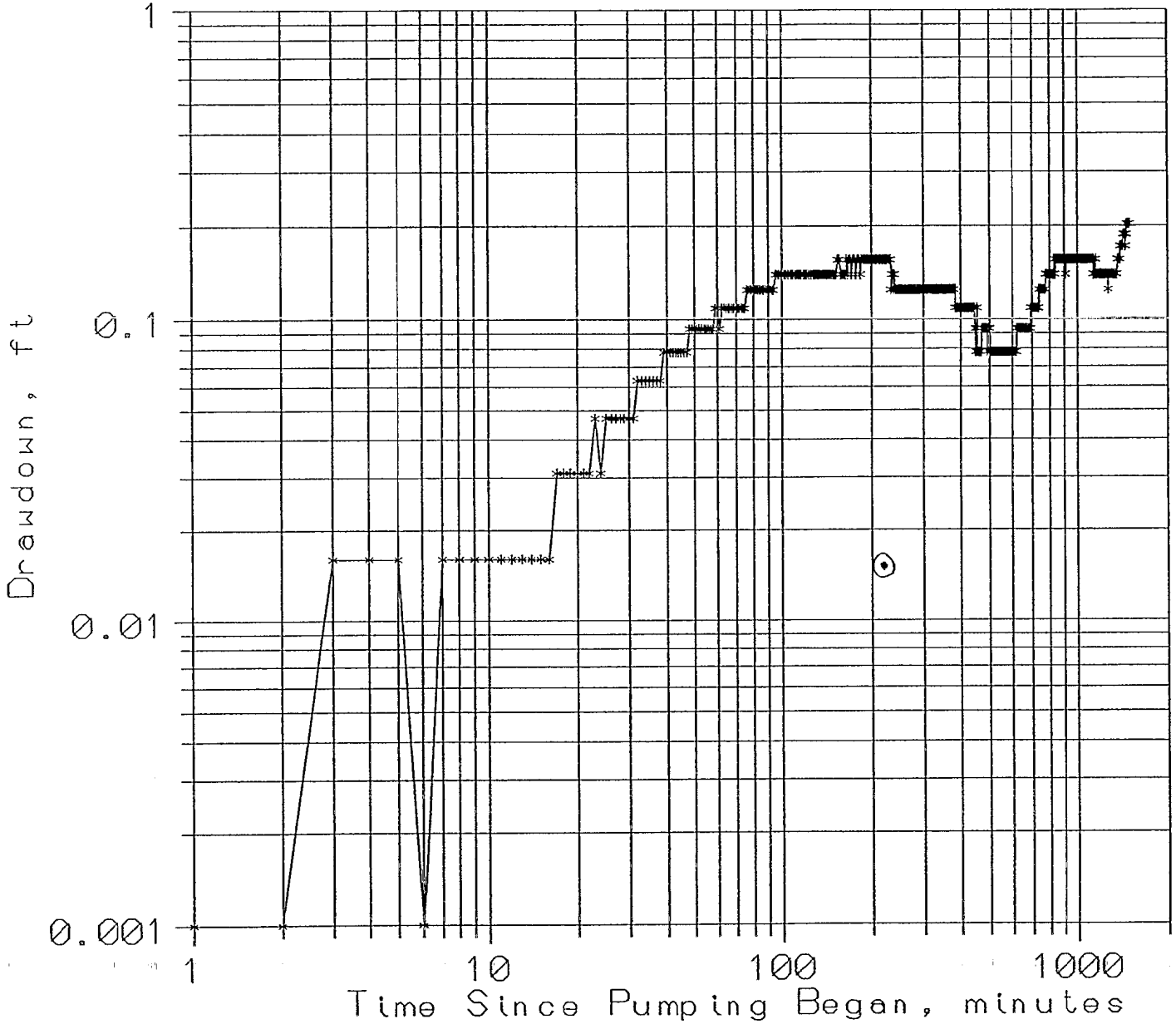
$$B = 242.32$$

$$\text{LEAKANCE} = \frac{B^2}{T}$$

$$= \frac{(242.32)^2}{11{,}612}$$

$$= 5.057\ \text{DAYS}$$

Camp Allen Landfill RI/FS
Monitoring Well A-MW10A Drawdown
Walton's Type Curve Method for Leaky Aquifers



$W(u, r/B) = 0.1$

$1/u = 10$

$t = 225$ mins

$s = 0.016$ ft

$Q = 38$ GPM

$r = 236.59$ ft

$$T = \frac{Q W(u, r/B)}{4 \pi s}$$

$$= \frac{38\ \text{gpm}\,(0.1)(1440\ \text{min/day})}{4(\pi)(0.016\ \text{ft})}$$

$$T = 27{,}215\ \text{GPD/ft}$$

$$S = \frac{4 T t}{r^2 (1/u)}$$

$$= \frac{4(27{,}215\ \text{GPD/ft})(225\ \text{mins})}{(236.59\ \text{ft})^2 (10)(7.48\ \text{GAL/ft}^3)(1440\ \text{min/day})}$$

$$S = 4.06 \times 10^{-3}$$

$$\frac{r}{B} = 0.8$$

$$B = \frac{236.59}{0.8}$$

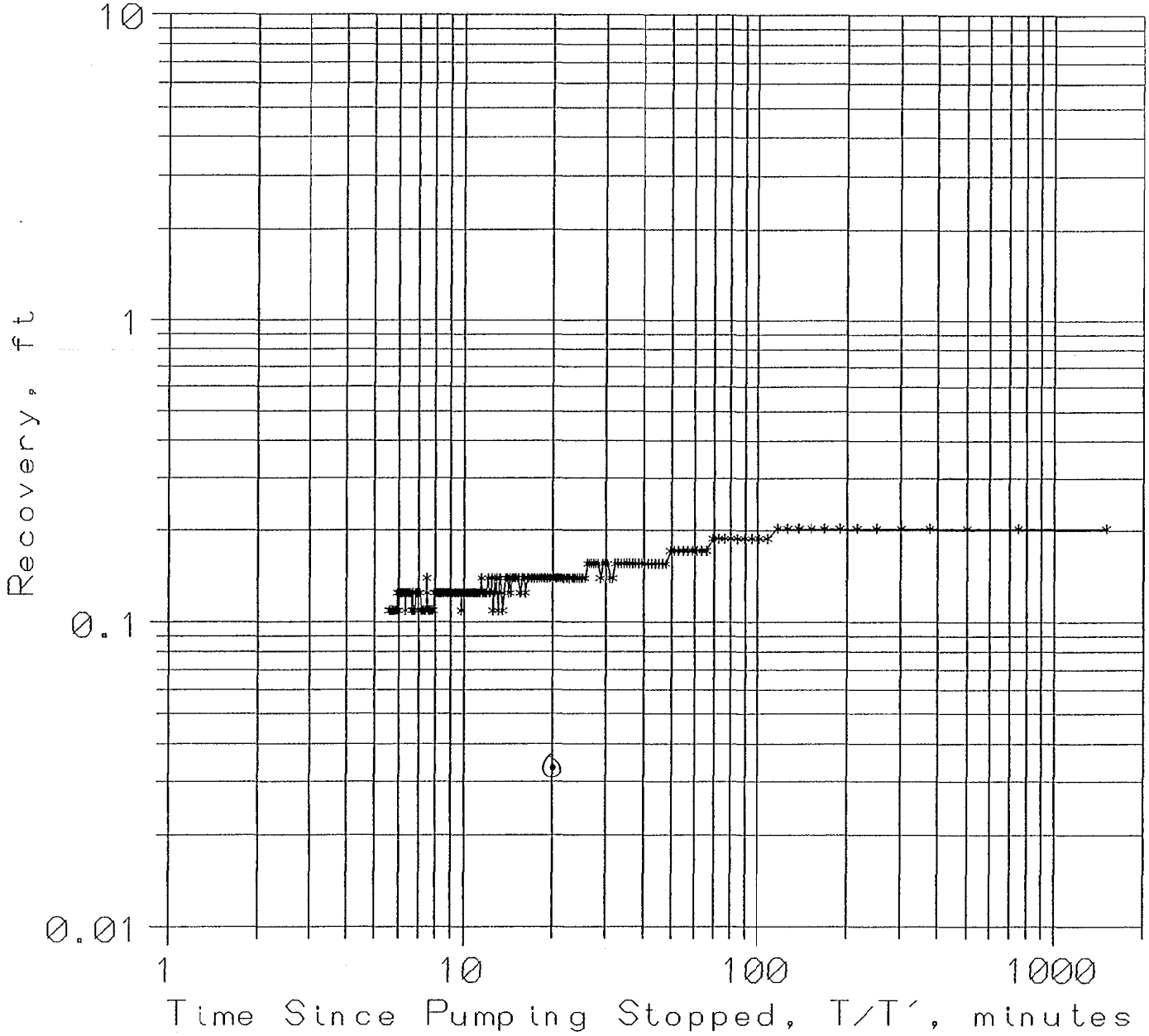
$$B = 295.74$$

$$\text{LEAKANCE} = \frac{B^2}{T}$$

$$= \frac{295.74^2}{27{,}215}$$

$$= 3.214\ \text{DAYS}$$

Camp Allen Landfill RI/FS
Monitoring Well A-MW10A Recovery
Walton's Type Curve Method for Leaky Aquifers



$r/B = 0$

$W(u, r/B) = 1.0$

$1/u = 100$

$t = 20$ min

$s = 0.034$ ft

$Q = 38$ GPM

$r = 236.59$ ft

$$T = \frac{Q\,W(u, r/B)}{4\pi s}$$

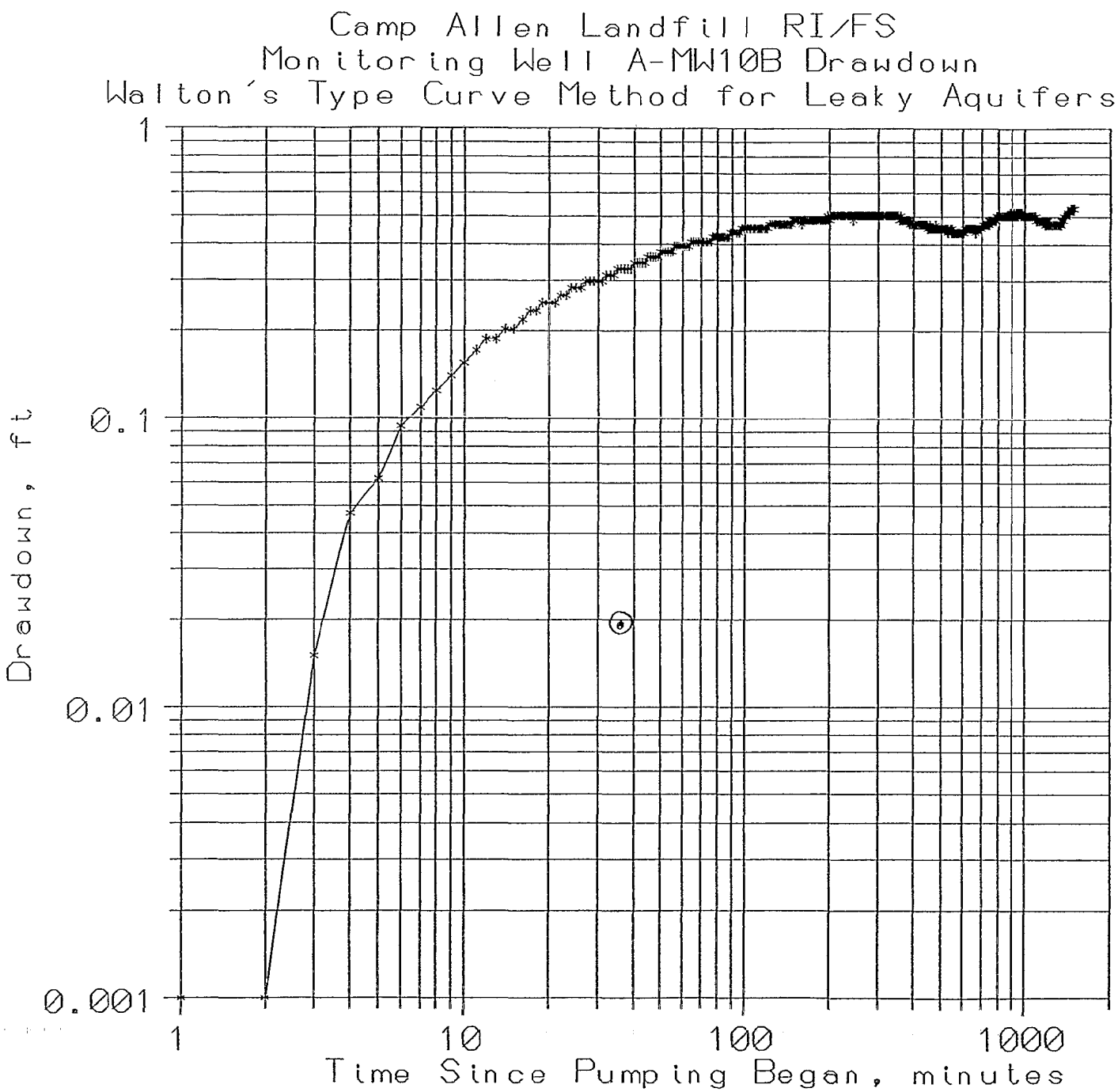
$$= \frac{38\ \text{GPM}(1.0)(1440\ \text{min/DAY})}{4(\pi)(0.034\ \text{ft})}$$

$$T = 128{,}073\ \text{GPD/ft}$$

$$S = \frac{4Tt}{r^2(1/u)}$$

$$= \frac{4(128{,}073\ \text{GPD/ft})(20\ \text{min})}{(236.59\ \text{ft})^2(100)(7.48\ \text{gal/ft}^3)(1440\ \text{min/DAY})}$$

$$S = 1.70 \times 10^{-4}$$



$W(u, r/B) = 0.1$

$1/u = 10$

$t = 36$ mins

$s = 0.019$ ft.

$Q = 38$ GPM

$r = 243.49$ ft

$$T = \frac{QW(u, r/B)}{4\pi s}$$

$$= \frac{(38\ \text{GPM})(0.1)(1440\ \text{min/day})}{4(\pi)(0.019\ \text{ft})}$$

$$T = 22{,}918\ \text{GPD/ft}$$

$$S = \frac{4Tt}{r^2(1/u)}$$

$$= \frac{4(22{,}918\ \text{GPD/ft})(36\ \text{mins})}{(243.49\ \text{ft})^2(10)(7.48\ \text{GAL/ft}^3)(1440\ \text{min/day})}$$

$$S = 5.17 \times 10^{-4}$$

$$\frac{r}{B} = 0.3$$

$$B = \frac{243.49}{0.3}$$

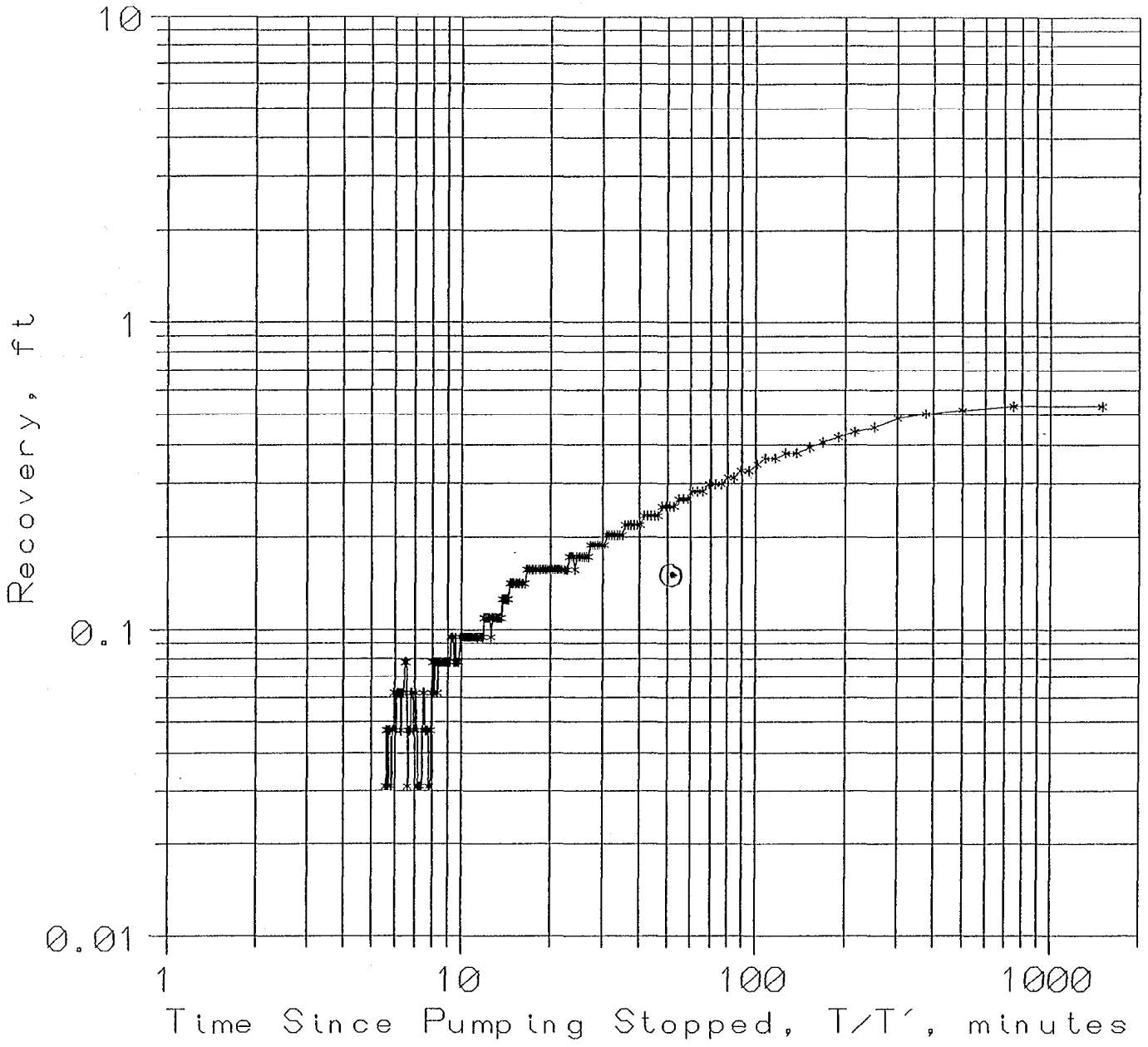
$$B = 811.63$$

$$\text{LEAKANCE} = \frac{B^2}{T}$$

$$= \frac{(811.63)^2}{22{,}918}$$

$$= 28.74\ \text{DAYS}$$

Camp Allen Landfill RI/FS
Monitoring Well A-MW10B Recovery
Walton's Type Curve Method for Leaky Aquifers



$r/B = 0.15$

$W(u, r/B) = 1.0$

$1/u = 10$

$t = 52$ mins

$s = 0.16$ ft

$Q = 38$ GPM

$r = 243.49$ ft.

$$T = \frac{Q\, W(u, r/B)}{4\pi s}$$

$$= \frac{38\ \text{GPM}(1.0)(1440\ \text{min/DAY})}{4(\pi)(0.16\ \text{ft})}$$

$$T = 27{,}215\ \text{GPD/ft}$$

$$S = \frac{4Tt}{r^2(1/u)}$$

$$= \frac{4(27{,}215\ \text{GPD/ft})(52\ \text{mins})}{(243.49\ \text{ft})^2(10)(7.48\ \text{GAL/ft}^3)(1440\ \text{mins/DAY})}$$

$$S = 8.86 \times 10^{-4}$$

$$\frac{r}{B} = 0.15$$

$$B = \frac{243.49}{0.15}$$

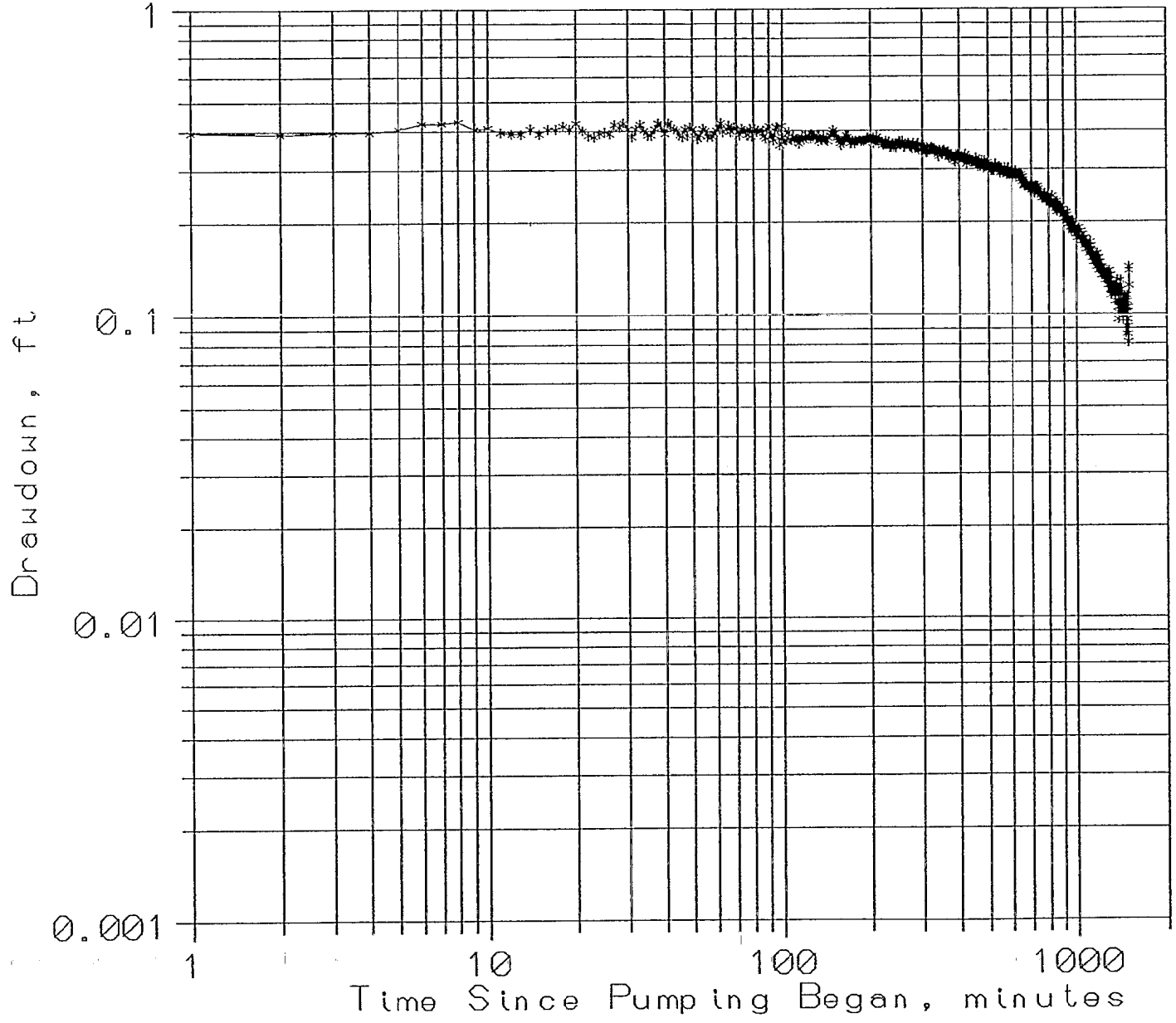
$$B = 1623.27$$

$$\text{LEAKANCE} = \frac{B^2}{T}$$

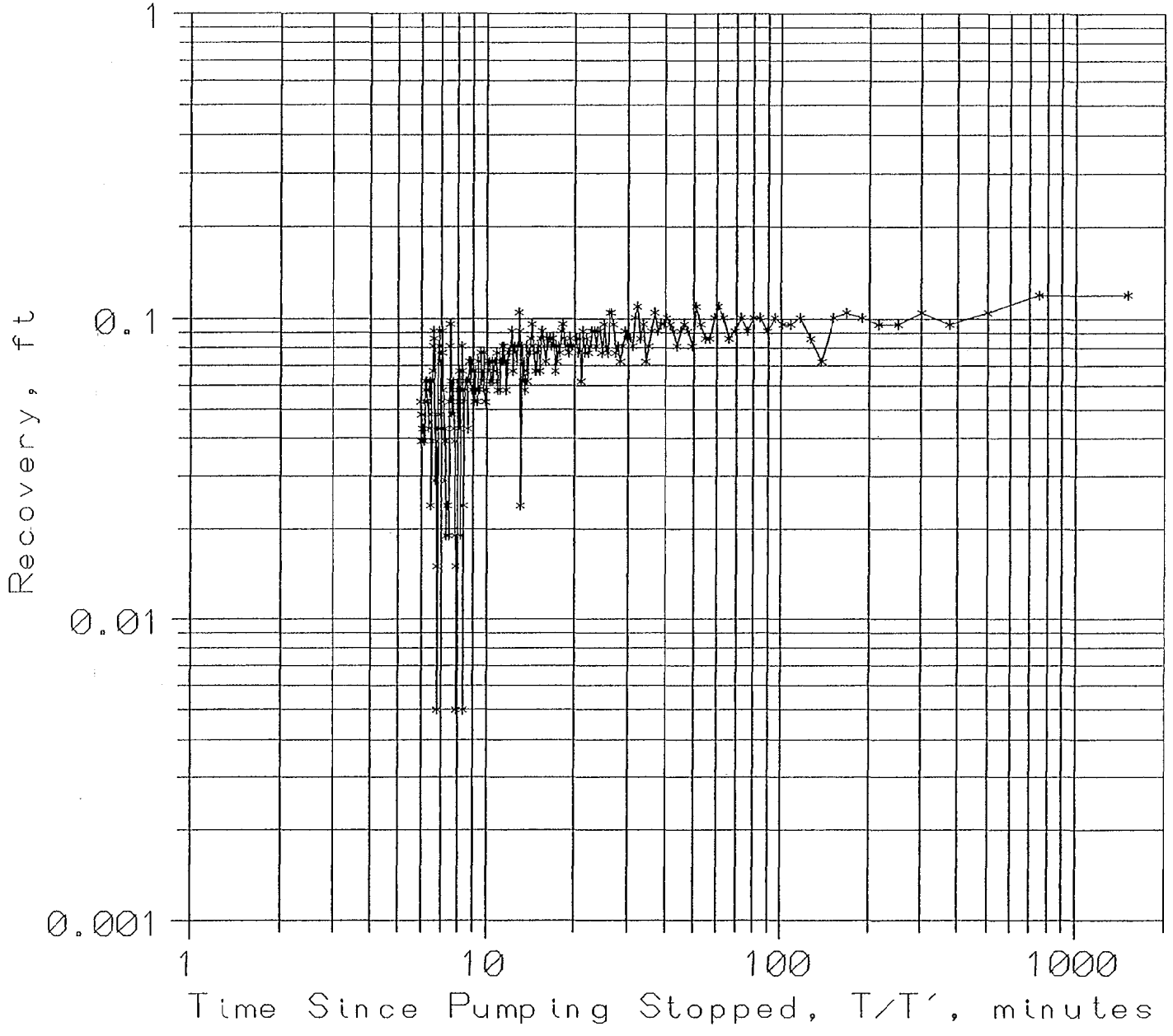
$$= \frac{(1623.27)^2}{27{,}215}$$

$$= 96.82\ \text{DAYS}$$

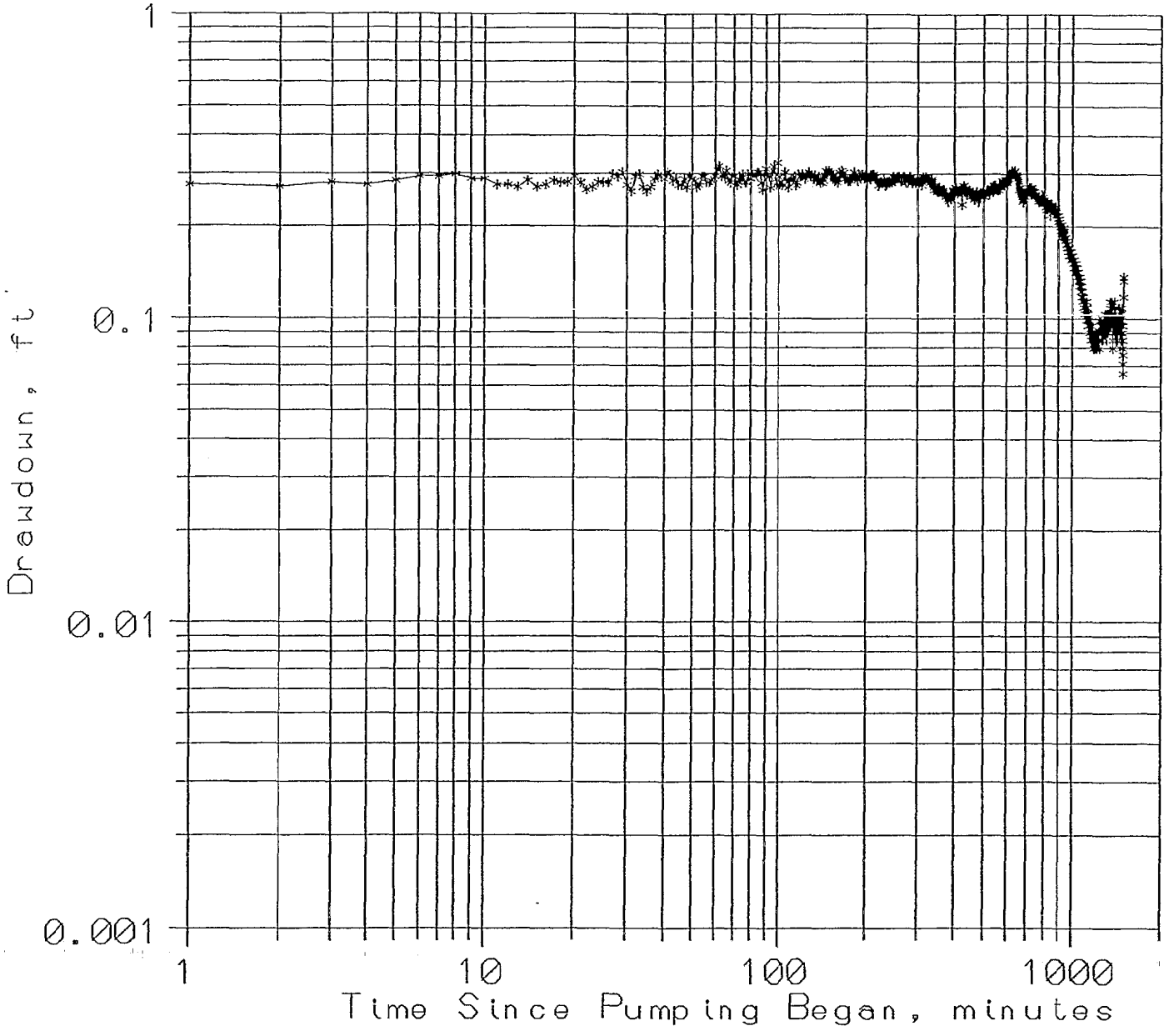
Camp Allen Landfill RI/FS
Monitoring Well B-20W Drawdown
Walton's Type Curve Method for Leaky Aquifers



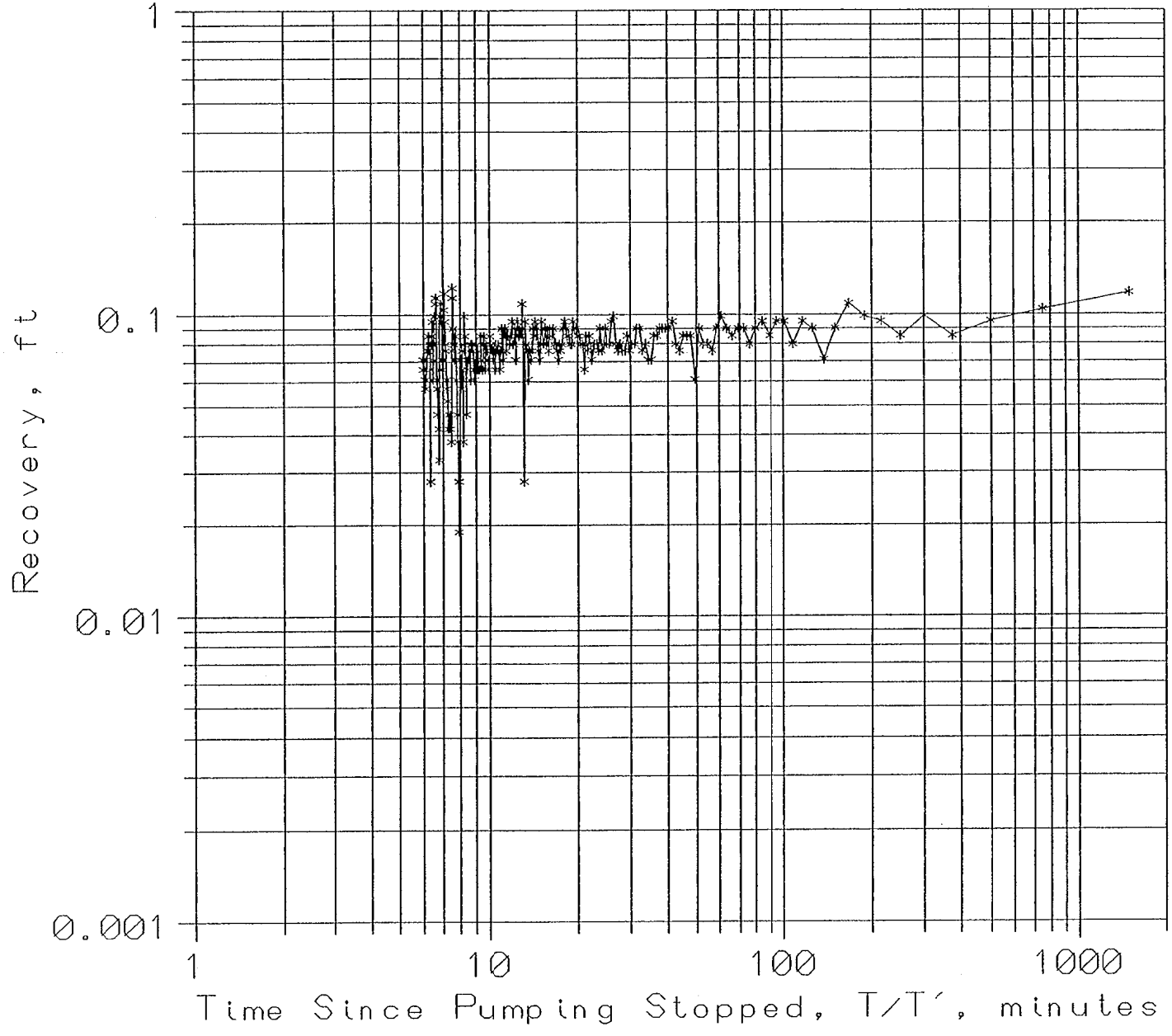
Camp Allen Landfill RI/FS
Monitoring Well B-20W Recovery
Walton's Type Curve Method for Leaky Aquifers



Camp Allen Landfill RI/FS
Monitoring Well B-20WSS Drawdown
Walton's Type Curve Method for Leaky Aquifers



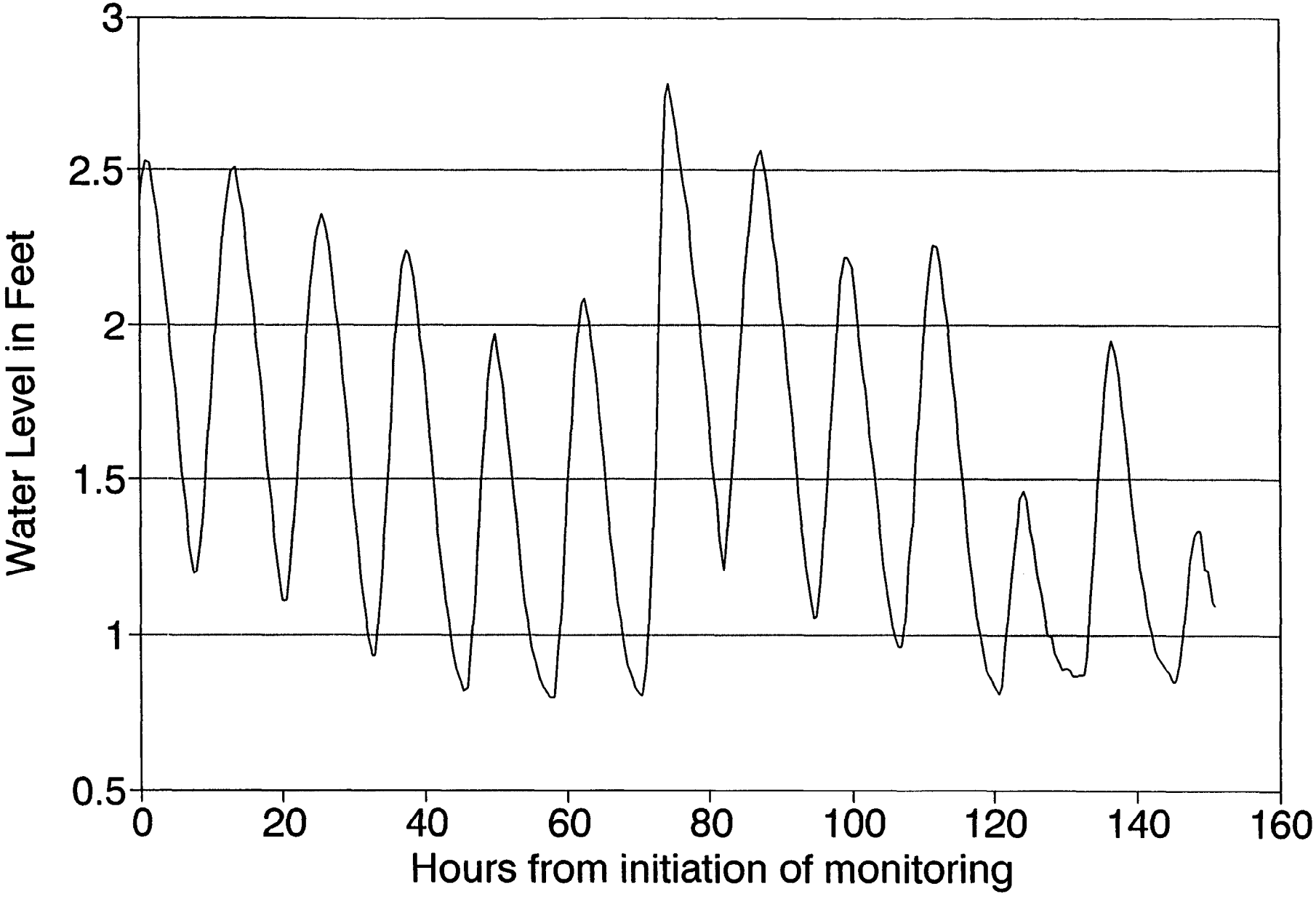
Camp Allen Landfill RI/FS
Monitoring Well B-20WSS Recovery
Walton's Type Curve Method for Leaky Aquifers



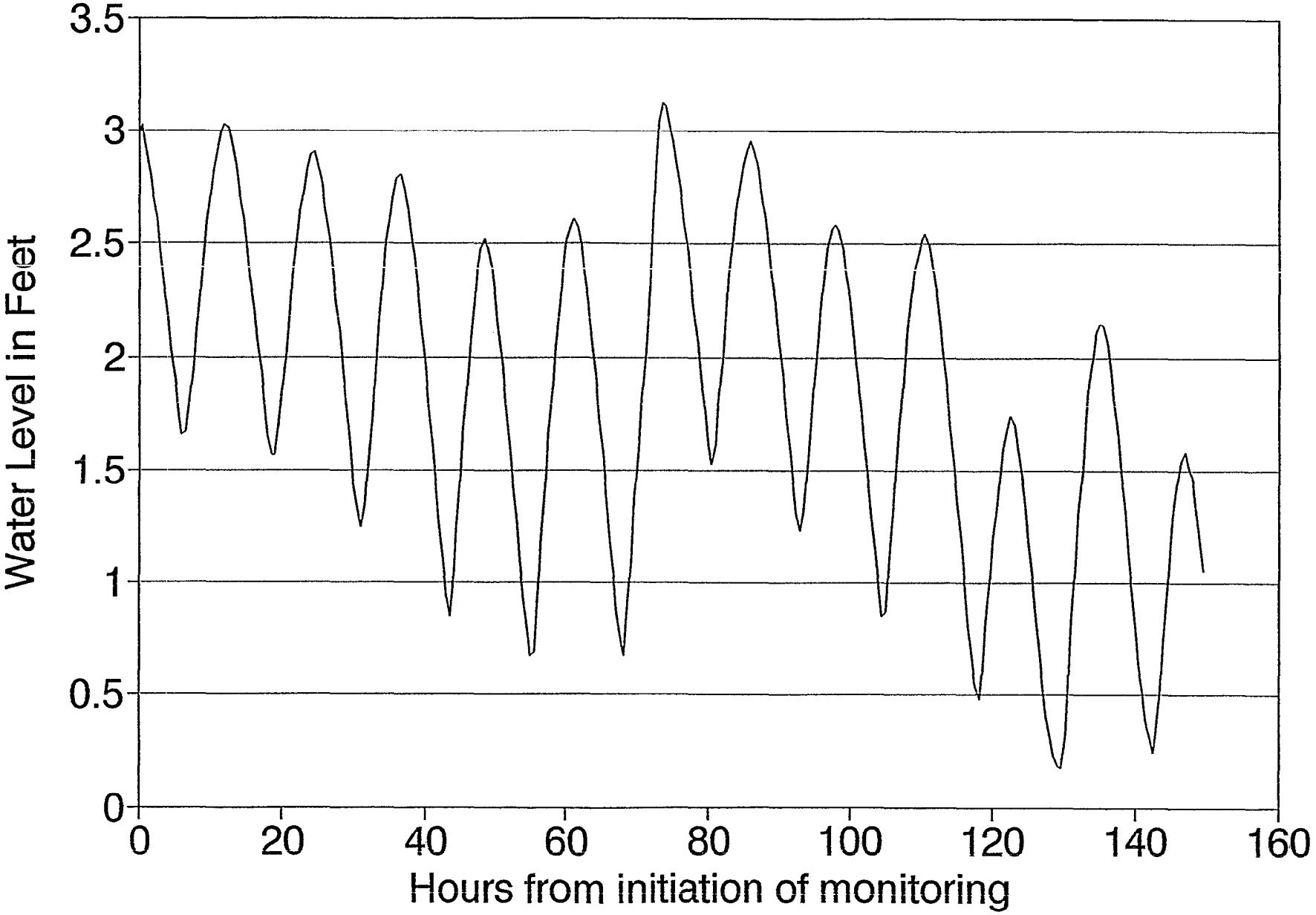
APPENDIX L

APPENDIX L
TIDAL STUDY INFORMATION

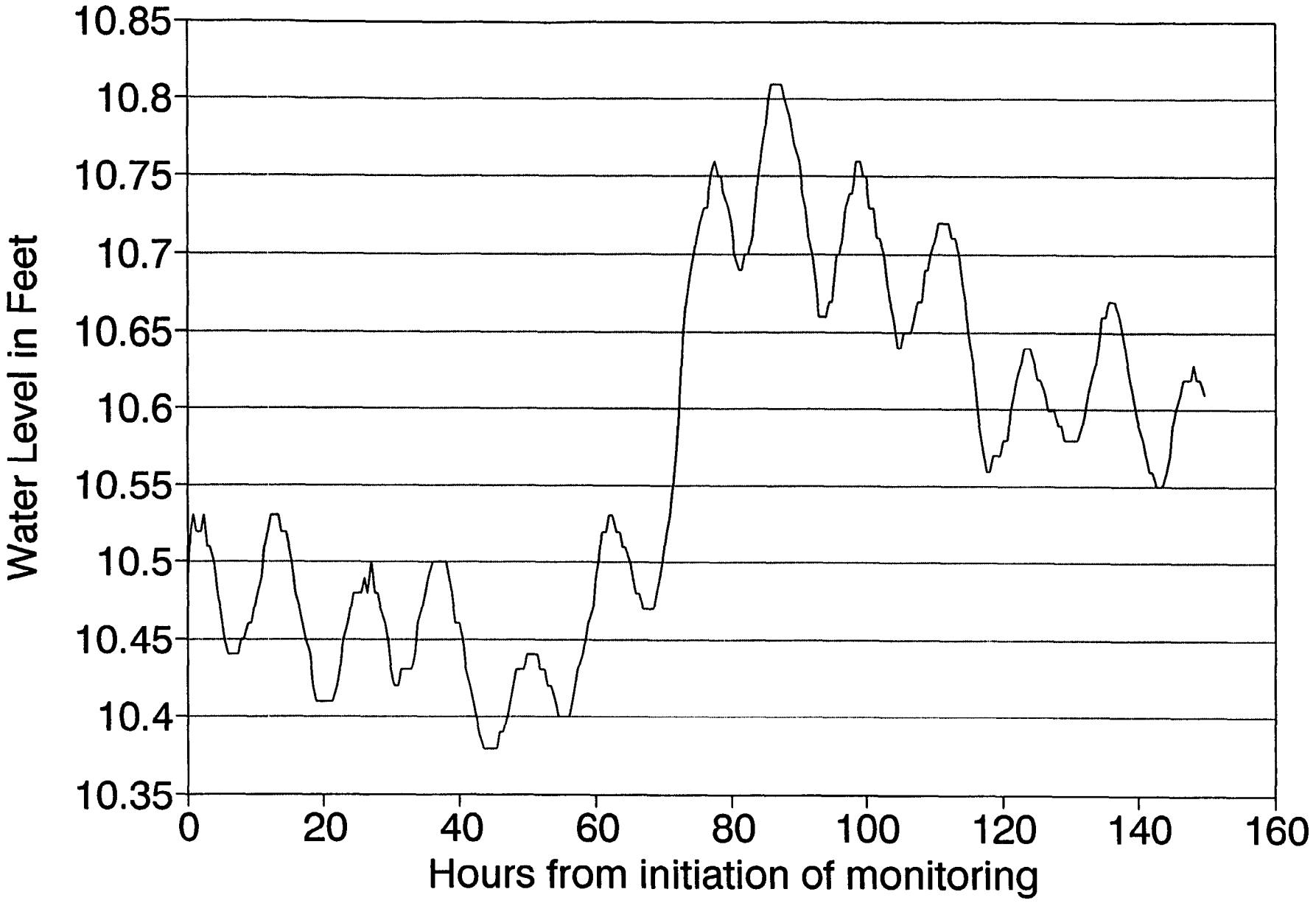
Camp Allen Landfill Tidal Study
Assumed Surface Water Location



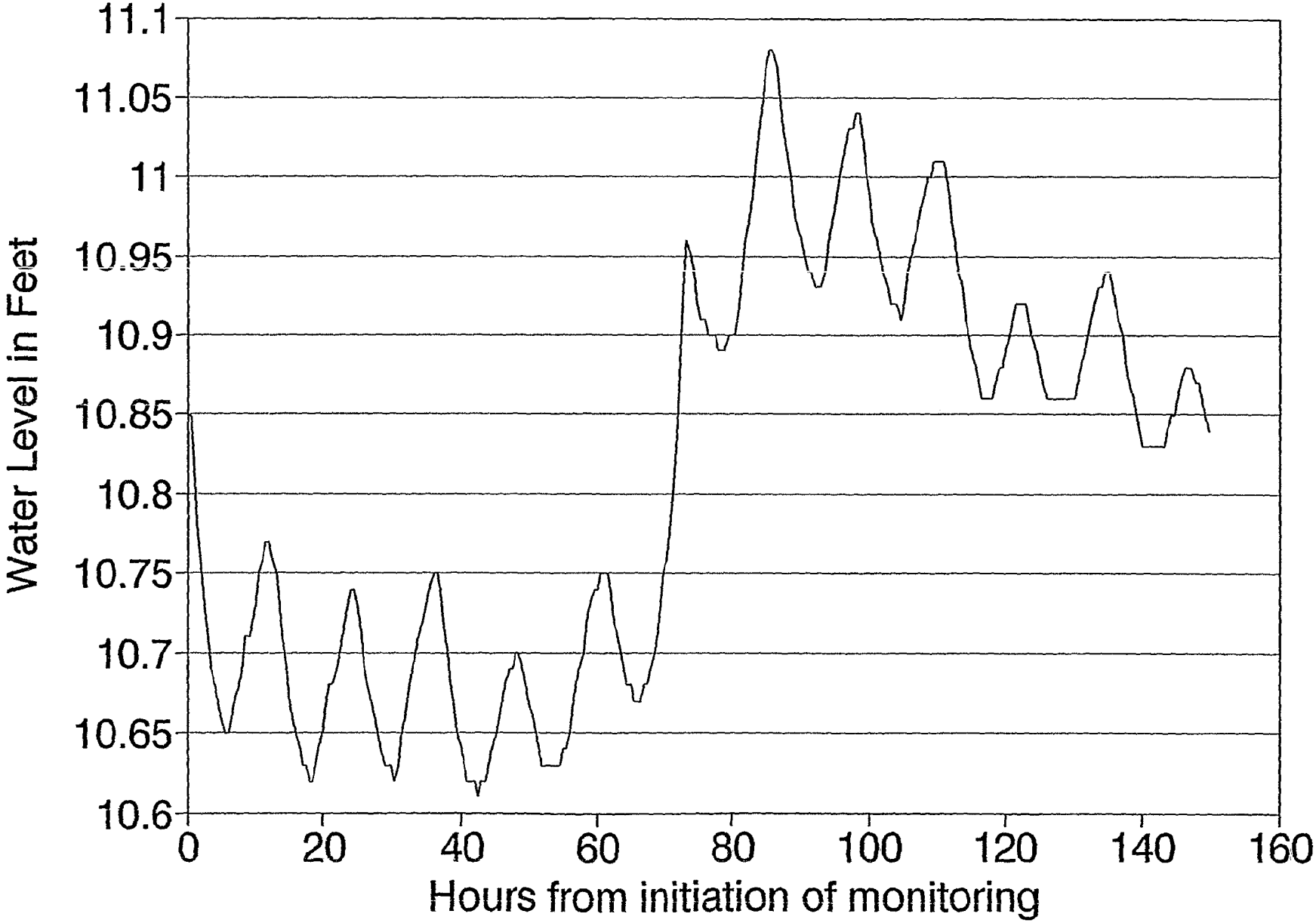
Camp Allen Landfill Tidal Study
Assumed Surface Water Location



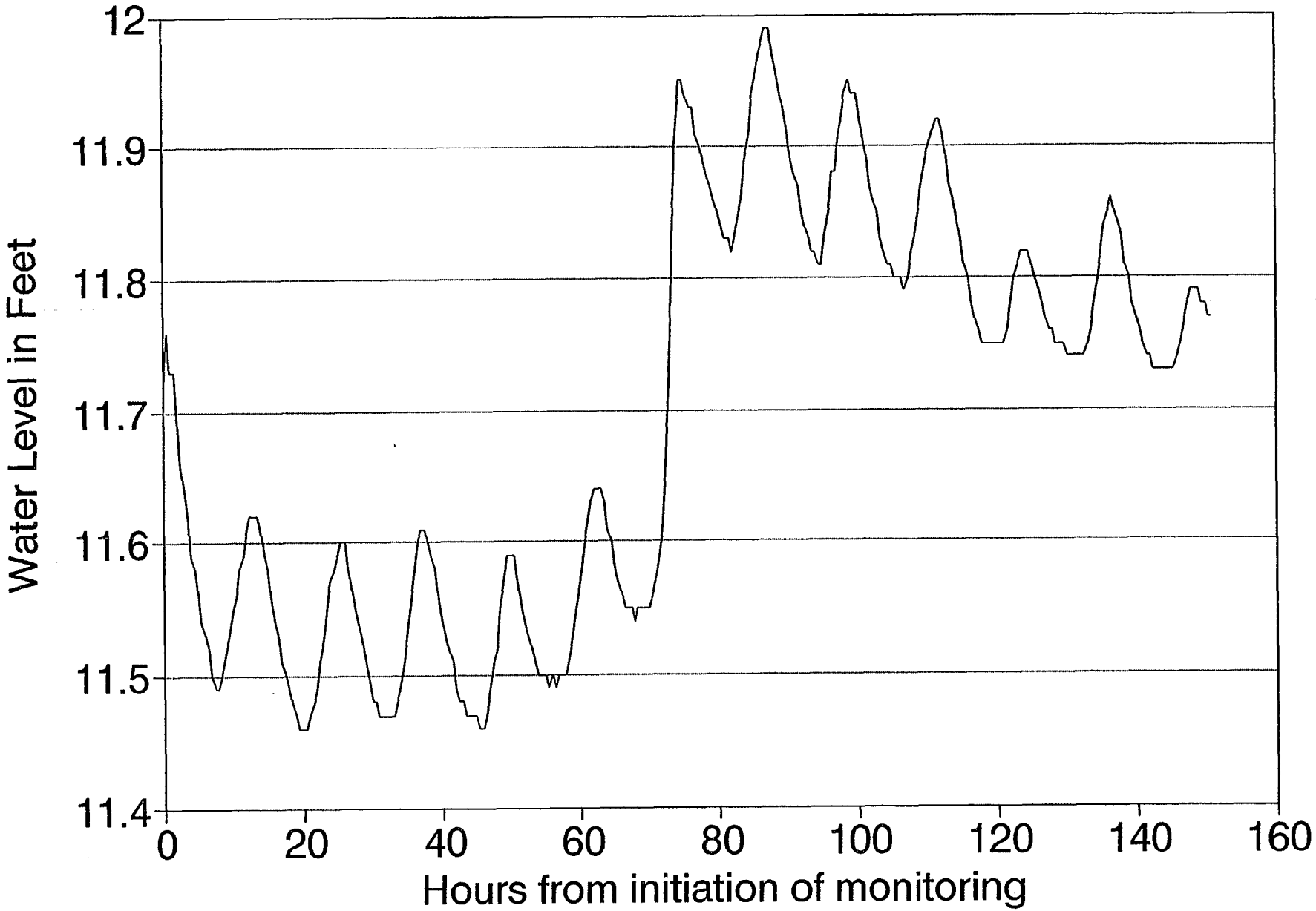
Camp Allen Landfill Tidal Study
Assumed Shallow Aquifer Location



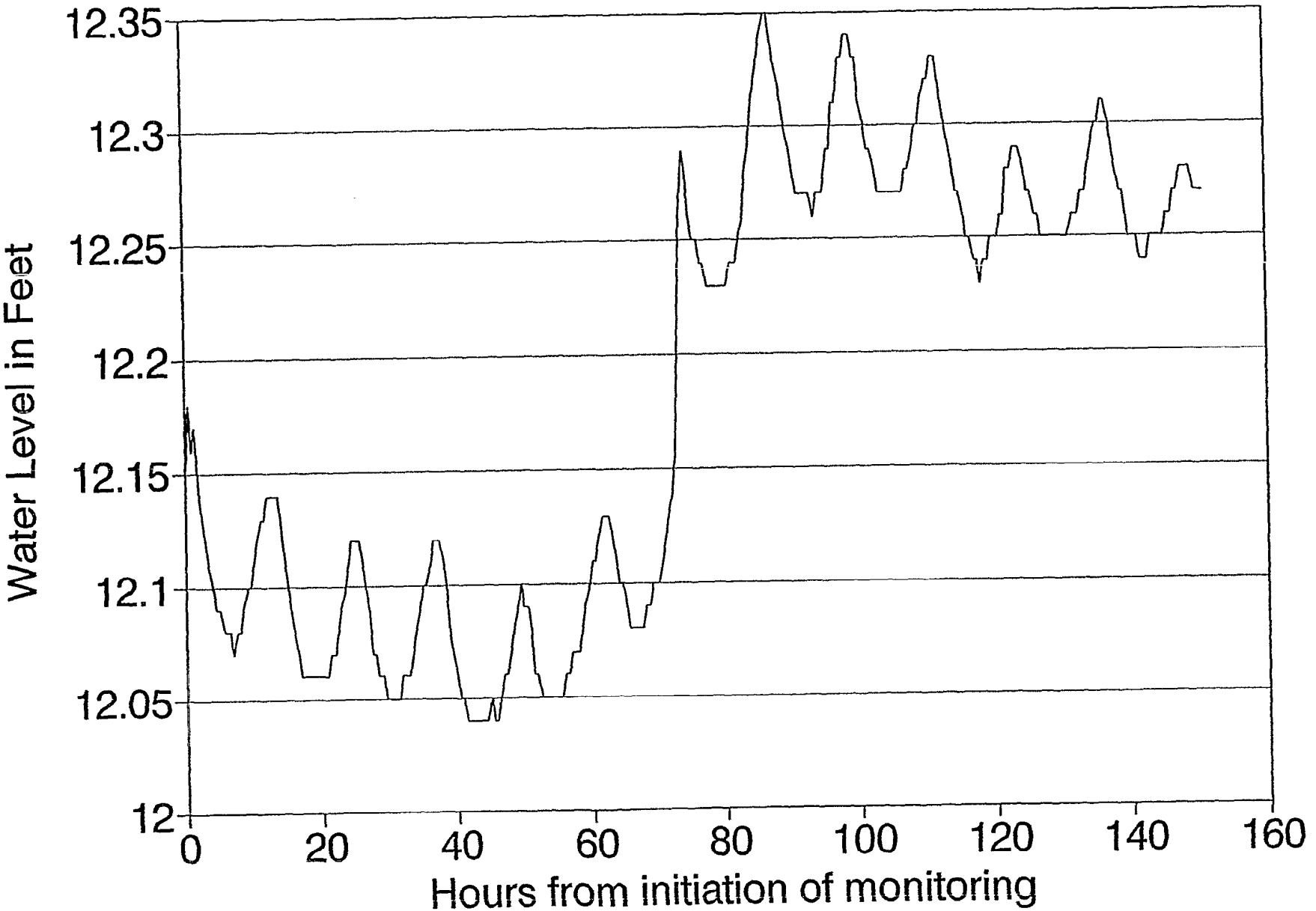
Camp Allen Landfill Tidal Study
Assumed Shallow Aquifer Location



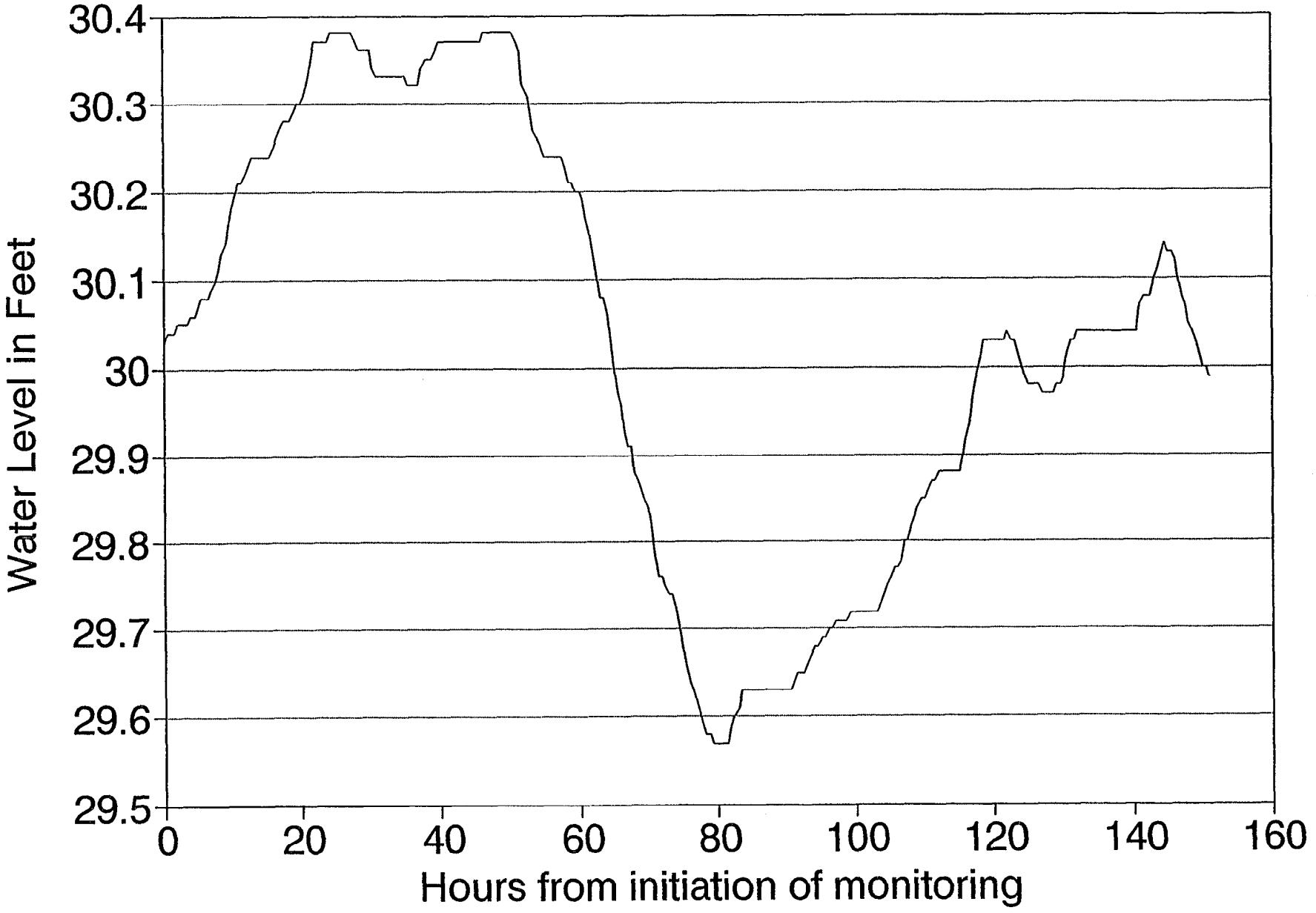
Camp Allen Landfill Tidal Study
Assumed Shallow Aquifer Location



Camp Allen Landfill Tidal Study
Assumed Shallow Aquifer Location



Camp Allen Landfill Tidal Study
Assumed Deep Aquifer Location



07/12/8

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Applied Marine Research Laboratory
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Norfolk, VA 23529-0456

DRAFT

BOUSH CREEK WATER LEVEL SURVEY

Prepared by

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Submitted by

Old Dominion University Research Foundation
P.O. Box 6369
Norfolk, VA 23508-0369

July 1988

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ENVIRONMENTAL SERVICES DIVISION

BOUSH CREEK WATER LEVEL SURVEY

Water levels were continuously measured in the Glenwood Park area of Boush Creek, Norfolk, VA, for a period of 40 hours from July 7, 1988 at 1530 hours to July 9, 1988 at 0730 hours to determine whether Boush Creek is tidal or non-tidal.

A water level measurement station was installed in Boush Creek on July 7, 1988, by field technicians of the Applied Marine Research Laboratory (AMRL), Old Dominion University (Fig. 1). The station consisted of a water level gage (digital, temperature/pressure, water level recorder with solid state memory) and a staff (graduated in 0.1 foot increments). Both the water level gage and the staff were connected to benchmarks by leveling, before the survey, by surveyors of Miller-Stephenson & Associates. The gage was set to continuously record water level at 6 minute intervals for the duration of the survey. Comparative water level readings of the staff were recorded at 0.5 hour intervals during daylight hours by AMRL field tehnicians. In addition, surface measurements of dissolved solids (using an optical refractometer) were recorded at 0.5 hour intervals during daylight hours, and hourly values of barometric pressure (at sea level) were obtained from the National Weather Service, Norfolk, VA, to convert gage pressure readings to water heights.

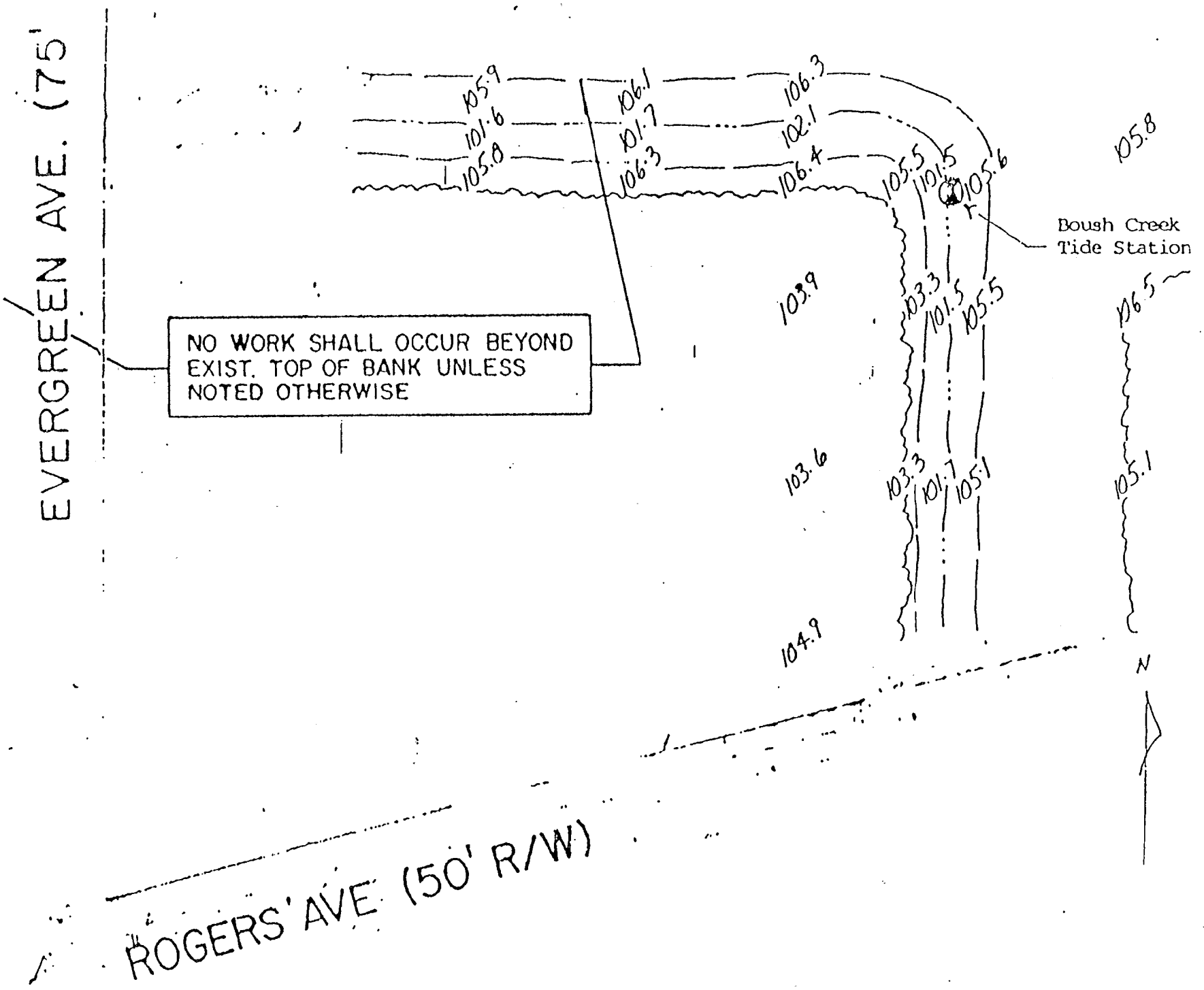


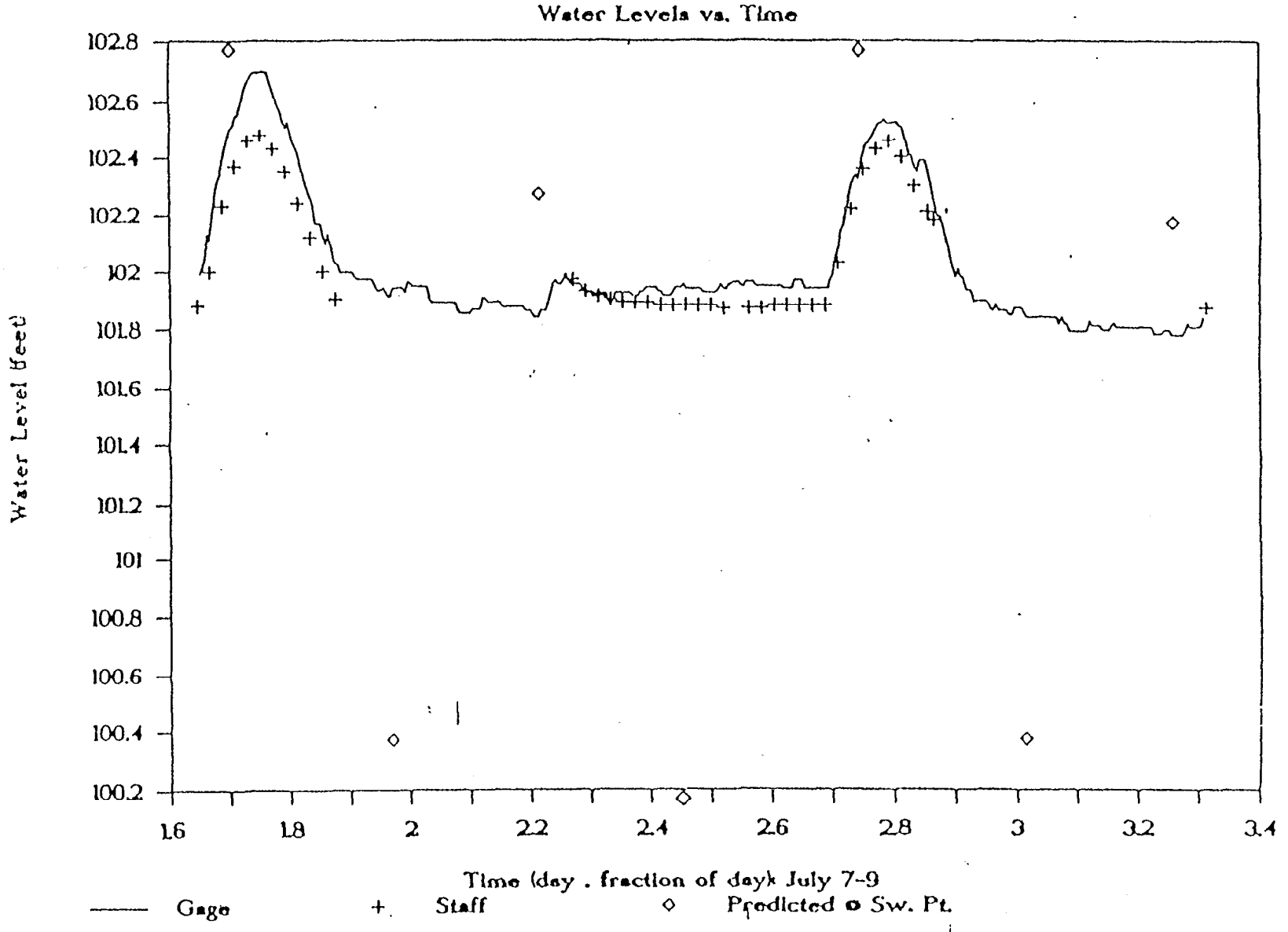
Figure 1. Water level measurement station location at Boush Creek.

The maximum observed water depth at the Boush Creek station was 1.27 feet, while the minimum observed water depth was 0.66 feet. Thus, the maximum observed water level change was 0.61 feet. During the survey, winds were calm and rainfall was slight (0.01 inches of rainfall were measured by the National Weather Service on July 8, at the Norfolk, VA, International Airport).

Both gage and staff water level measurements at the Boush Creek station are plotted for the duration of the survey in Figure 2, along with the predicted tide heights at Sewells Point, VA. All water levels have been plotted in reference to the City of Norfolk's mean low water (MLW) datum of 99.00 feet. The predicted tide heights at Sewells Point (the closest reference tide station to Boush Creek) were extracted from the NOAA Tide Tables 1988. These heights were then converted to reference elevations using the presently accepted MLW value (99.97 feet) at Sewells Point, found by adding the steady, average rise in mean sea level (0.014 feet/year) to the accepted MLW value (99.70 feet) at Sewells Point for the 1960-1978 tidal epoch (NOAA Office, Rockville, MD).

In Figure 2, both gage and staff water level curves generally follow the same trend over time but lack a correspondence, particularly near times of high water, which presently cannot be accounted for without further investigation. Two distinctive high waters appeared during the Boush Creek survey, corresponding approximately to the

Fig. 2. BOUSH CREEK WATER LEVEL SURVEY



predicted higher high waters at Sewells Point (Fig. 2). A less distinctive high water occurred at Boush Creek about midway between the higher high waters, corresponding approximately to the predicted lower high water at Sewells Point (Fig. 2). The phase difference in the tide at Boush Creek, lagging that at Sewells Point, can be expected due to the distance from the source of the tide and bottom friction of the creek bed. The "leveling off" of the curves near times of predicted low water at Sewells Point may be a result of an elevated creek bottom (higher than that at the Boush Creek station), downstream of the Boush Creek station, i.e., before the creek enters Willoughby Bay. A plot of surface measurements of dissolved solids (salinity) over time at Boush Creek in Figure 3, shows that salinity intrusion also has a periodicity similar to that of the predicted tide heights at Sewells Point.

The results of this survey indicate that Boush Creek is tidal and falls within the jurisdiction of the City of Norfolk Wetlands Board. A more extensive tidal data set would be necessary to establish the precise tide range at Boush Creek and hence the Boush Creek wetlands boundary.

Fig. 3. BOUSH CREEK WATER LEVEL SURVEY

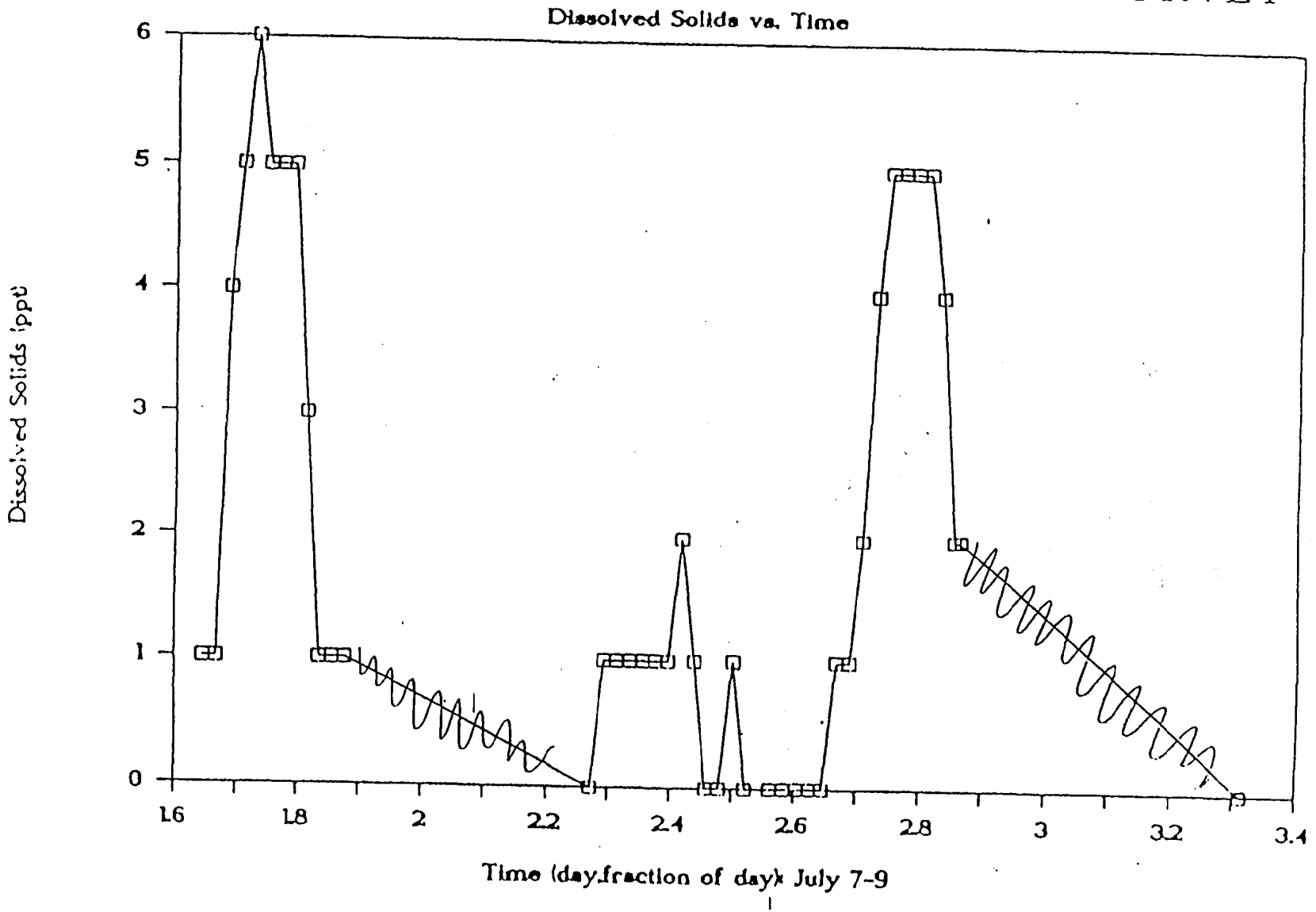
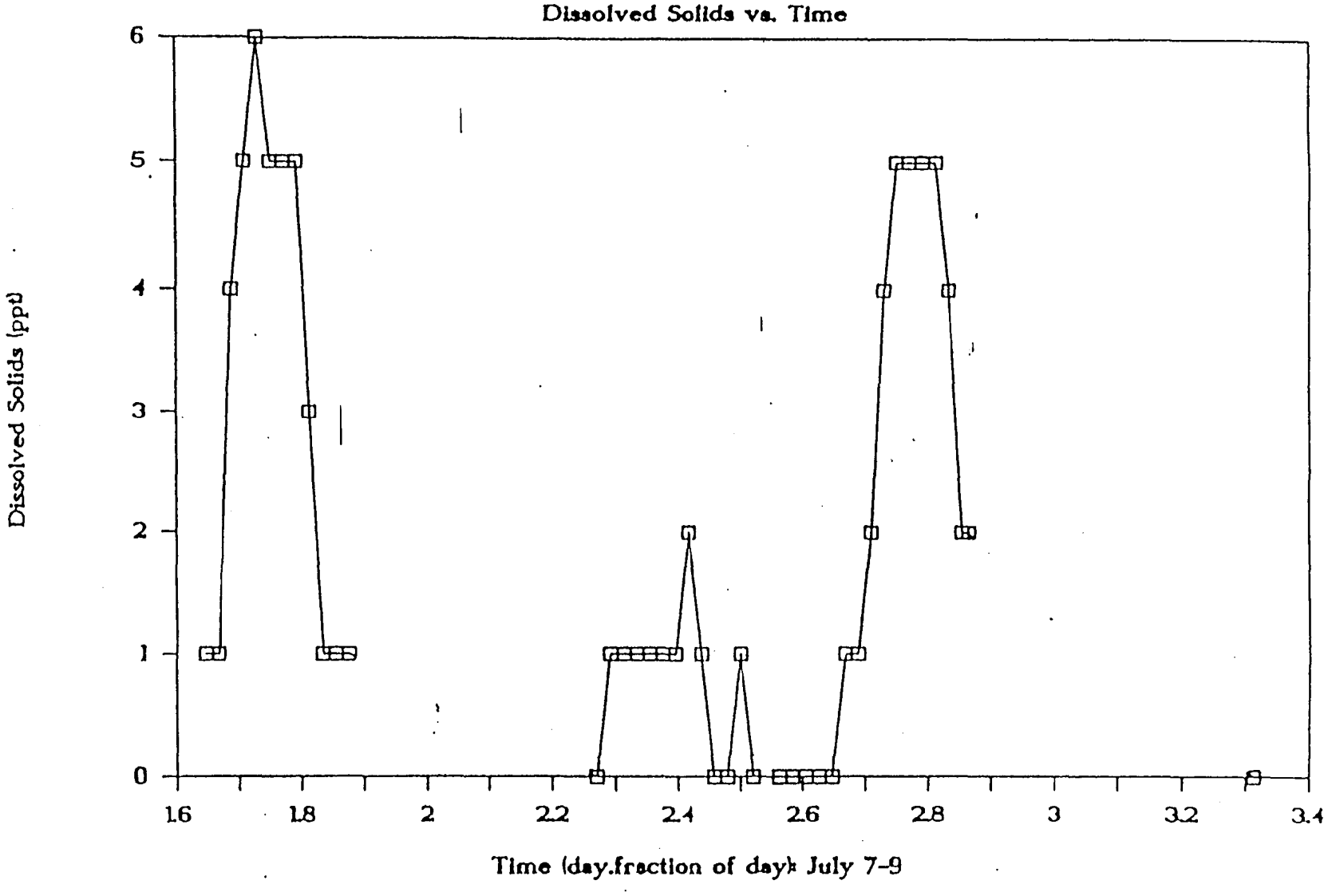



Fig. 3. BOUSH CREEK WATER LEVEL SURVEY