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INSTALLATION ASSESSMENT OF FORT DRUM, NEW YORK

Mr. C.R. Magness, Mr. J.M. Bane, Mr. R.J. Grula, Mr. H.K. Woods, and Mr. R.L. Yon

CHEMICAL SYSTEMS LABORATORY
Environmental Technology Division
Installation Restoration Branch
Aberdeen Proving Ground, Md. 21010

July 1981

Final Report for Period Oct. 6-10, 1980

Distribution limited to U.S. Government Agencies only for protection of privileged information evaluating another command: July 1981. Other requests for this document must be referred to: Commander, Fort Drum, Fort Drum, N.Y. 13602

Prepared for:

Fort Drum
Fort Drum, N.Y. 13602
and
U.S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY
Environment and Safety Division
Aberdeen Proving Ground, Md. 21010

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STATEMENT

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

A records search was conducted at Fort Drum (FD), N.Y. to determine the existence of toxic and hazardous materials, and related contamination, emphasizing those posing a potential for migration to offpost areas.

A review of the records indicate the most likely sources for contaminant migration are from past leaking petroleum/oil/lubricant (POL) tanks along gasoline alley, spillage/leaching from washrack areas, leaching from old land-

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fill areas, and past pesticide usage.

Major contaminants include: POL products, pesticides (DDT and 2,4,5-T), arsenic, and other metals (Al, Fe, and Pb).

The geological evidence indicates a high potential for migration of contaminants via both the surface drainage and the subsurface aquifers.

A survey by U. S. Army Toxic and Hazardous Materials Agency is recommended.

ABSTRACT

A records search was conducted at Fort Drum, New York to determine the existence of toxic and hazardous materials, and related contamination, exphasizing those posing a potential for migration to offpost areas.

A review of the records indicate the most likely sources for contaminant migration would be from past leaking petroleum/oil/lubricant (POL) tanks along gasoline alley, spillage/leaching from washrack areas, leaching from old landfill areas and past pesticide usage.

Major contaminants include, POL products, pesticides (DDT and 2,4,5-T), arsenic and other metals (Al, Fe and Pb).

The geological evidence indicates a high potential for migration of contaminants via both the surface drainage and the subsurface aquifers.

A survey by US Army Toxic and Hazardous Material Agency is recommended.

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I. GENERAL

A. Purpose of the Assessment

To assess Fort Drum (FD), N.Y., to determine the existence of toxic and hazardous materials and related contamination, emphasizing those posing a potential for migration to offpost areas.

B. Authority

DARCOM Regulation 10-30, Mission and Major Functions of the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), 22 May 1979.

C. Introduction

1. In response to a letter from the Commander USATHAMA, requesting the identification of potentially contaminated installations, the Commander, U.S. Army Forces Command (FORSCOM), recommended that FD be included in the Installation Restoration Program.

2. Presurvey instructions were forwarded to FD to outline assessment scope, provide guidelines, and obtain advance information for review by the Records Search Team.

3. The FD personnel were briefed on the Installation Restoration Program by a USATHAMA representative on 5 Oct 1980 prior to the onsite records search.

4. Various Government Agencies were contacted for documents pertinent to the records search effort. Agencies contacted included:

a. Department of Defense Explosives Safety Board (DDESB).

b. U.S. Army Environmental Hygiene Agency (USAEHA).

c. U. S. Geological Survey (USGS).

d. Defense Technical Information Center (DTIC).

e. U.S. Army Engineer Waterways Experiment Station (WES).

f. Corps of Engineers, New York District (COE).

g. U.S. Army Engineer Topographic Lab, Ft. Belvoir, Va.

h. U.S. Department of Agriculture (USDA).

i. Chemical Systems Laboratory (CSL) (ARRADCOM).

5. The onsite phase of the records search was conducted from 6 through 10 Oct 1980. The following personnel were assigned to the team:

a. Mr. Reed Magness, Team Leader (CSL).

b. Mr. John Bane, Chemist (CSL).

c. Roy Yon, Ordnance Specialist (CSL).

d. Mr. Robert Grula, Chemist (CSL).

e. Mr. Harry Woods, Hydrogeologist (WES).

6. In addition to the review of the records, interviews were conducted with former and present employees. Ground and aerial tours of the installation were made; Appendix A contains photographs taken during the tours.

7. Findings are based on the records made available at the time of the search. Where conspicuous discrepancies existed, attempts were made to determine the correct information by interviewing personnel (if available) involved in preparing the original data.

D. Installation History

1. Location

FD is located in the north central portion of New York about 16 kilometers (km) northeast of Watertown, 129 km north of Syracuse, and 40 km southeast of the United States/Canadian border. The reservation is approximately rectangular in shape measuring 10 km in width and 32 km in length and contains 43,410 hectares (ha), Fig. 1.

The land area contains:

a. Improved grounds - 371 ha.

b. Semi-improved grounds - 318 ha.

c. Un-improved grounds - 29,670 ha.

d. Forest land - 13,051 ha.

An additional 40,470 ha are used by permission from the private sector to support winter training operations. The additional land adjoins the northeast boundary, Fig. 2.

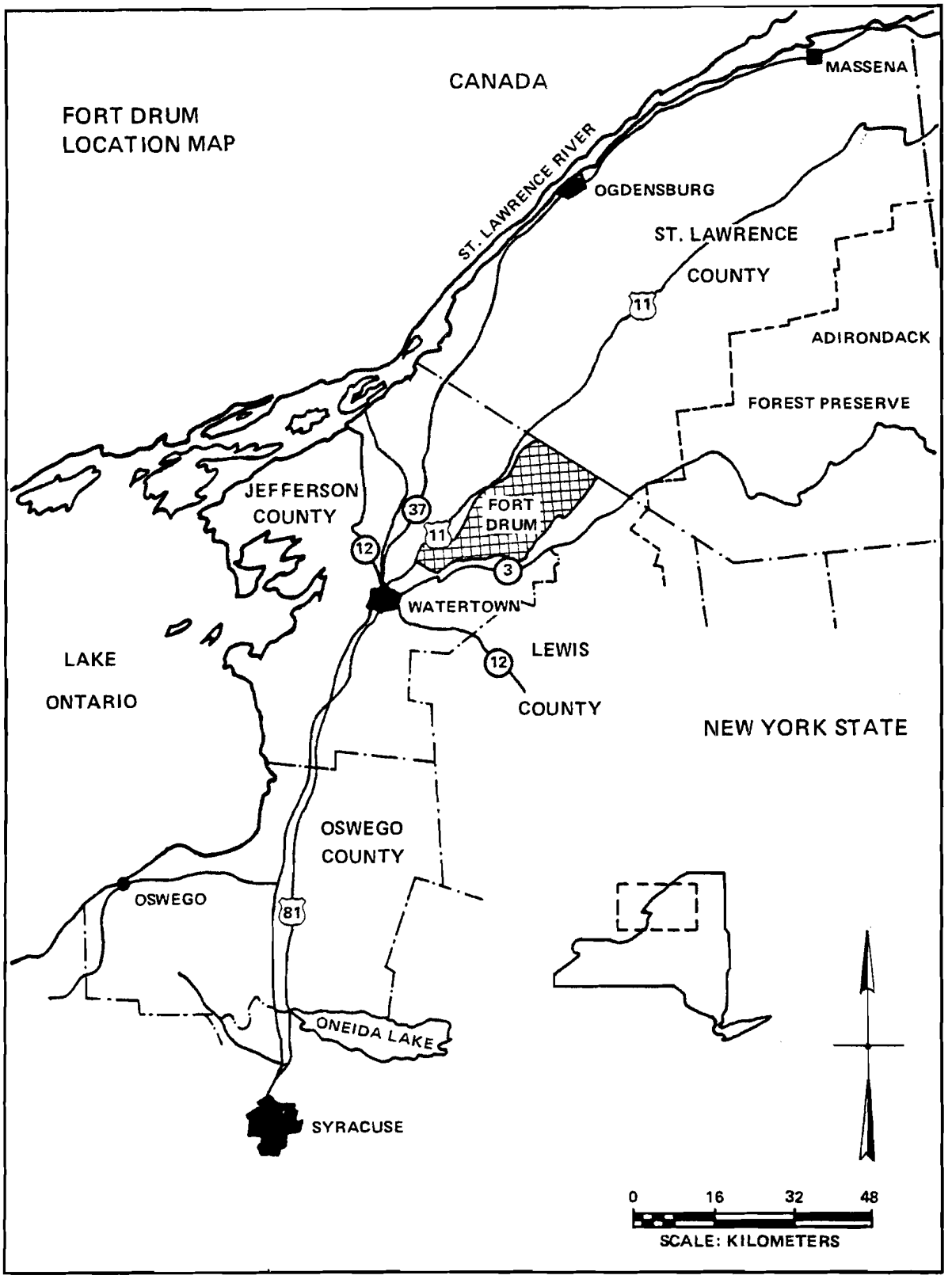


Figure 1. Location Map of Fort Drum

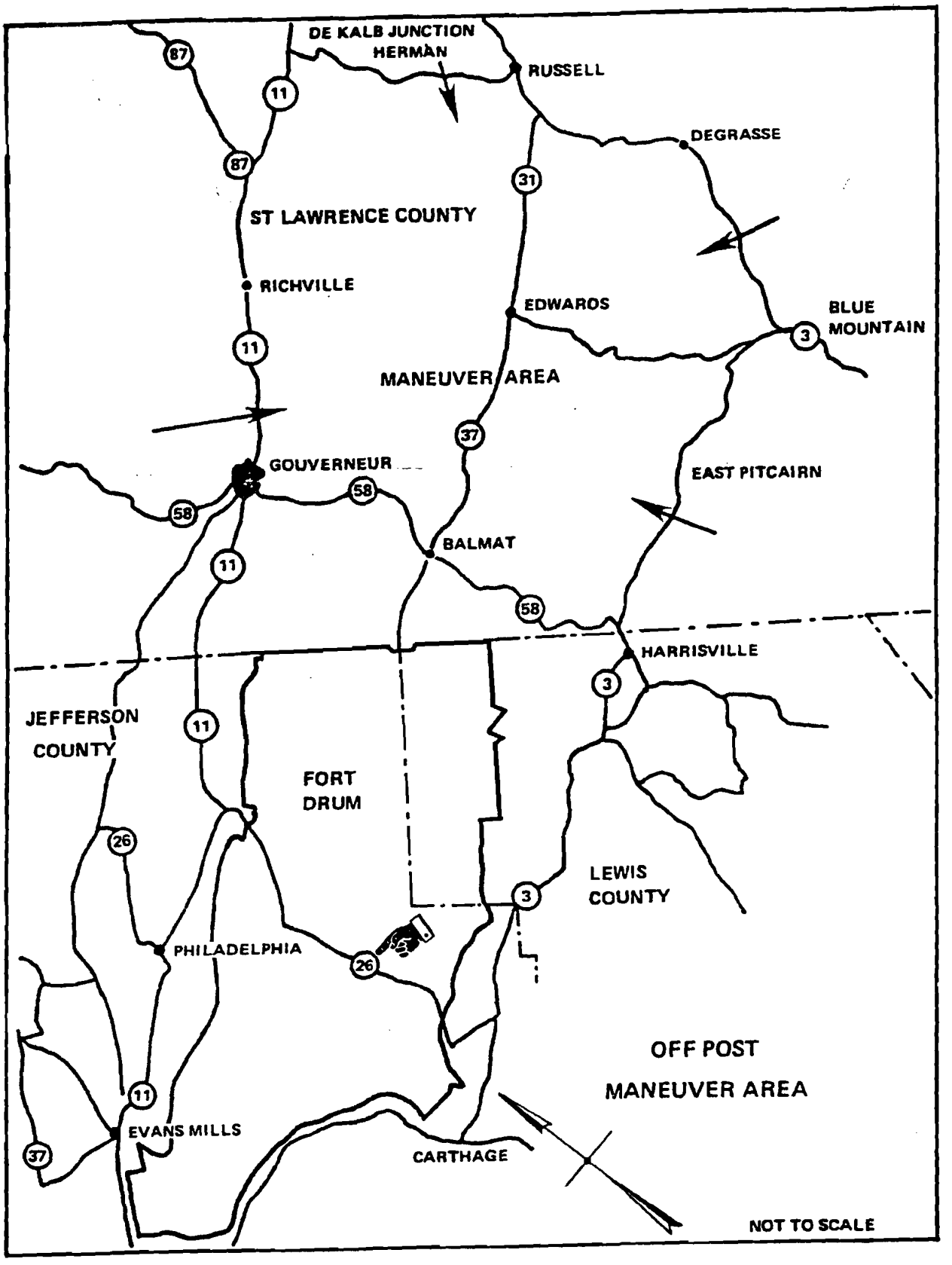


Figure 2. Off Post Maneuver Area

Note: The Maneuver Area indicated was only used for "Empire Glacier" one training exercise in FY78. Ft. Drum does not have leased maneuver rights for the area shown. That portion of Route 26 that passes through Fort Drum is abandoned.

2. Mission

The primary mission of Fort Drum is to provide training facilities and services to U.S. Armed Forces requiring land and air space to practice combat skills and operations.

3. Chronological Synopsis

a. In 1906 an installation was established as a training area for the National Guard.

b. In 1908, 4,047 ha north of the Black River known as Pine Plains were leased for the camp site from the City of Watertown.

c. In 1909, the Government purchased the 4,047 ha.

d. From 1930 to 1940, the Government purchased an additional 39,363 ha (approximately), and construction began on the present cantonment area.

e. During World War II (WWII), the 45th Infantry Division and the 4th and 5th Armored Divisions trained at the reservation.

f. In 1952, the installation was named Camp Drum in honor of LTG Hugh A. Drum.

g. In September 1974, Camp Drum was officially redesignated Fort Drum.

E. Environmental Setting

1. Meteorological Data

The climate at FD has fairly long, cold winters, and short, warm summers that are comparatively moist and humid. The annual average temperature at FD is about 7.2^{o} C. January is the coldest month with temperature falling to -17.8^{o} C. The warmest months are June, July, and August, with the warmest month being July. The highest temperature recorded is 27.7^{o} C. The annual rainfall is 100 centimeters (cm). Table I is a climatic summary for FD.

2. Biota

a. Flora

Approximately 32,558 ha of the installation consist of woody vegetation. Selected areas of the range suitable for the production of forests are managed by the installation forester to produce merchantable timber. Woodlands under management total 14,266 ha and comprise three groups: merchantable and mature timber, 4,877 ha consisting of 8,467,000

TABLE I. CLIMATIC SUMMARY FOR FORT DRUM/WHEELER SACK AAF

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	DATA YEARS
1. Temperature															
Absolute Maximum	C	18.9	16.1	27.2	29.4	30.6	35.6	37.7	35.0	35.6	29.4	24.4	18.9	36.7	30
	F	66	61	81	85	87	96	98	95	96	85	76	66	98	30
Mean Daily Maximum	C	-1.0	-0.4	4.4	11.9	19.0	24.5	27.3	26.3	21.9	15.3	7.8	0.7	13.2	30
	F	30.3	31.2	40.2	53.5	66.2	76.1	81.1	79.3	71.5	59.5	46.0	33.2	55.7	30
Mean Daily Minimum	C	-11.2	-10.9	-5.2	1.4	7.6	13.2	15.9	14.9	11.0	4.9	-0.4	-8.3	2.8	30
	F	11.8	12.4	22.6	34.5	45.6	55.8	60.7	58.8	51.8	40.9	31.2	17.1	37.0	30
Absolute Minimum	C	-35.6	-32.8	-28.3	-15.6	-4.4	-1.1	5.0	2.2	-2.8	-9.4	-19.4	-39.4	-39.4	30
	F	-32	-27	-19	4	24	30	41	36	27	15	-3	-39	-39	30
Heating Degree Days (2)(3)		1477	1332	1030	688	382	62	57	95	219	530	854	1341	8067	8-15
2. Precipitation															
Mean Relative Humidity Percent		74	74	71	67	66	68	68	71	73	72	73	75	71	23
Mean Monthly Precipitation and Annual	MM	79.5	64.0	72.6	78.7	80.8	69.3	81.8	80.0	98.3	97.3	103.6	95.0	999.7	30
	IN	3.13	2.52	2.86	3.10	3.18	2.73	3.22	3.15	3.87	3.83	4.08	3.74	39.36	30
Mean Monthly Snowfall and Annual	MM	657.9	569.0	401.3	68.6	(4)	0.0	0.0	0.0	(4)	17.8	254.0	932.2	2900.7	30
	IN	25.9	22.4	15.8	2.7	(4)	0.0	0.0	0.0	(4)	0.7	10.0	36.7	114.2	30
Maximum Monthly Snowfall	MM	2016.7	988.1	1366.6	203.2	20.3	0	0	0	T	127.0	1137.9	1869.4	2016.7	15
	IN	79.4	38.9	53.8	8.0	0.8	0	0	0	T	5.0	44.8	73.6	79.4	15
Mean Number of Days with Snowfall 0.25 MM (0.1 In)		16	14	11	3	(4)	0	0	0	0	(4)	5	14	63	23

TABLE I. CLIMATIC SUMMARY FOR FORT DRUM/WHEELER SACK AAF (Continued)

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	DATA YEARS
3. Wind		WSW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	S	W	WSW	WSW	W	23
Prevailing Surface Direction															
Mean Speed	KMPH	17	17	17	19	15	13	13	11	13	13	10	15	15	23
	MPH	10	10	10	12	9	8	8	7	8	8	17	9	9	23
Extreme Speed	KMPH	104	93	104	96	93	91	87	80	96	117	109	96	117	23
	MPH	65	58	64	60	58	56	52	50	60	73	68	60	73	23

NOTES:
1. Fort Drum/Wheeler Sack Army Airfield is located at latitude 44°03'N, longitude 75°43'W, elevation 207.3m (680 ft), it is 16 Km (10 Mi) northeast of Watertown, N.Y.

2. Degree-day is a unit equal to the number of degrees that the mean temperature for a 24 hour day is above or below a base temperature. The base temperature for heating is 18.3° (65°F).

3. Data taken at Watertown, N.Y. City Water Supply Plant, September 1962 to May 1969, except June, July and August, and at Fort Drum Waste Water Treatment Plant, July 1969 to February 1978.

4. Number less than 0.5 day or 1.27 mm (0.05 IN).

5. T - Trace.

board-feet of saw timber and 7,000 cords of pulpwood; unmerchantable, 6,657 ha; and undetermined type, 2,732 ha. Active management has been conducted since 1950 when an independent survey determined 400,000 board-feet of northern hardwood species could be harvested annually over a 20-year period cutting cycle. Appendix B is a list of native plants protected by the state of New York. The plant names marked with asterisks are known to be common to FD.

b. Fauna

Fish and wildlife management at FD is carried out over a 41,892 ha area with 285 ha of ponds and lakes, and 63 km of streams and rivers. In 1959, a cooperative agreement between the Environmental Conservation Department of the State of New York, the U.S. Fish and Wildlife Service of the Department of Interior, and Department of Defense, FD, was adopted. Since the signing of the cooperative agreement, the public has been permitted to hunt and fish on the installation, providing training is not adversely affected and the New York State laws are obeyed. The number of days that the reservation is open for hunting and fishing is from 195 to 232 days per year. Appendix B contains a list of game species with estimated numbers present or stocked.

c. Miscellaneous

According to a report, "The nature of the potential for impacts to threatened and endangered species at FD cannot be fully ascertained until a complete survey of the installations flora and fauna has been undertaken".[1]

3. Geology

a. Physiography/Topography/Drainage

FD is situated in the north central part of New York State, occupying a large portion of northeast Jefferson County and a smaller portion of northwestern Lewis County. Lake Ontario lies approximately 32 km due west of FD and the city of Watertown is 16 km southwest of the cantonment area. FD is positioned within two physiographic provinces, Lake Erie-Ontario Lowland and the Adirondack Uplands.

The southwestern two-thirds of the reservation occur within the Lake Erie-Ontario Lowlands, which typically includes small sand plains, moraines, drumlins, swamps, and disrupted drainage patterns resulting from Pleistocene glaciation. The northeastern third of the installation falls in the Adirondack Uplands which is characterized by narrow ridges and flat-bottomed valleys.

The topography is predominantly flat in the southern third of the reservation to gently rolling in the northern two-thirds of FD. A few subdued, low, narrow NE-SW trending ridges occur in the northeast corner of the installation. Along the southern reservation boundary, several isolated hillocks rise 60 meters (m) above the surrounding terrain. Elevations within FD range from 150 to 275 m above mean sea level (MSL).

FD lies within the Black River drainage basin in which the Black River is the major drainageway. The Black River flows in a westwardly direction along the southern installation boundary, but falls within FD between the villages of Great Bend and Deferiet (see Fig. 3). Approximately 82 percent of surface drainage on FD is to the west via Indian River, Black Creek, West Branch, Rockwell, and Bonaparte Creeks, and their tributaries. A small drainage divide along the northern installation boundary directs the drainage of small localized drainageways to the northeast.

Numerous lakes, ponds, springs and marshes are scattered throughout the installation. The larger lakes/ponds are Indian Lake, Mud Lake, Indian Pond, Narrow Lake, Dority Pond, and St. James (Remington) Pond, which total more than 170 ha. Smaller water bodies and large marsh-swamp complexes occupy over 215 ha.

b. Surface

The surface geology of FD is the result of the glacial deposition during the Pleistocene period. No map is available that portrays these surficial features which are based on soils; however, the southern part of the installation is generally characterized by deltaic sands and gravels (sand plains), lacustrine deposits along the northern reservation boundary, and glacial outwash throughout the remainder of the installation.

c. Subsurface

Rock underlying FD consists of Ordovician and Cambrian sandstone, shale, and limestone in the southern and west central portion, while pre-Cambrian granite, gneiss, biotite, and dolostone occur in the central and northern portion of the installation (see Fig. 4). The depth to rock underlying FD is variable. For example, sandstone was encountered at a depth of 53 m in Water Well No. 1 while 2,500 m northwest of this well, limestone outcrops and provides an excellent source of construction material. The total thickness of sandstone in Water Well No. 1 is not known, but the well penetrated ⁻5 m of sandstone. Boring logs for the water wells and for various construction projects are presented in Appendix C. Well borings are shown on Fig. 5. North of the Indian River, rock is exposed or blanketed with a soil veneer.

d. Soils

Seven major soil series have been identified by the U.S. Department of Agriculture within the confines of FD, which range from organics to gray and reddish brown silty sand with gravels, cobbles, clayey silt, and clay. The aerial distribution of these soils is shown on Fig. 6 and a description of each soil series, down to a depth of 180 cm and the related permeability values are tabulated in Table II. Available data indicate the depth of soil within the installation to be from 0 (rock outcrops) to 53 m in Water Well No. 1.

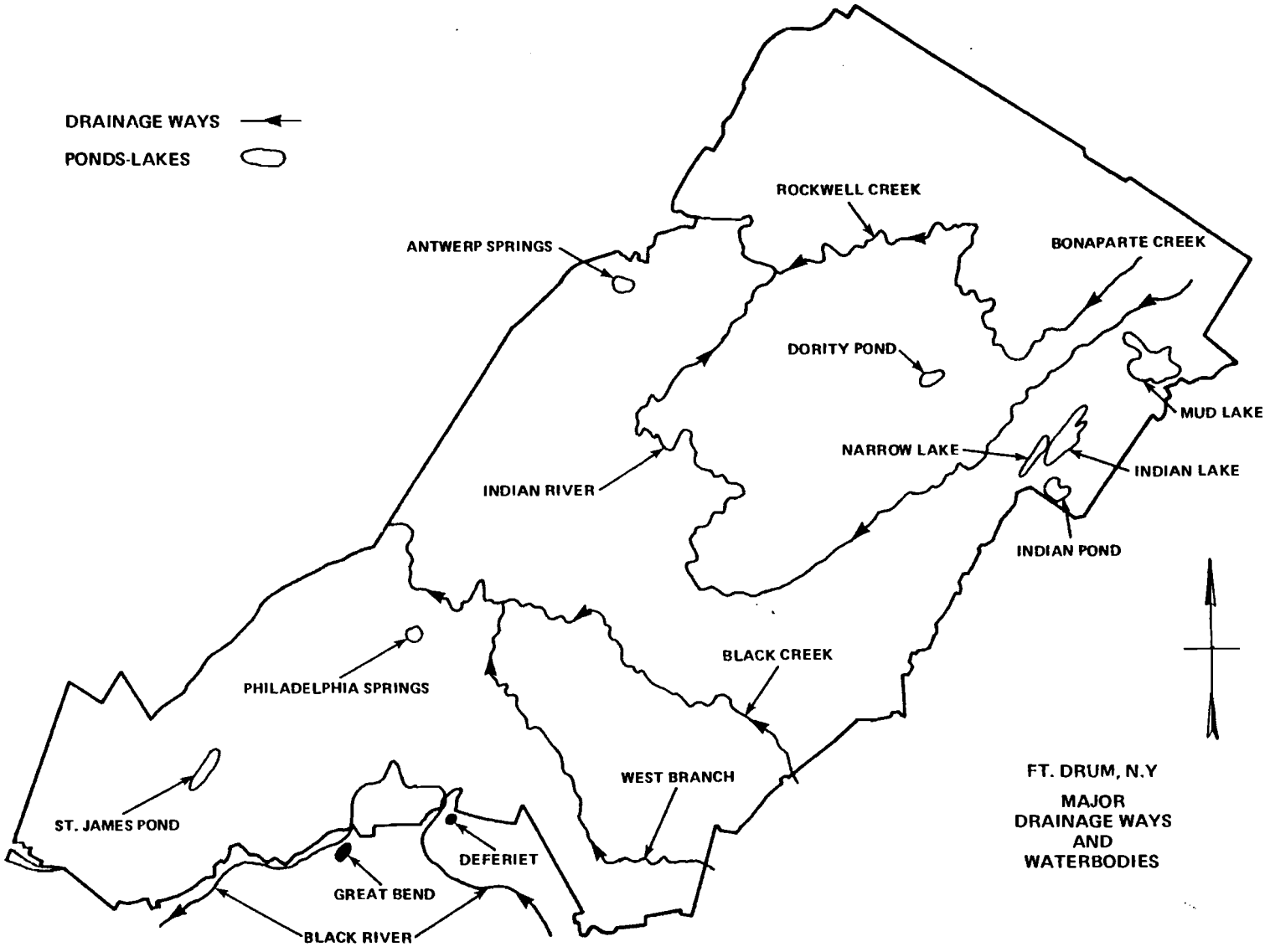


Figure 3. Major Drainageways and Waterbodies

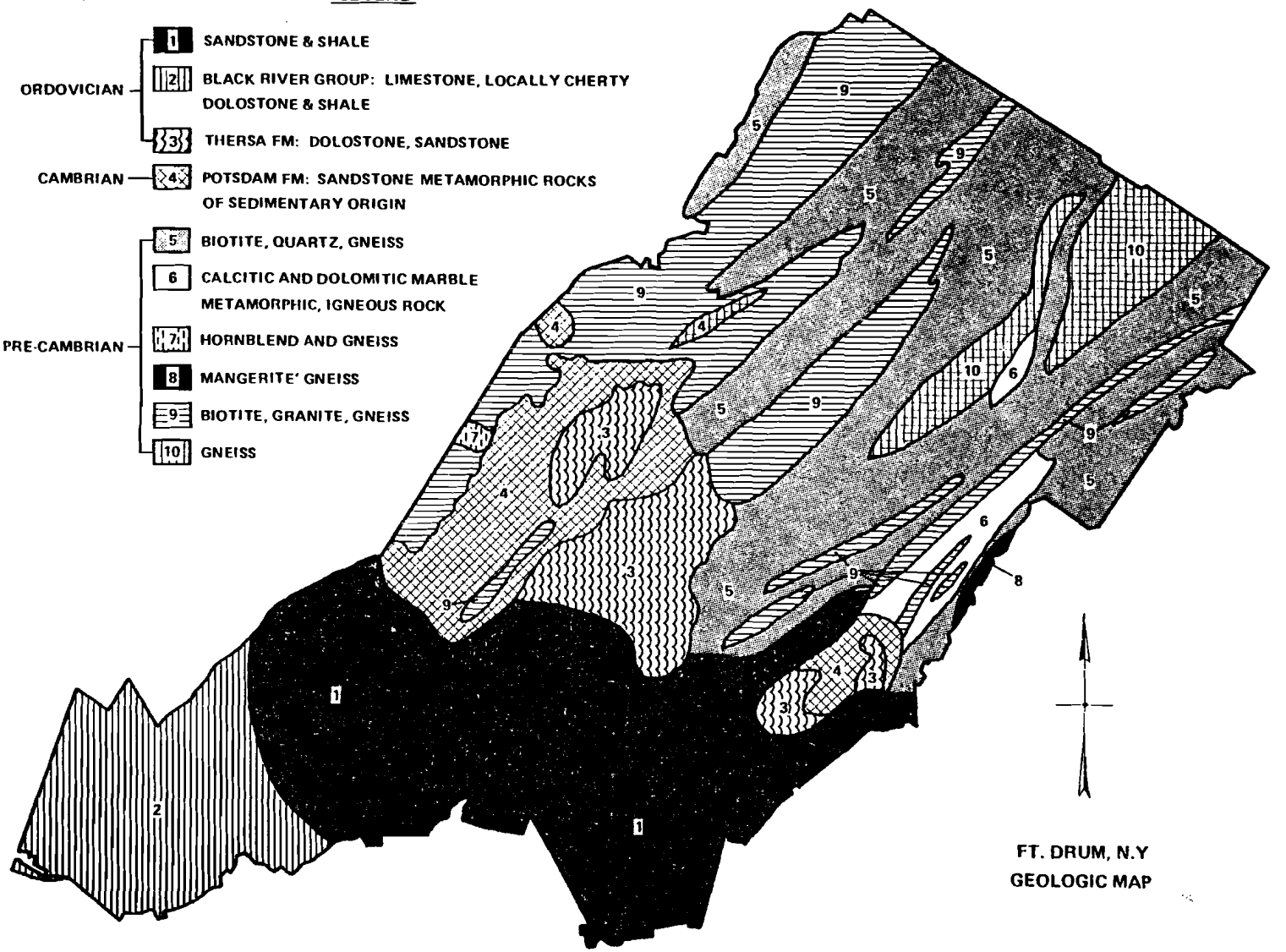


Figure 4. Geologic Map

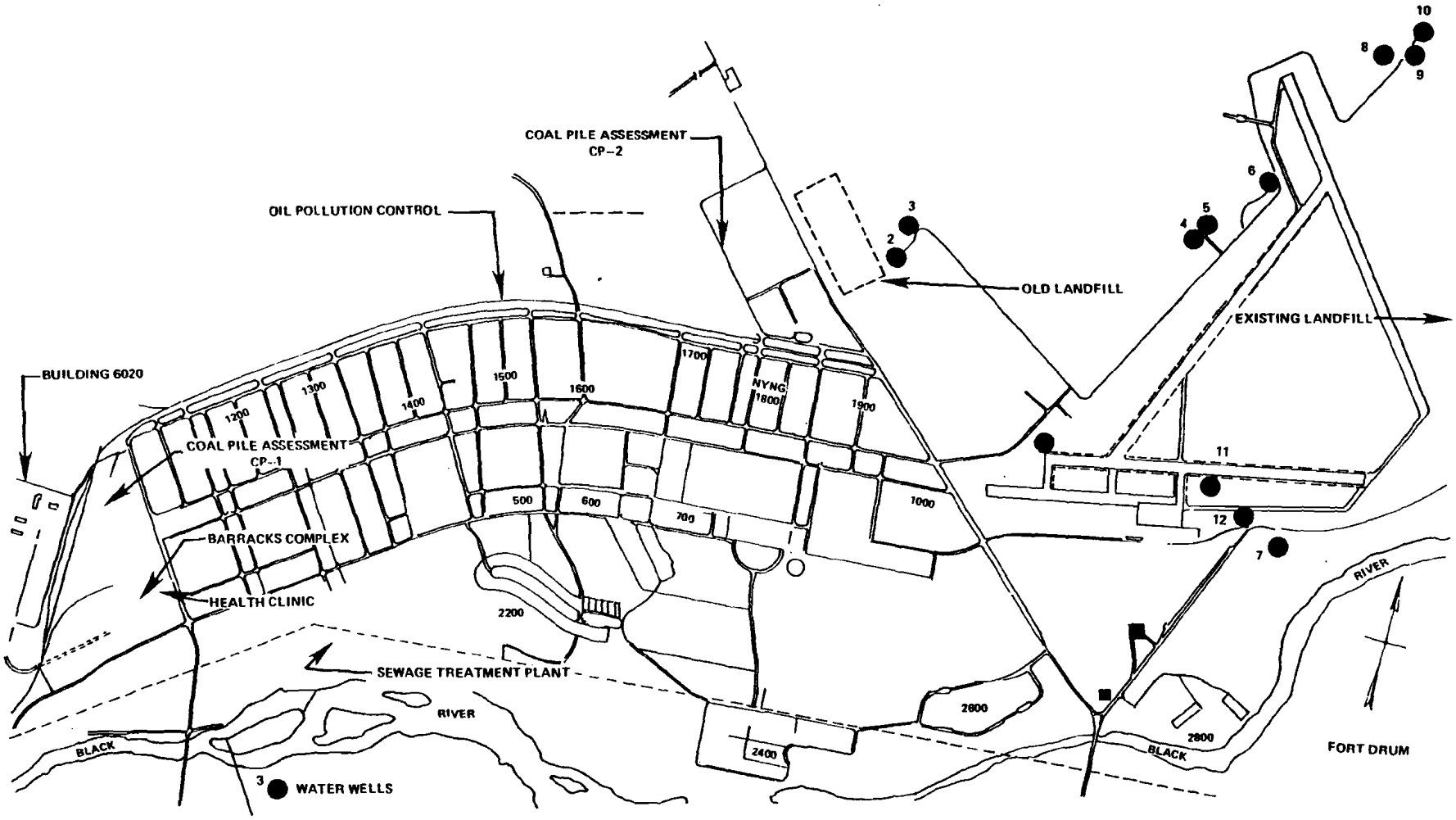


Figure 5. Boring Projects and Water Well Locations

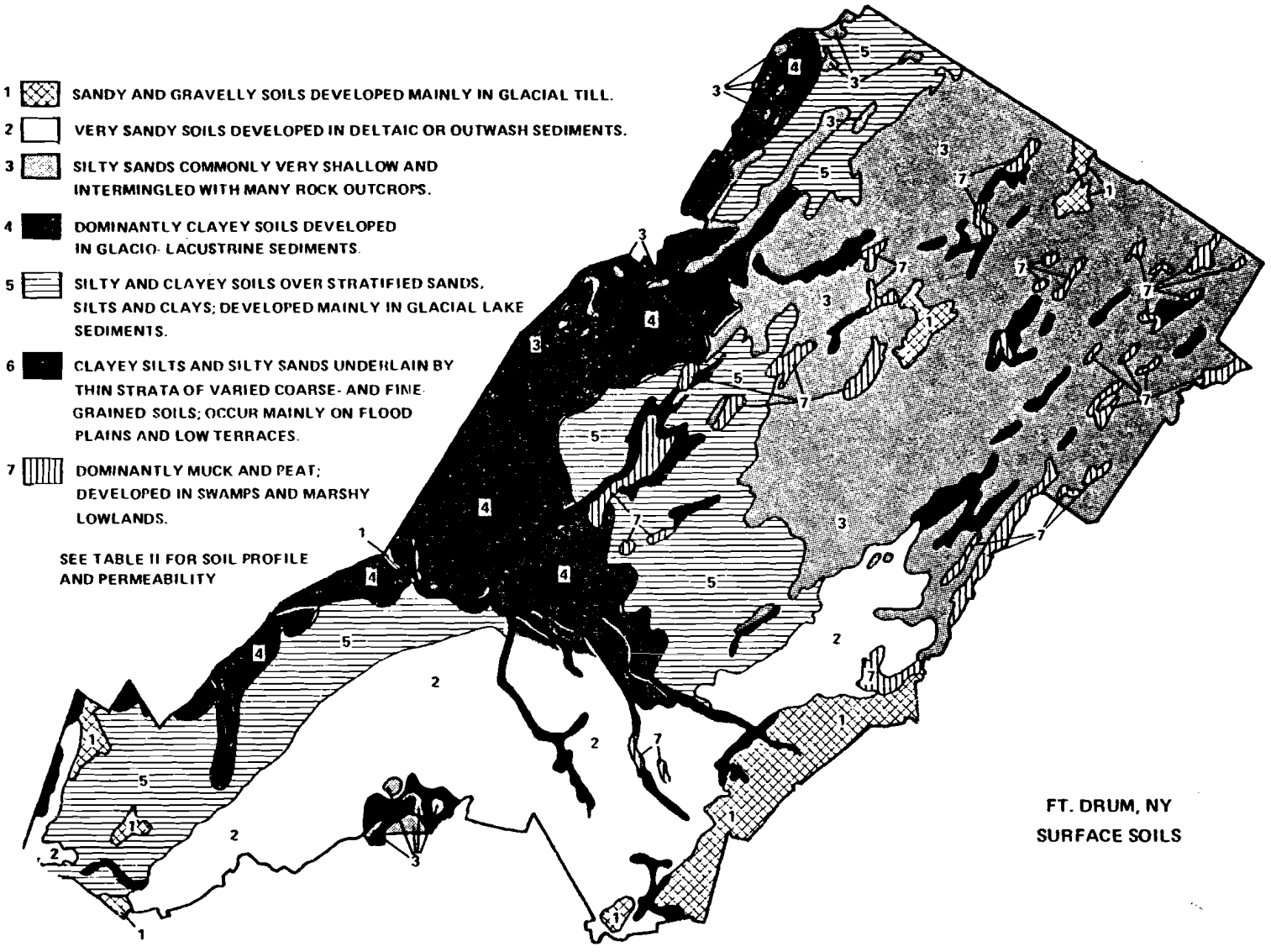


Figure 6. Surface Soils

TABLE II. SOIL CHARACTERISTICS AND PERMEABILITY VALUES

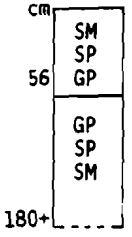
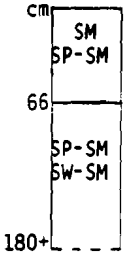
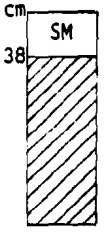
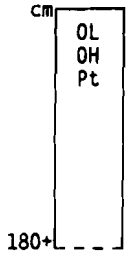
MAP UNIT	MAJOR SOIL SERIES	TYPICAL SOIL PROFILE - layers, thickness and color of layers, depth to rock and Unified engineering classification (Profile diagram not to scale).	PERMEABILITY centimeters/hour or (inches/hour)
1	CHARLTON COLTON	 Dark brown to yellowish brown silty sand and poorly graded sand and gravel; contains varied amounts of cobbles and small boulders. Grayish brown poorly graded gravel, poorly graded sand and silty sand. High content of cobbles and small boulders.	1.5-15 cm/hr (0.6-6.0 in/hr)
2	ADAMS WINDSOR CROGHAN	 Pinkish gray to reddish brown silty sand. In some places grading to poorly graded sand. Grayish brown, loose, fine sand.	15.0-50 cm/hr (6.0-20 in/hr) More than 50 cm/hr (20 in/hr) below 66 cm
3	ROCKLAND HOLLIS	 Grayish brown to dark yellowish brown silty sand. Generally contains many rock fragments. Bedrock, mainly granite or schist.	1.5-15 cm/hr (0.6-6.0 in/hr)

TABLE II. SOIL CHARACTERISTICS AND PERMEABILITY VALUES (Continued)

MAP UNIT	MAJOR SOIL SERIES	TYPICAL SOIL PROFILE - layers, thickness and color of layers, depth to rock and Unified engineering classification (Profile diagram not to scale).	PERMEABILITY centimeters/hour or (inches/hour)
4	KINGSBURY VERGENNES HUDSON	cm 20 CL, CH — Dark brown clays of medium to high plasticity. 74 CH, MH — Dark grayish brown clays of medium to high plasticity; commonly mottled. 180+	0.15-0.5 cm/hr (0.06-0.2 in/hr) Less than 0.15 cm/hr (0.06 in/hr) below 20 cm
5	COLLAMER NIAGARA	cm ML — Dark grayish brown clayey silt. 20 ML, CL — Brown clayey silt and clay of low plasticity. 71 ML, SM, CL — Stratified layers of clayey silt, silty sand and clay of low plasticity; strata vary in thickness and sequence. 180+	1.5-5.0 m/hr (0.6-2.0 in/hr) 0.5-1.5 m/hr (0.2-0.6 in/hr) below 20 cm
6.	RUMNEY SACO	cm ML, SM — Dark grayish brown clayey silt and silty sand. 30 ML — Gray, mottled, clayey silt. 81 SP, SM, GP — Thin strata of poorly graded sand, silty sand and poorly graded gravel; strata vary in thickness and sequence. 180+	5.0-15 cm/hr (2.0-6.0 in/hr) More than 15 cm/hr (6.0 in/hr) below 30 cm

TABLE II. SOIL CHARACTERISTICS AND PERMEABILITY VALUES (Continued)

MAP UNIT	MAJOR SOIL SERIES	TYPICAL SOIL PROFILE - layers, thickness and color of layers, depth to rock and Unified engineering classification (Profile diagram not to scale).	PERMEABILITY centimeters/hour or (inches/hour)
7	CARLISLE PALMS	 Undifferentiated organic soils; mostly muck but also some peat. Organic material in all stages of decomposition.	———

e. Groundwater

Groundwater data are scarce to absent in the central and northern portion of the installation due to the lack of well drilling. The porous sands in the southern part of FD are excellent sources of potable water. Twelve water wells in the vicinity of Wheeler-Sack Airfield supply approximately 15,900 m^3 of water per day from confined and unconfined aquifers. The water is chlorinated prior to storage in two elevated steel tanks and one underground reservoir. Only a small quantity of water can be expected from the low to moderate permeability of the rock formations.

The initial depths to the water table (1941) varied from 3.3 m in Well No. 2 to 50.9 m in Well No. 1 with Well No. 10 flowing at the surface. Water levels of the remaining wells (1941) are compared to the water levels of September 1980 in Table III. Water levels from boring logs of varous projects within the cantonment area are also included in Table III and the boring locations are shown in Fig. 5.

Several springs are located at the contact between the porous sands in the southern part of FD and the underlying clay deposits to the north and northwest. Two small communities, Philadelphia, outside the west central reservation boundary, and Antwerp, which borders the northwest boundary, receive potable water from surface springs located on FD. The Philadelphia facility consists of an open, surface reservoir formed by a concrete dam, a 40 cm diameter intake pipe, chlorination station, and a pumping system. The Antwerp facility consists of three separate springs, each boxed in an enclosed structure and equipped with a pump, which supply water to storage tanks in Antwerp. These springs are shown in Fig. 3.

The general direction of groundwater movement in the Black River drainage basin, including FD, is westwardly toward Lake Ontario. Locally, the direction of groundwater movement may vary, which is indicated by groundwater data at the old landfill and the oil storage area north of Bldg. 1529. Movement of groundwater at these locations is to the north-northwest.

f. Geological Aspects of Potential Migration

The permeability of the near surface sands, silty sands, and gravels, ranges from 15 to greater than 50 cm per hour (cm/hr), as determined by the Department of Agriculture. Although, no physical tests are available for the deeper soils, the classification of these deposits from the boring logs would indicate permeability values around 10^{-2} to 10^{-4} cm per second (cm/sec) which would permit movement of contaminants. An example of known migration at FD occurred from a fuel storage tank at Bldg. 1529. Fuel from this tank leaked into the subsurface, migrated in a northerly direction, and was discharged onto the surface via a spring approximately 137 m north of the fuel tank. The soil conditions at and within the old landfill (coarse grained and loose) are allowing surface infiltration of rainfall and snow melt to the subsurface. Leachate is being emitted along the northeast slope which runs into a northerly flowing drainageway.

TABLE III. GROUNDWATER DATA

LOCATION	BORING NO.	ELEV. FT. MSL	BORING DEPTH, FT.	STATIC LEVEL, FT.	DATE OF MEASUREMENT
Oil Pollution Control	PC-1	*Topo. 626	20	5.8	4-17-79
North of bldg 1595	PC-2	Topo. 626	20	9.8	4-17-79
	PC-3	Topo. 626	30	11.5	4-17-79
Coal Pile Assessment					
4000 Area	CP-1	Topo. 640	26	18.6	4-18-79
4800 Area	CP-2	Topo. 640	30	10.4	4-18-79
Sewage Treatment Plant	DH-28	629	34	22.9	4-5-71
**Barracks Complex	DH-5	646	50	15	-
**Health Clinic	DH-5	648	50	19.5	12-77
**Building 6020	-	-	30	13	12-77
Landfills:					
Existing	EL-1	Topo. 693	75	-	-
	EL-2	Topo. 693	70	61.8	4-12-79
	EL-3	Topo. 693	70	48.5	4-12-79
Old	OL-1		50	36	4-10-79
	OL-2		25	9	4-18-79
	OL-3		30	14	4-19-79
	OL-4		No log available		
	OL-5		30	10.4	4-18-79
				Level-date	Level-date
Water Wells	1	679	350	167 1941	60.5 9-80
	2	613	111	11 1941	7 9-80
	3	651	119	49 1941	40 9-80
	4	685	93	42 1941	57 9-80
	5	685	228	79 1941	71 9-80
	6	684	119	42 1941	30.5 9-80
	7	673	107	34 1941	78 9-80
	8	670	92	37 1941	- -
	9	650	190	60 1941	48 9-80
	10	594	103	Flowing 1941	9 9-80
	11	690	227	66 1941	11 9-80
	12	681	126	44 1941	62 9-80

* Topographic map - approx.
** No boring logs

The potential for movement of contaminants within the surface and the subsurface does exist.

F. Leases/Tenants

1. Industrial Leases

There are no industrial leases at FD.

2. Agricultural Leases

There are no agricultural leases at FD; however, timber grown on FD is offered for sale under sealed bids. The total volume of saw logs harvested between 1951 and 1976 was 1.56 billion board feet.

3. Grazing Leases

There are no grazing leases at FD.

4. Tenants

Table IV lists the tenants located on post.

G. Legal Actions

There are no legal actions against the post resulting from contamination migration.

TABLE IV. TENANT ACTIVITIES

a. US Army Communications Command Detachment
b. 68th Military Police Detachment
c. 553rd Engineer Detachment
d. First United States Army, Area Maintenance Support Activity/Equipment Concentration Site #1
e. US Army Corps of Engineers, Northern New York Area Office
f. US Army New England Area Exchange
g. US Army Troop Support Agency (Commissary)
h. US Army 55th Ordnance Detachment
i. US Air Force, Detachment 11, 1st Combat Evaluation Group (SAC)
j. US Air Force, 2nd Air Logistic Command (USAFR)
k. New Jersey Army National Guard Mobilization and Training Equipment Site (NJARNG MATES)
l. New York Army National Guard Unit Training Equipment Site (NYARNG UTES)
m. New York Army National Guard Combined Support Maintenance Shop (NYANG-CSMS)
n. New York Air National Guard Gunnery Range
o. Medical Department Activity (MEDDAC)
p. OL-A, Detachment 8, Weather Squadron (MAC)

II. PAST AND CURRENT ACTIVITY REVIEW

A. Installation Operations

1. Industrial Operations

There are no manufacturing operations at FD. The industrial-type operations relate primarily to the maintenance of military vehicles and equipment required to support the training mission. The activities include washing of vehicles, tuning and cleaning engines, periodic maintenance (oil changes, lubrication, etc.) of vehicles, and repairs and overhaul of equipment. A small amount of equipment repainting is done. This equipment is sandblasted, not stripped, prior to painting. Lead-acid batteries are recharged and filled. These operations are performed in the New York and New Jersey National Guard Maintenance areas.

Other activities include the operation of heating boilers throughout the cantonment area, washing of garbage trucks and trash cans at the wash facility near the airport, and facilities type operations (electrical, plumbing, etc.).

2. Lessee Industrial Operations

There are no lessee industrial operations at FD.

3. Laboratory Operations

Laboratory operations include activities at the sewage treatment plant (STP, Bldg. 2166), water treatment plant (WTP, Bldg. S-2067) and various photographic laboratories (Training Aids Services Center; Bldg. T-1030, the Arts and Crafts Shop, Bldg. 5-2009; U.S. Army Health Center, Bldg. 2407).

STP and WTP laboratory operations are discussed under following section II.B. and II.C. of this report.

FD's principal photographic laboratory is located in Bldg. T-1030. Operations include development of both color and black and white film, 35mm up to 20.3x25.4 cm in size. Fixer solutions containing silver are accumulated in 55-gallon drums. The drums are taken to FD's Directorate of Industrial Operations and subsequently to the Defense Property Disposal Office (DPDO), Griffiss Air Force Base, Rome, N.Y., for disposal.

Photographic liquid wastes are also produced by X-ray activities at the U.S. Army Health Clinic (Bldg. T-2407). Their silver containing wastes are also saved for silver recovery.

Both activities have been in the silver recovery program for several years. No-silver bearing liquid wastes are discharged to the sanitary sewer.

The Arts and Crafts Section of the Morale Support Division has a small laboratory set up for black and white film processing. Because the

level of activity is very low, the small quantities of liquid wastes generated are discharged to the sanitary sewer.

4. Materiel Proof and Surveillance Tests

Research, development, test and evaluation programs conducted at FD are:

a. Snow removal equipment.

b. Control of breeding locations for the black fly.

c. DDT effects within the soil.

d. Wind power for electrical generation.

Definitive information about the above RDT&E activities is not available.

5. Training Areas

U.S. Army Reserve components and the active Army as well as Marine, Air Force and Navy Units use the training facilities at FD for training. Approximately 75,000 individuals undergo training at the installation each year. A wide variety of training facilities are available for use by the tactical and logistical units requiring wheel, track, and helicopter transportation. General and specialized areas are also available for bivouac, river crossings, rock quarrying, parachute landing and air drop zones, tactical landing, and demolition. Weapon firings from small arms up to, and including, the largest artillery are conducted at various range complexes and areas. Duds are reported in the impact areas as a result of these operations.

The Nuclear, Biological and Chemical School (NBC) at FD conducts summer training courses to coincide with unit training periods. The class duration is one week with a maximum of 50 students for each class. Fig. 7 identifies the training areas. Table V lists the number and type of training facilities; Table VI indicates the acreage of each training area.

6. Toxic/Hazardous Materials--Handling and Storage

a. Industrial Chemicals

The industrial chemicals at FD are primarily those related to the maintenance operations. They include solvents, cleaners, paints, antifreeze, and POL materials. These materials, along with water treatment chemicals, bleaches, and similar chemicals, are stored in well maintained buildings near Warehouse road.

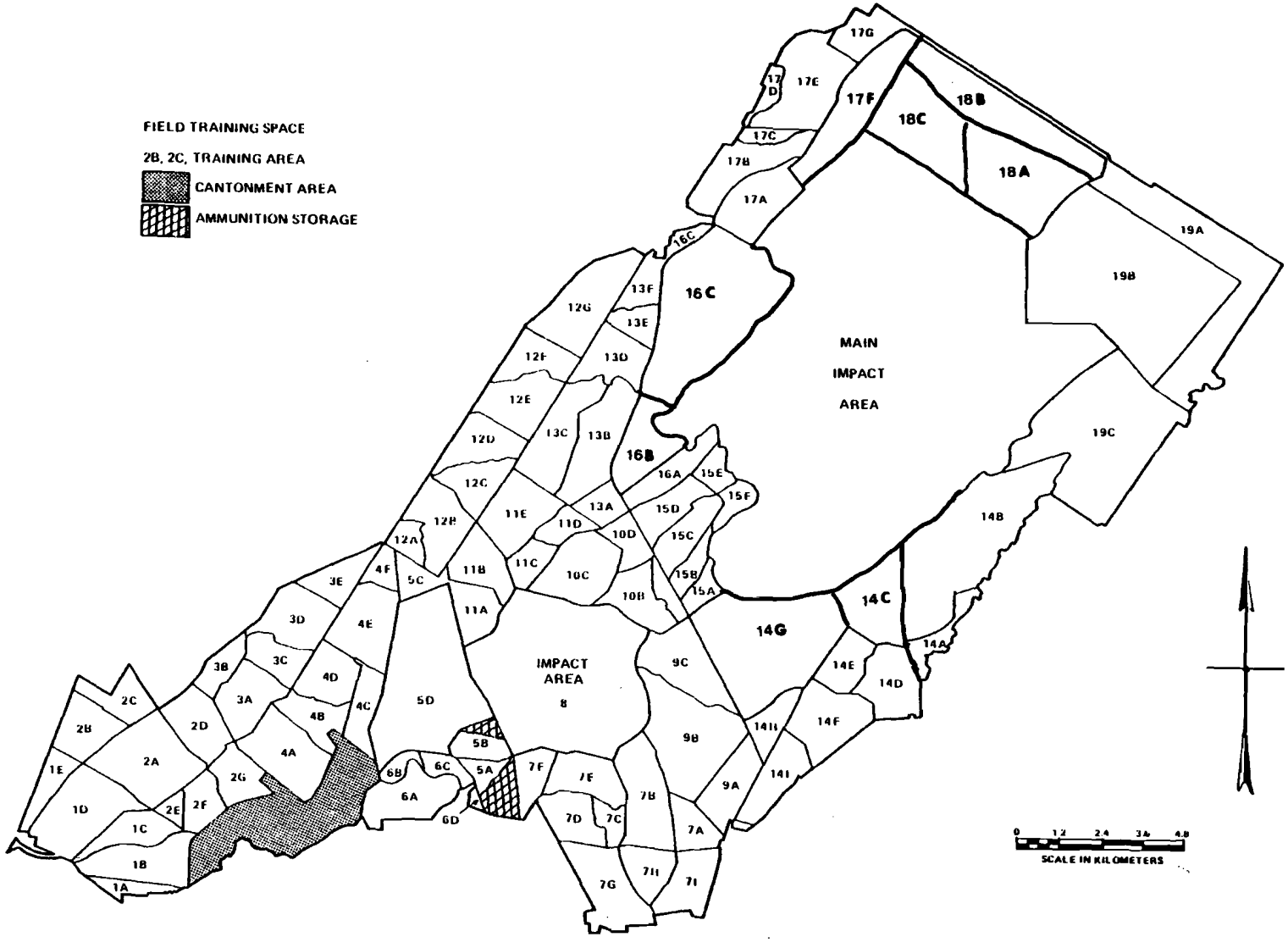


Figure 7. Training Areas

TABLE V. FORT DRUM RANGES AND TRAINING AREAS

1	Helicopter Gunship Qualification Range
1	Air to Ground Gunnery Range (Fixed Wing)
1	Pistol Range
1	Known Distance Range 100, 200, 300 meter
2	10 and 25 Meter Machine Gun Ranges
1	Machine Gun Transition Range
1	Machine Gun Field Firing Range
1	Recoilless Rifle Range
1	Rocket Launcher Range/LAW Range
1	M79/M203 Grenade Launcher Range
10	Tank Firing Ranges:
	2 Tank Subcaliber Tables I, II, III
	1 Tank Table V/Dry TCQC Scout Vehicle
	4 Tank Table VI/2 Without Moving Targets
	2 Tank Table VII & VIIC & VIII
	1 Tank Table VIIC/Scout Squad Proficiency
6	Combat Ranges:
	2 Squad Attack Courses
	1 Platoon Attack Course
	1 Squad and Platoon Attack Course
	1 Combined Arms Course
	1 ARTEP Forces March/Live Fire Exercise
14	Engineer Training Sites:
	M4T6 Float Bridge
	Light Tactical Raft
	Aluminum Foot Bridge
	Deck Balk Fixed Bridge
	Amphibious Landing Site
	Debarkation Site
	Bailey Bridge
	Demolition Site
	Field Fortifications
	Mine Warfare
	Timber Trestle Bridge
	Rigging
	Camouflage
	Armored Vehicle-Launched Bridge (AVLG)
137	Surveyed Artillery/Mortar Firing Points
28	Ranges
11	OPs
19	Major Training Areas
97	Subdivided Training Areas
1	Trainfire Complex
1	Hand Thrown Grenade

TABLE VI. TACTICAL TRAINING AREAS

TRAINING AREA	ACREAGE	HECTARE	TRAINING AREA	ACREAGE	HECTARE
1A	275	111	9A	644	261
1B	851	344	9B	1,669	675
1C	486	197	9C	987	399
1D	1,256	508	10A	235	95
1E	462	187	10B	572	232
2A	1,304	528	10C	934	378
2B	599	242	10D	379	153
2C	518	210	11A	479	194
2D	764	309	11B	589	238
2E	142	57	11C	325	132
2F	397	161	11D	284	115
2G	466	189	11E	843	341
3A	717	290	12A	244	99
3B	357	145	12B	775	314
3C	411	166	12C	572	232
3D	809	327	12D	650	263
3E	446	181	12E	771	312
4A	967	391	12F	589	238
4B	516	209	12G	574	232
4C	467	189	13A	309	125
4D	561	227	13B	1,149	465
4E	967	391	13C	983	398
5A	203	82	13D	759	307
5B	142	58	13E	337	136
5C	402	163	13F	163	66
5D	2,853	1,155	14A	321	130
6A	751	304	14B	3,329	1,347
6B	199	81	14C	1,068	432
6C	280	113	14D	790	320
6D	40	16	14E	536	217
7A	347	140	14F	923	374
7B	923	374	14G	2,732	1,106
7C	231	94	14H	244	99
7D	535	217	14I	597	242
7E	660	267	15A	244	99
7F	243	98	15B	284	115
7G	980	397	15C	516	209
7H	522	211	15D	528	214
7I	684	277	15E	276	112
8 (Impact Area)	4,720	1,910	15F	162	66
			16A	803	325
			16B	734	297
			16C	2,918	1,181
			17A	1,462	592
			17B	812	329
			17C	231	94
			17D	231	94
			17E	1,470	595
			17F	1,322	535
			17G	402	163
			18A	938	380
			18B	1,292	523
			18C	1,730	700
			19A	2,094	847
			19B	4,900	1,983
			19C	3,396	1,374
			Ammo Dump	540	219
			Cantonment Area and Airfield	2,330	943
			Main Impact Area	22,500	9,106
			TOTAL	107,265	43,410

There is large-scale storage of fuels, including 42 underground storage tanks for gasoline, 48 for diesel fuel, and 449 for No. 2 fuel oil. The major portion of the gasoline and diesel fuel storage is along the area called gasoline alley (1).*

In addition, there are several 55-gallon drums and underground tanks for collecting waste POL materials. The waste POL in these containers is collected by a private contractor and recycled.

b. Chemical Agents

No records were found to indicate that lethal or incapacitating chemical agents had ever been used or stored at FD. There is an NBC school on the installation, but this is staffed only during the summer training period. As a result, no details of its operations could be obtained.

Signal smokes, pyrotechnics, and riot control agents (RCA) are used in training operations. These materials are stored at the ammunition storage area.

c. Biological Agents

A dissemination test of a cereal rust disease was conducted in August 1950. The disseminated material consisted of washed, fluffed, white turkey feathers infected with 10 percent by weight of the uredospores of Puccimia graminis avenae, Race 8, a parasitic fungus of oats. Three cluster bomblets of feathers were dropped from an airplane over sixteen 0.2 ha plots of oats (exact location onpost could not be determined). When the study was completed, all of the oat crops were destroyed. No effect was observed in the oat crops of surrounding farms.

No evidence was found to indicate any other use or storage of biological agents or simulants at FD.

d. Radiological Materials--Permits and Licenses

FD has no items that require the installation to have a Nuclear Regulatory Commission (NRC license or DA permit. There are small quantities of radioactive isotopes in test sources (Kr-85, Ra-226), calibrators (SR-90, Pu-239), and other sealed sources such as watches (H-3), compasses (H-3, Ra-226), and gunsights (Pm-147). These items are stored and controlled by the using organization. No records of disposal practices were found.

At the time of the team visit, there were no formal procedures for control, storage, and disposal of radioactive materials.

*Numbers in parentheses are keyed to Figure 8, Map Identifying Areas Relevant to the Survey.

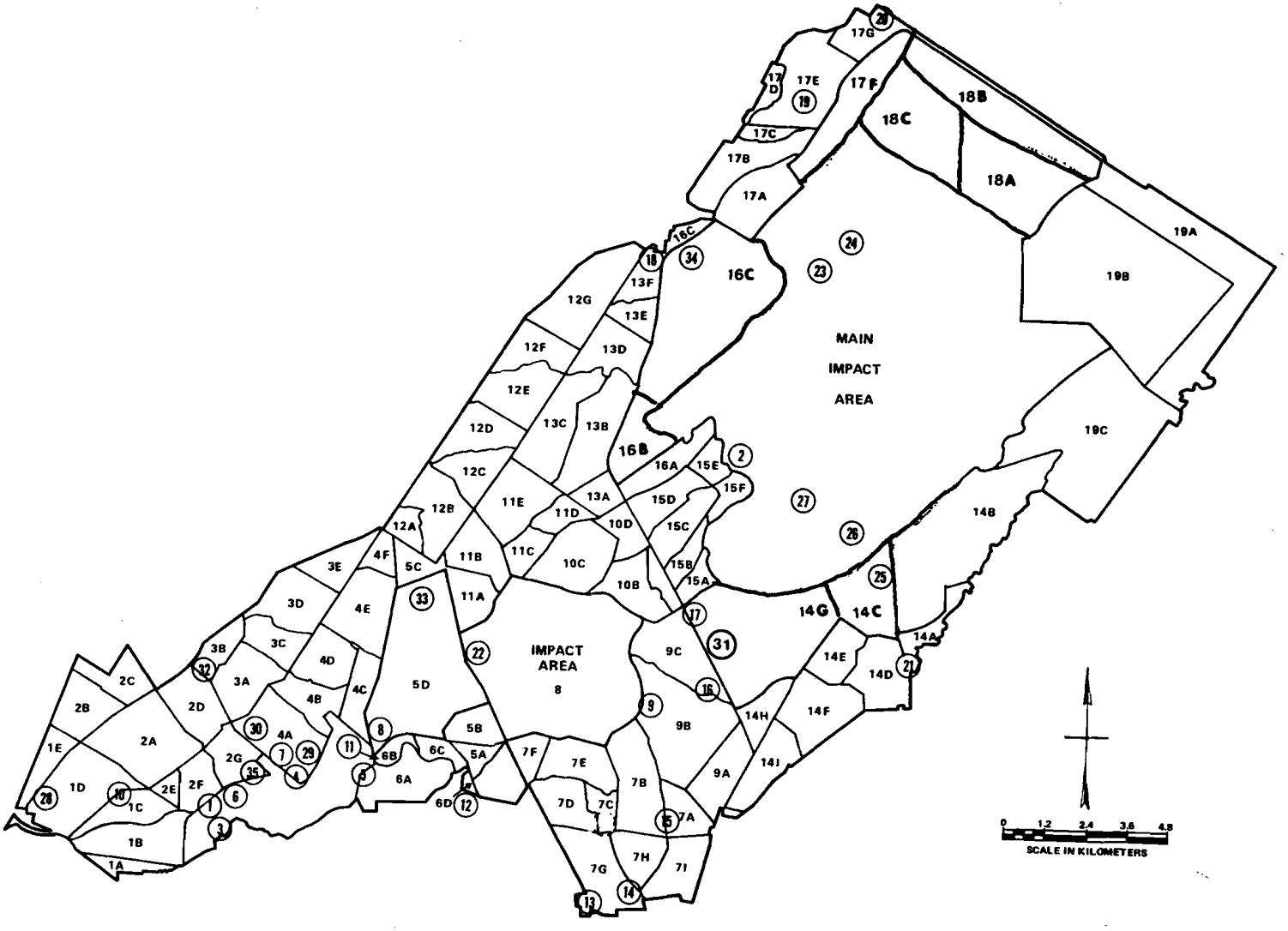


Figure 8. Map Identifying Areas Relevant to the Study

FIGURE 8--LEGEND

1. Gasoline and Diesel Fuel Storage Area--1940's to present.
2. Defoliant Spray Test--Late 1960's.
3. STP-1941 to present.
4. New Wash Rack Facility--Under Construction.
5. Dumpster and Garbage Can Washout Facility--1940 to present.
6. Washrack Wastewater Holding Ponds--1979-1980.
7. Old Landfill--1940-1973.
8. Present Landfill.
9. Field Sanitary Landfill--1970-1974.
10. Old Landfill--1978-1980.
11. Landfill--1950 (Used 6 months).
12. Landfill (General Trash from Deferiet City)--unknown to present.
13. Surface Fill (from Carthage City)--unknown to present.
14. Landfill--unknown to present.
15. Field Dump--Early 1970's.
16. Field Dump--1974-1977.
17. Trench Dump--1975-1977.
18. Landfill--1975-1977.
19. Field Dump--1970.
20. Landfill from Somerville--1973.
21. Landfill--Unknown to present.
22. Demolition and Burning Ground--1978-present.
23. Large Cal. Ammo Destroyed by Detonation [90 millimeter (mm) - 105mm]--1970 to present.
24. 2-500 lb bombs destroyed by Air Release (one time operation)--1972-1973.

FIGURE 8--LEGEND (Continued)

25. Old Hosford Estate Swim Pool Used for Destruction of Old Ammo, Smoke Grenades, Fuel Oil, Smoke Pots, Small and Large Cal. Ammo--1967--1970.
26. Same Material Destroyed as Mentioned in 25 Above.
27. Explosive Ordnance Disposal (EOD) Operations (one time)--Smoke Pots, Broken Lots of Ammo, Flares--1960.
28. Demo Training Area.
29. Simulated "A" Bomb Test Area.
30. German and Japanese Landmine Field--WWII to present.
31. Demo Training Area.
32. Oil Sludge Burial.
33. Spring for Philadelphia Water Supply.
34. Spring for Antwerp Water Supply.
35. Oil Leaching from Unnamed Spring.

However, draft documents of proposed procedures have been written, and will be submitted for approval after discussion with USAEHA during a radiation protection survey scheduled to start in the near future.

At present, tubes, radiacs, and dials containing small amounts of radioactive material are stored in Bldg. T-83 until disposal procedures are defined.

e. Pesticide/Herbicide/Fertilizer Usage

Pest control at FD involves the use of herbicides, insecticides, and rodenticides. The total quantities used in calendar year 1979 are listed in Table VII. These operations are covered under New York State permit No. 6-04493.

Three areas onpost are used for storage. Bldg. T-4002, with a concrete floor with floor drains that connect to the sanitary sewer, is used for both mixing and storage. Bldg. T-4011, an unheated wooden frame building with a wooden floor, is used for storage of additional materials, including ten 5-gallon (18.9 liter) metal cans of 2,4,5-T. Bldg. 4099 has a floor of railroad ballast rock and is used to store 34 drums of Naled and 6.8 kilograms (kg) of DDT.

A building is currently scheduled for renovation in order to properly store pesticides/herbicides temporarily until completion of a new facility targeted for FY 87.

DDT was used from the 1940's until the mid 1960's. The treated areas included the bivouac area, the Luray mansion locality, and some of the range firing points. In 1959-1960, the bivouac areas, the ranges in the southern half of Area 5D, and the roadsides of Route 26 and Pearl Street were sprayed with DDT. Until 1977, DDT was kept in open storage north of Bldg. 199 along First Street.

From 1969 to 1978, 2,4-D at 1.1 kg/ha was used to control vegetation along fences and 2,4,5-T at 2.2 kg/ha was used to control brush along Town Line Rd. and Russell Turnpike in the main impact area. In the late 1950's, a large quantity of herbicide (exact composition could not be determined) was sprayed from a helicopter over a site in the main impact area (2). In 1961, the Dow Chemical Company tested an experimental defoliant mixture along 2.4 km of Range Rd. (location could not be determined). No evidence of stress could be found during the ground or aerial tours. At present, Simazine is used for vegetation control.

According to interviewers, herbicide 2,.4,5-T was used on the range impact areas during the 1950's thru the early 70's. The use was to improve the line of vision from observation points to target impact areas.

No records of fertilizer use onpost were found. Stabilized sludge from the sewage treatment plant is spread in the blown-sand areas in an attempt to encourage the growth of stabilizing vegetation.

TABLE VII. PESTICIDES APPLIED IN CY 1979

INSECTICIDE	AMOUNT OF CONCENTRATE
Baygon 14% EC	4 Gal (15 liters)
Baygon 1% SLN	15 Gal (57 liters)
Diazinon 47.5% EC	3.73 Gal (14 liters)
Carbaryl 80% WP	206 Lbs (93 kg)
Lindane 1% DUS	33 Lbs (15 kg)
RODENTICIDE	
Anticoagulant .025 BT	397 Lbs (180 kg)
HERBICIDE	
Simazine 80% WP	371 Lbs (168 kg)

SOURCE: Fort Drum DFAE Files
1980 (DD Form 1532)

B. Disposal Operations

1. Liquid Waste Treatment

a. Sanitary Wastewater Treatment

FD's STP (3) was built in 1941 to provide primary treatment for domestic wastewater generated in the cantonment area. The original facilities included two parallel grit chambers, two comminutors, a Parshall flume, two primary clarification tanks having scum and sludge digestors, two sludge holding tanks and three sludge drying beds. The plant was upgraded in 1973 to provide secondary treatment. Added facilities were a 12,490 m^3 per day (m^3/day) wet well pumping station, 35.6 cm diameter main, two 2,081.8 m^3/day contact stabilization and settling units, three 22.7 m^3 per minute centrifugal blowers and a chlorine contact chamber. In 1974, the original primary treatment facilities were also upgraded through repair and renovation.

Design parameters for the secondary plant included average daily winter flow rate (681.3 m^3/day), average daily summer flow rate (4,163.5 m^3/day) and instantaneous peak flow rate (12,490.5 m^3/day). The plant was designed to function as a contact stabilization plant during the high flow rates of summer and as an extended aeration plant during the low flow rates of winter (below 1,031 m^3/day).

FD has an Environmental Protection Agency (EPA) permit (NPDES Permit No. NY 0026905; effective date: Aug 22, 1977, expiration date: Jun 30, 1981) that authorizes the discharge of STP effluent (Discharge 003) into the Black River. Parameters required to be monitored are total flow, biological oxygen demand (BOD), settleable solids, suspended solids (SS), phosphorus, temperature, and pH.

The STP has had a need for tertiary treatment for phosphorus removal since the NPDES permit was reissued in 1977. Plant personnel anticipate that this capability will be attained by Dec 1980.* The permit restricts concentration of phosphorus in STP effluent to 1 mg/liter. Since phosphorus monitoring began in 1977, phosphorus in the effluent has averaged 2.2 mg/liter .[1]

The STP has also experienced difficulties in meeting discharge limits for BOD and SS since the NPDES permit became effective in 1974. Plant failures with respect to these parameters have been attributed in part to shock loading associated with the extreme variation in FD's population. A second factor is the high rate of groundwater/stormwater infiltration into the sewer system (estimated in 1970 to range between 757 and 1,892 m^3/day depending on climatic conditions.[2] FD currently has projects underway to correct these deficiencies.*

*Work was completed in Jan 1981.

Field operations involving troop training are capable of generating large volumes of sanitary wastewaters. No records are available at FD to indicate the amounts of wastewaters generated at latrines, shower points, laundry facilities water purification points, mess operations, and bakery activities. However, it has been estimated that during a summer peak usage week, 16,000 troops using 0.121 m^3 of water per day potentially could generate 1,892 m^3 of sanitary wastewater in the field each day.

Under a 1973 construction program, the old style pit latrines were replaced with latrine buildings equipped with water-tight, concrete holding tanks of approximately 8.5 m^3 capacity. Approximately six of the old style seepage pits remain; however, they are seldom used. Concrete tanks are pumped out regularly by a contractor who takes the wastes to a manhole near Bldg. T-2170 and discharges it into the sewer system. Latrine pits/trenches are dug for use only in remote areas or as demonstrations for construction and maintenance training. Rented portable latrines are usually employed in areas where permanent facilities are unavailable.

During the summer of AT80, five shower points (concrete pads with rock sumps) were constructed at various locations, thereby replacing the old inadequate slabs. The shower points obtain water from nearby streams. A total of six pads are now available. However, the troops generally shower in the cantonment area rather than at the permanent shower points. There is also a tendency to set up mobile shower units in the field rather than use the permanent ones. Showers are installed on raised wooden platforms equipped with rubber floors. Water is trucked in and the used water drains into staved rubber bladder holding tanks. Holding tanks are emptied by the trainees as needed and the wastewater is discharged into FD's sanitary sewer.

Mobile laundry facilities used in field operations discharge up to 1.9 m^3 per hour of wastewater into staved rubber holding tanks. Contaminants include synthetic detergents, bleaches, soaps, and clothing soil. Wastewater is taken from the holding tanks and disposed of in the sanitary sewer.

The mobile bakery is usually located in Area 4C. Wastewater, containing soap and bread ingredients, is collected in staved rubber holding tanks and discharged to the sanitary sewer as required.

Mobile water purification units take stream water and purify it only as an equipment training exercise. The purified water is not actually used for drinking. Wastewater is produced when the unit's diatomaceous earth filter is backwashed. Wastewater is held temporarily in an aboveground covered steel tank. It is subsequently pumped out and discharged to the sanitary sewer. Contaminants include diatomaceous earth particles, coagulants, inorganic silts, and organic slimes.

Field mess operations generate some sanitary wastewater during food preparation and cleanup activities. Permanent facilities are not available for containment/treatment of field mess wastewater. It is usually dumped on the ground; occasionally, some goes into seepage pits.

b. Industrial Wastewater Treatment

Most of FD's industrial type wastewater is generated during the cleaning of wheeled and tracked vehicles at washrack facilities. There are numerous washracks located in the cantonment area, especially along Oneida Ave. (gasoline alley) and just east of Great Bend Rd. (1).

The installation obtained a New York State Pollution Dischareg Elimination System Permit (SPDES NY 010 6798; effective date: Sept 1, 1979, expiration date June 30, 1981) to authorize discharges from 10 washracks to groundwaters via unlined percolation ponds or ditches. These discharges (identified as Outfalls #001 through #010) are associated with the following washracks: 1590A, 1590B 1591, 1592, 1593, 1594, 2090, 2091, 2092, 2093, and the aircraft wash facility. The permit specifically forbids discharge of wastewater from these washracks to surface waters. Use of temporary liners in ponds/ditches to facilitate removal of oil from the wastewater via pickup by imbiber beads has not been very successful. In addition to oil, the SPDES requires that effluent to groundwater be monitored for aluminum arsenic, chloride, chromium, foaming agents, lead, grease, zinc, pH, and flow. An evaluation of monthly SPDES reports (June through September 1979) showed that discharge limits were exceeded for aluminum (18 times), arsenic (5 times), foaming agents (2 times), lead (18 times), oil and grease (9 times), and pH (1 time).

Construction of a centralized wheeled and tracked vehicle wash facility (4) is expected to be completed by the end of CY 80.* Wastewater will be collected in concrete vaults for solids removal. It will subsequently pass through an oil and grease separator and sand filter. All treated wastewater will be recycled so that the need for percolation ponds will be eliminated.

FD's current NPDES permit covers discharges of wastewater from tank washrack (discharge 001) and vehicle washrack (discharge 002) facilities into Pleasant Creek. Parameters required to be monitored under this permit include flow, BOD, SS, oil and grease and pH. Additionally, floating solids and visible foam are not allowed in these effluents. FD personnel no longer collect samples of washrack wastewater as it discharges to Pleasant Creek (NPDES discharges 001 and 002) and no monitoring data were available. These monitoring points will be closed out when the centralized vehicle wash facility becomes operational. However, until the new centralized wash facility proves large enough to handle the large number of vehicles, a few old washrack areas will be retained on standby status.

*Completed in Dec 80.

Since the 1940's, only sediment traps (no seepage pits) were provided to treat wastewater from some washracks (1389, 1390, 1593, 1594, 1690, 1693, 1964, 1796, 2090.[4] Oil and dissolved materials would have been discharged with the effluent. Tracked vehicle washracks 2091 and 2092 had sediment traps and also discharged a part of their effluents to seepage pits. No information was available on wastewater treatment at washracks 1199 and 1294.

Small volumes of other industrial type wastewaters (battery acid, boiler blowdown, antifreeze, paint water-screen, garbage can washwaters) are also generated.

Waste battery acid is disposed in the Battery Shop (Bldg. P44) by dumping it into a disposal sink that discharges directly into the sewer system. Since the mid 1960's, the New York National Guard (NYNG) has discharged its battery acid into lime pits near Bldg. 1826. During earlier NYNG operations, batteries were emptied directly onto the ground in the 1700 and 1800 areas. (This area has a sand covering over limerock.) Battery acid generated by the New Jersey National Guard was neutralized in a plastic drum. This drum was buried in the southwest corner of the 6000 area.

Boiler blowdown water is produced in one high pressure boiler located in Bldg. T-2063 (garbage can washout facility) and in numberous low pressure boilers. All boilers are treated with sodium hydroxide and sodium sulfite. The high pressure boiler also receives tannin. These chemicals are added to boilers to provide rust, corrosion and scale control. Boiler blowdown is variously disposed onto the boilerhouse floor for evaporation or subsequent discharge to the ground around the building or to floor drains that empty into the sanitary sewer.

Waste antifreeze has been discharged to the sanitary sewer via floor drains, and it has been added to waste oil in underground storage tanks.

A water curtain is used for air scrubbing in the paint spray booth (Bldg. 197). Paint is skimmed from the wastewater and sent to the sanitary landfill. The resulting wastewater is disposed in a rock sump outside the building.

Wastewater is generated at Bldg. T-2063 (5) during the cleaning of garbage cans and messhall air filters. It passes successively through a grease trap, septic tank and to one of two seepage pits. Dumpsters and garbage trucks are washed near Bldg. T-2063. Resulting wastewaters drain toward Black River; however, they are absorbed by the soil before reaching the river. By the end of FY 82, under the on-going APAP - Misc. Water Pollution Control Project, a septic tank with a series of interconnecting seepage tanks will be installed to preclude discharge to the Black River.

c. Holding Ponds

Four plastic lined holding ponds were constructed along Oneida Avenue in the washrack areas during 1979 and 1980. Vehicle washwater is held temporarily to permit oil and suspended solids removal before being discharged into adjacent percolation ponds for final disposal.

d. Stormwater Drainage

FD's stormwater drainage system includes 67,907 linear feet (20,698 m) of vitreous tile, cast iron, vitreous clay, and reinforced concrete piping that vary from 15.2 to 121.9 cm in diameter. Stormwater is collected in various systems consisting of catch basins, manholes, paved or grassy open swales and ditches. Stormwater piping in the southern portion of the cantonment area discharges to the Black River. Other piping segments tend to discharge in a general northerly directon. Surface runoff from land near the Black River discharges to the river. Most surface runoff ends up in natural drainageways that flow northwest to the Indian River. This river drains approximately 82 percent of the installation. Stormwater runoff in the extreme northern portion of the reservation drains into several small streams which eventually discharge into the Oswegatchie River just above Gouverneur, N.Y.

There are no deliberate discharges of wastes into the stormwater drainage system. However, past discharges and spills of oil, particularly in the cantonment area, are potential sources of stormwater contamination. Landfill leachate especially from the old landfill (7), is also a potential stormwater contaminant.

2. Solid Waste Treatment

a. Sanitary Landfills

The present landfill (8) has been in operation since 1973. It is located in a level area of permeable sandy soil with very little vegetation. The trench method of landfilling is used. This landfill receives solid waste generated by messhalls, offices, barracks, maintenance shops, and the training units. It is operated under New York State Permit No. 1265.

The old landfill (7) was operated from 1940 to 1973. The site covers about 20 ha of permeable sandy soil and is divided into two cells by a deep ravine. The northern boundary of the landfill is a steep-sided ravine which has a perennial stream flowing in a westerly direction. The deep ravine dividing the landfill acts as a drainage path to the perennial stream. Discoloration of the banks of this stream has been reported.

According to persons interviewed, this landfill was used for the disposal of DDT, POL wastes, and unused ammunition, in addition to the types of refuse being put into the present landfill.

These two landfills were studied in April 1979 under a Corps of Engineers Army Pollution, Abatement Program (APAP) contract. This study showed that the depth to groundwater under the current landfill varied from 15.8 m to at least 19.8 m and that the direction of groundwater flow was probably trending westerly away from the Black River. Under the old landfill, the depth to groundwater varied from 2.7 m to 11.2 m and the flow was in a general northerly direction.

Groundwater samples taken around the landfills were analyzed for fecal coliform bacteria, pH, specific conductance, zinc, hexavalent chromium, copper, iron, lead, chlorinated hydrocarbon pesticides, polychlorinated biphenyls (PCB), and volatile halogenated organic compounds. Samples from the current landfill violated the New York State groundwater quality standards for lead and iron. Samples from the old landfill contained excessive iron.

In 1973, a field sanitary landfill (9), located on Lake School Rd. just north of its intersection with Gormerly Rd., was closed because of water-filled trenches.

An open landfill operation (10) is located off Pearl Street Rd. Construction type debris and waste have been placed in this area since 1978. No contaminated material was reported to have been dumped in this area. Many other unauthorized landfills and dumps were observed by the team during the ground and aerial tours. It was reported that many of these dumps were a result of nearby civilian population intrusion and dumping. The post is an open post which is poorly fenced, not well posted, and easily accessible in the remote range and impact areas. The most significant dumps observed by the team are identified on Figure 8 as numbers (11) through (21).

Many of the range landfill areas contained packing crates, ammunition casings, and other military packing and shipping debris.

b. Contaminated Waste

The old sanitary landfill (7) was used for the disposal of all solid waste. This included POL-saturated solid waste (empty oil cans, oily rags, oil filters, etc.); empty containers from paints, solvents, and pesticides; and, according to some reports, excess ammunition and pesticides, including DDT.

At present, the active landfill (8) receives empty paint and solvent containers, empty pesticide cans that have been rinsed three times and crushed, and POL-saturated wastes.

Pathological wastes from the medical facility are disposed of in the incinerator in Bldg. 2415 under N.Y. State Permit No. 6-04462.

FD disposes of excess material through the DPDO at Griffiss Air Force Base, Rome, N.Y. Excess pesticides are disposed of in this manner. Waste POL is collected by private contractor and recycled. POL sludge from replaced fuel storage tanks along gasoline alley (1) was buried in a trench (32) near Evans Mills gate in the 1960's.

Nine transformers containing PCBs have been stored in Bldg. S-2005 since November 1979 awaiting disposal instructions. The floor is concrete and not bermed.

3. Demolition and/or Burning Grounds

Ten demolition and/or burning grounds were located at FD. They are shown on Fig. 8 as numbers (22) through (31). Little migration of contaminants would be expected from these activities. Conventional ammunition and explosives (including smoke and incendiaries) were reportedly destroyed at these areas.

4. Demilitarization

The only demilitarization operations reported at FD was covered under demolition and burning grounds above. No supporting data could be found with reference to lethal or incapacitating chemical munitions.

C. Water Quality

1. Surface

The quality of FD's surface waters has been characterized in terms of known or potential contamination without reference to specific contaminants. Beaver Meadow, Buck, Deerlick, Hunter Matoon, and Shingle Creeks; Trout Brook; West Branch of Black Creek and Indian River were identified as having no known pollution. Drainage from the Main Impact Area may be introducing pollutants into Cold and Rockwell Creeks. There is a potential for agricultural pollution of Black Creek at its headwaters area. Black River (runs along the southern boundary) may receive municipal and industrial wastes upstream of FD when wastewater treatment plants fail. Bonaparte Creek is subject to potential contamination from residences around and recreational uses of Lake Bonaparte. Pleasant Creek has a high pollution potential due to contaminants (especially petroleum products) generated in the cantonment area.

All of the above streams are designated Class C streams for fishing and fish propagation.

Benton, Buck Creek Campsite, Dority, Indian and Quarry Ponds; Indian and Narrow Lakes are all characterized as having no known pollution. No information was available on the pollution susceptibility of Burnt and Marsh Ponds or Sawyer Creek.

Mud lake is susceptible to pollutants associated with residential and recreational activities at Lake Bonaparte.

St. James Lake pond is located northwest of the cantonment area. This pond is the only available facility for swimming onpost. It experienced fecal coliform pollution in the past that was attributed to the nearby bathhouse septic tank.[5] Post personnel stated that, in the past, truck loads of brass from spent ammunition have been taken from the pond.

Spring No. 2 (33), located in Area 5D, serves as the public water supply for the Village of Philadelphia. The spring discharges 11,355 m^3 of water per day. Philadelphia Reservoir, formed by damming Spring No. 2, is

approximately 0.4 ha in size. In the past, samples of the water had a general bacterial count that ranged from 1 to 5,000 cells per ml. The reservoir is not fenced off and it is readily accessible to man and wild animals.

Three other springs located on Government property (34) supply the community of Antwerp with potable water. No problems with water quality were identified in the records.

2. Subsurface

FD's water requirements are satisfied by a well field having 12 drilled wells located around the perimeter of Wheeler-Sack Airfield on the east side of the cantonment area. (see Table VIII.[3])

The well field has an estimated capacity of 15,900 m^3/day. All water is pumped to the WTP (Bldg. S2067) located on Well Rd. where it is treated with chlorine, fluoride and sodium silicate. Treated water is stored in two 1,900 m^3 elevated storage tanks (Bldgs. S2068, S2160) and a 2,850 m^3 ground storage reservoir (Bldg. S1699). Potable water is monitored daily for chlorine and pH and monthly for coliform bacteria.

Three of the 12 water wells are drilled into sand and the others are drilled into rock. Water taken from sand deposits tends to be softer (low calcium bicarbonate type) than water from the other wells which tends to be higher in mineral content, especially magnesium sulfate.

In the summer of 1979, water samples were taken from each potable water well. Samples were also taken from Spring No. 2 (water supply for Philadelphia); a composite of waters from Springs 3,. 4, and 5 (serves Antwerp) and West Creek at the installation boundary (receives water from Springs 1 and 9 and serves the town of Evans Mills). Analyses were made for pH, nitrate, chloride, total dissolved solids, specific conductance, fluoride, sulfate, total alkalinity, total hardness, arsenic, barium, cadmium, chromium, copper, lead, mercury, silver, zinc, calcium, sodium, iron, magnesium, manganese, and selenium. Analytical results indicated that these waters in general are of excellent quality.[3] Water from Well No. 8 was found to be high in iron. Samples from West Creek and the components of Springs 3, 4, and 5 "apparently" (some doubt about sample preparation) were high in iron and manganese. High values indicate that concentrations of iron and manganese exceed concentration levels established under EPA's National Secondary Drinking Water Regulations. Parameters covered by these regulations are of concern primarily because of their adverse affects on aesthetic quality (appearance, color, odor, taste) rather than adverse affects on health, although they do constitute health hazards at very high concentrations.

It has been reported that for at least four years an unnamed spring(35) located approximately 152 m northwest of Petroleum Dispensing Area No. 1595 has been contaminated by oil seepage.[3] Area No. 1595, located along Oneida Avenue, has several underground fuel storage tanks. In 1975, one of the tanks was determined to have a 2.5 cm diameter hole and it was

TABLE VIII. FORT DRUM WELL DATA

Well Number	Bldg Number	Surface Elevation (feet above MSL)	Depth of Well (Feet)	Depth to Static Water Level July 1979 (Feet)
1	S2071	679	350	167
2	2072	613	111	11
3	2073	651	119	49
4	2074	685	93	42
5	2075	685	228	78
6	2076	684	119	42
7	T2080	673	107	34
8	2077	670	92	37
9	2078	650	190	60
10	2079	593	103	Artesian (flowing)
11	S2081	690	227	66
12	S2082	681	126	64

1 foot = 0.305 meters

subsequently replaced. The drainageway from the spring is foul smelling and contaminated with petroleum products. The extent of oil contamination of the surrounding aquifer is not known. Discharge from the spring flows to St. James Pond, an onpost recreational area.

It has been reported that "a significant amount of leachate moves via the groundwater path to the toe of the slope north of the old landfill where it surfaces along a stream"[3]. This leachate has been described as orange-colored and odoriferous.

Several of the surveillance wells established at the old landfill (OL-1 through OL-5) and existing landfill (EL-1 through EL-3) were sampled in July 1979 and analyzed for pH, nitrate, chloride, total dissolved solids, specific conductance, fluoride, sulfate, total alkalinity, total hardness, arsenic, barium, cadmium chromium copper, lead, mercury, silver, zinc, calcium, sodium, iron, magnesium, manganese, and selenium. Surveillance wells OL-1, OL-2, OL-3, OL-5, EL-2, and EL-3 showed high iron and EL-2 showed elevated lead.[6] These data have been questioned by AEHA due to sample handling deficiencies. (Metal samples were not filtered before acidification.) None of the shallow monitoring wells at either landfill is located in the known or projected down-gradient or site source direction of groundwater flow. Subsequent work by AEHA in 1979 using above surveillance wells showed that most of the wells have been dug too shallow and were dry. Of the wells that could be sampled (OL-2, OL-3, OL-4), OL-2, and OL-3 exceeded National Secondary Drinking Water Regulation limits for iron and manganese (0.3 and 0.05 mgh/l, respectively).

It was reported that "Water from glacial-deposits aquifers is commonly objectionably high in iron and manganese content."[7]

The contribution of naturally occurring iron and manganese to the quantities of these contaminants found in samples from wells OL-2 and OL-3 is unknown.

Another potential source of groundwater contamination is runoff from a large coal pile (4.5 to 7.3 million kg capacity) located in a coal yard near Bldg. T4010. Runoff accumulates in the southeastern end in a depression filled with large crushed stones and sinks into the ground. Parameters adversely affected by coal pile runoff include pH, sulfate, iron and dissolved solids. Analytical results from the assessment of coal pile runoff conducted June 1979, indicated that the NYS-DEC Effluent Standards and/or Limitations for groundwater standards were not contravened.

During 1973, a well approximately 12.8 m deep was dug by an Air Force radar detachment at FD. The well was constructed just south of Bldg. P2342 for use as a grounding well. The well was cased all the way to the limestone bedrock base. Approximately 227 kg of Epsom salt (magnesium sulfate heptahydrate) was added to the well during the summer of 1974 to improve

conductivity. Analysis of the well water by AEHA (September and October 1974, August 1979) shows that the original high levels of magnesium, sulfate, hardness, dissolved solids and conductivity no longer exist. Present levels of well water constituents are not health hazards and do not pose a significant aquifer pollution threat.

3. NPDES Permits

FD has one National and one State of New York pollutant discharge elimination permit. They are discussed above under sanitary and industrial wastewater treatment.

III. INSTALLATION ASSESSMENT

A. Findings

1. FD had its beginning in the 1905-1910 time-frame on 4,047 ha of land. During the 1930's, the Government purchased over 39,363 ha of additional land. The primary mission of FD has always been training.

2. The area has long, cold winters, and short, warm summers with an annual rainfall of approximately 100 cm.

3. There is a wide variety of flora and fauna with biological stress being observed in range impact areas and along some streams and swampy areas.

4. The geohydrologic data at FD indicates a high potential for migration by both surface and subsurface waters. The topography is predominantly flat in the southern third of the reservation to gently rolling in the northern two-thirds. Approximately 82 percent of the surface drainage is to the west, with a small northeastern drainage divide in the northern section. The soils identified range from organics to gray and reddish brown silty sand with gravels, cobbles, clayey silt, and clay. The groundwater data are very scarce to non-existent in the northern two-thirds; however, well data in the lower portion indicate the depth to initial water to vary from 0 to 51 m. Other water levels from boring logs of various projects are all within the cantonment area and fall within the well data range. The general groundwater movement in the Black River drainage basin, which includes FD, is westwardly towards Lake Ontario; however, the limited groundwater data from the old landfill and Oil Pollution Control Study indicate the local groundwater movement on FD to be in a north northwest direction.

5. The major industrial type operations at FD include vehicle and heavy equipment maintenance, repair and overhaul.

6. There are no industrial leases at FD.

7. Laboratory operations at FD include activities at the STP (Bldg. 2166), WTP (Bldg. 2067), and various photographic laboratories (Bldgs. T-1030, 5-2009, and 2407). A silver recovery program has been in effect for several years.

8. Approximately 75,000 individuals receive training at FD per year. This includes active Army, Army Reserve, Marine, Air Force and Navy units.

9. Solvents, cleaners, paints, antifreeze, and petroleum, oil, and lubricants (POL) materials are the primary industrial chemicals utilized at FD. There is a large-scale underground storage of fuels including 42 gasoline, 48 diesel, and 449 fuel oil tanks. Waste POL is collected by private contractor and recycled. A fuel holding tank at Bldg 1595 was known to have leaked in the past. Fuel leaked in the subsurface, migrated in a

northerly direction and discharged onto the surface via a spring approximately 137 m north of the fuel tank. The tank has since been replaced.

10. Signal smokes, pyrotechnics and riot control agents are used in training operations. No records were found to indicate the use of lethal or incapacitating chemical agents at FD.

11. A dissemination test of a cereal rust disease on oats was conducted in August 1950. When the study was completed, all crops were destroyed. No effect on crops off the installation were reported from this activity. No evidence was found of any other use or storage of biological agents at FD.

12. FD has no radiological items that require the installation to have an NRC license or DA permit. No record of past rad disposal practices was found. Procedures for disposal of the tubes, radiacs and dials used in the training operations were being prepared at the time of the team's visit. Bldg. T-83 is used to store material until disposal procedures are defined.

13. Pesticides including DDT and 2,4,5-T have been used in the past. Pesticide storage buildings used do not meet present day requirements for storage of pesticides. Defoliant tests have reportedly been conducted at FD in the past. Exact range locations could not be found in FD documents.

14. Sanitary wastes at FD are treated at the post STP. The STP has experienced difficulties in meeting all discharge limits of the NPDES permit. Failures are attributed in part to shock loading associated with the extreme variation in FD population and the high rate of groundwater/stormwater infiltration into the sewer system. Projects are underway for correcting these deficiencies. During field operations, wastewaters are generated at latrines equipped with water tight concrete holding tanks. The tanks are pumped out regularly by contractor, who takes the wastes to a manhole near Bldg. T-2170 and discharges it into the sewer system.

15. The primary industrial wastewater generated at FD is from cleaning of wheeled and tracked vehicles at washracks. The NPDES permit authorized the use of unlined percolation ponds associated with the washracks. Temporary liners in ponds/ditches for removal of oil has not been successful. A new centralized wheeled and tracked vehicle washrack facility was being built at the time of the team's visit and should be operational before next summer's training exercises.

16. The records indicate that toxic waste discharges have occurred in the past into the storm drainage system. The most significant examples are: leachate from the old landfill area and oil spills in and around the cantonment area.

17. Several landfills were identified on FD. The present landfill has a New York State permit; however, it does not meet all of the EPA requirements. Attempts are being made to work with offpost communities to locate a suitable future site. The old landfill was operated from 1940-1973

near a drainage path and perennial stream. Leachate has been reported flowing from this landfill. The landfill was reported to have been used for the disposal of pesticides (DDT), POL wastes, and unused ammunition. The depth to groundwater is reported to vary from 2.7 m to 11.2 m. This landfill has a large quantity of debris (old autos, ammo cases, and general junk) exposed on the surface. Other landfills and dumps were identified in the training range areas. Some are a result of field training operations while others appear to be a result of indiscriminate dumping by offpost private citizens. Many of these are surface dumps located in low lying areas and subject to possible leaching by surface and subsurface waters.

18. Excess materials are disposed of through the DPDO at Griffis AFB, Rome, N.Y. There are nine transformers containing PCBs stored in Bldg. S-2005 awaiting disposal instructions. The floor is concrete; however, it is not bermed. Future renovation of Bldg. S-2005 includes a berm at all door thresholds.

19 Water quality data at FD is primarily on the 12 water wells which supply potable water to FD. The quality is reported to be excellent with well No. 8 high in iron. Several springs and streams onpost are used as water supplies to nearby communities. Two communities (Philadelphia and Antwerp) outside the northwest boundary have agreements to obtain their potable water from springs which are located on FD while other communities obtain their drinking water from streams which have a portion of its watershed on FD. No problems were surfaced with respect to water quality of these springs; however, a spring located approximately 152 m northwest of Oneida Avenue was reported as contaminated with POL.[3] Oil was observed seeping from this spring during the ground tour. It has been reported that the source was a result of leakage from underground fuel storage tanks along Oneida Avenue. The extent of oil contamination is not known and the flow from the spring is to St. James Pond (recreational area) and eventually to Pleasant Creek, which is a potable water supply for the community of Evans Mills. All old fuel tanks have been recently replaced. Leachate analysis of the old landfill indicated high contents of iron only. The unconfined aquifer has never been analysed to the extent to arrive at the conclusion of contamination.

B. Conclusions

1. Available geological evidence and information on contaminant sources indicates a potential for migration of contaminants via streams and subsurface aquifers.

2. The most likely sources of contamination from a migration point of view are from storage of POL materials which includes residual from past leakage of underground tanks, past usage of pesticides, and landfills.

3. Based on the previously collected limited water quality data, primarily in the cantonment area, indications are that contaminants are migrating via the surface and initial groundwater.

4. Due to the past usage of pesticides in the Northeast Range Areas, there is a possiblity that residual amounts of pesticides are present; however, a lack of sampling and analyses data precludes determining the impact of this situation on the environment.

5. A potential hazard exists as a result of unrestricted access to impact areas.[1,2]

6. Pesticides and PCB transformers are improperly stored.[3,4,7]

7. There is a potential for underground leakage from POL storage tanks, due to the fact that the integrity of the tanks is not checked.[5,6]

[1]AR 385-30, Safety Color Code Markings and Signs, 19 Nov 71, Chapter 2.
[2]AR 385-63, Policies and Procedures, for Firing Ammunition for Training,Target Practice, and Combat, 22 Feb 78, Chapter 2.
[3]AR 200-1, Hazardous and Toxic Materials Management, Chapter 6.
[4]USAEHA Entomology Special Study No. 99-045-75/76: Criteria for Design of a Pest Control Shop, Pesticide Storage and Mixing Facility.
[5]CFR-Title 40-112, Oil Pollution Prevention.
[6]AR 200-1, Chapter 9, Oil and Hazardous Substances Spill Control and Contingency Plans.
[7]CFR-Title 40-761, Polychlorinated Biphenyls (PCB's) Manufacturing, Processing, Distribution, In Commerce, and Use Prohibitions.

C. Recommendation

1. That a survey be performed by USATHAMA to determine if any contaminants are migrating off-post, via the surface or subsurface waters. It should include as a minimum, the POL storage area and the old and present landfills. In addition, a limited sampling and analysis of the northeast range areas should be performed to determine if residual amounts of pesticides are present in the environment.

2. That Fort Drum do the following:

a. Limit/control accessibility to the impact areas.

b. Consolidate all pesticide storage into one area which meets all applicable Army regulations and AEHA guidelines, and dispose of excess materials.

c. Include leak testing of all underground POL tanks in the Post Spill Contingency Plan.

d. Properly store PCB Transformers.

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2. USAEHA, Water Quality Engineering Consultation No. 24-M17-75/76, Fort Drum, N.Y., 28 April - 1 May 75.

3. USAEHA, Geohydrologic Consultation No. 31-24-0189-80, 23 - 26 July 79.

4. Fileccia, R. J. et al., Vehicle Washing Operations and Wastewater Discharges, Fort Drum, N.Y. - Findings and Recommendations, Technical Report E-80, June 76.

5. USAEHA, Special Study of Remington Pond, Survey No. 24-018-70, Camp Drum, Watertown, N.Y., 12-14 November 69.

6. "Landfill Leachate Analyses, Fort Drum, N.Y.," APAP Study (Unnumbered), prepared by O'Brien and Gere, Engineers, Inc., for the New York District, COE, June 1979.

7. "Terrain Analysis, Fort Drum, New York," prepared by The Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Ft. Belvoir, Va., October 1977.

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9. Kelly, Charles, "Coastal Resources - Geology," Eastern Ontario Commission, Service Area, 1977.

10. Long, Paul W., "Preliminary Report on the Geology of Camp Drum, New York," City College of New York, Honors I, II, and III, 1959.

11. MacClintock, Stewart, David, P., "Pleistocene Geology of the St. Lawrence Lowland," New York State Museum and Science Service, Bulletin No. 394, Albany, New York, 1965.

12. New York State Museum and Science Service, "Geologic Map of New York," Map and Chart Series No. 15, 1970.

13. O'Brien and Gere Engineers, Inc., "Industrial Wastes of Ft. Drum, N.Y.," Study No. 1027-W-3, Ft. Drum, New York, 1979.

14. _____, "Oil Pollution Control, Ft. Drum, N.Y.," APAP Study No. 1027-W-7, Ft. Drum, N.Y., 1979.

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15. Stewart, David P., "The Pleistocene Geology of the Watertown and Sackets Harbor Quadrangles, N.Y.," New York State Museum and Science Service, Bulletin No. 369, Albany, N.Y., 1958.

16. U.S. Army Corps of Engineers, "Miscellaneous Water Pollution Control, PN 28, Ft. Drum," Watertown, N.Y., 1979.

17. U.S. Army Environmental Hygiene Agency, "Environmental Impact Statement (EIS) Data Review, No. 24-1453-78, Ft. Drum, N.Y.," Aberdeen Proving Ground, MD, 1978.

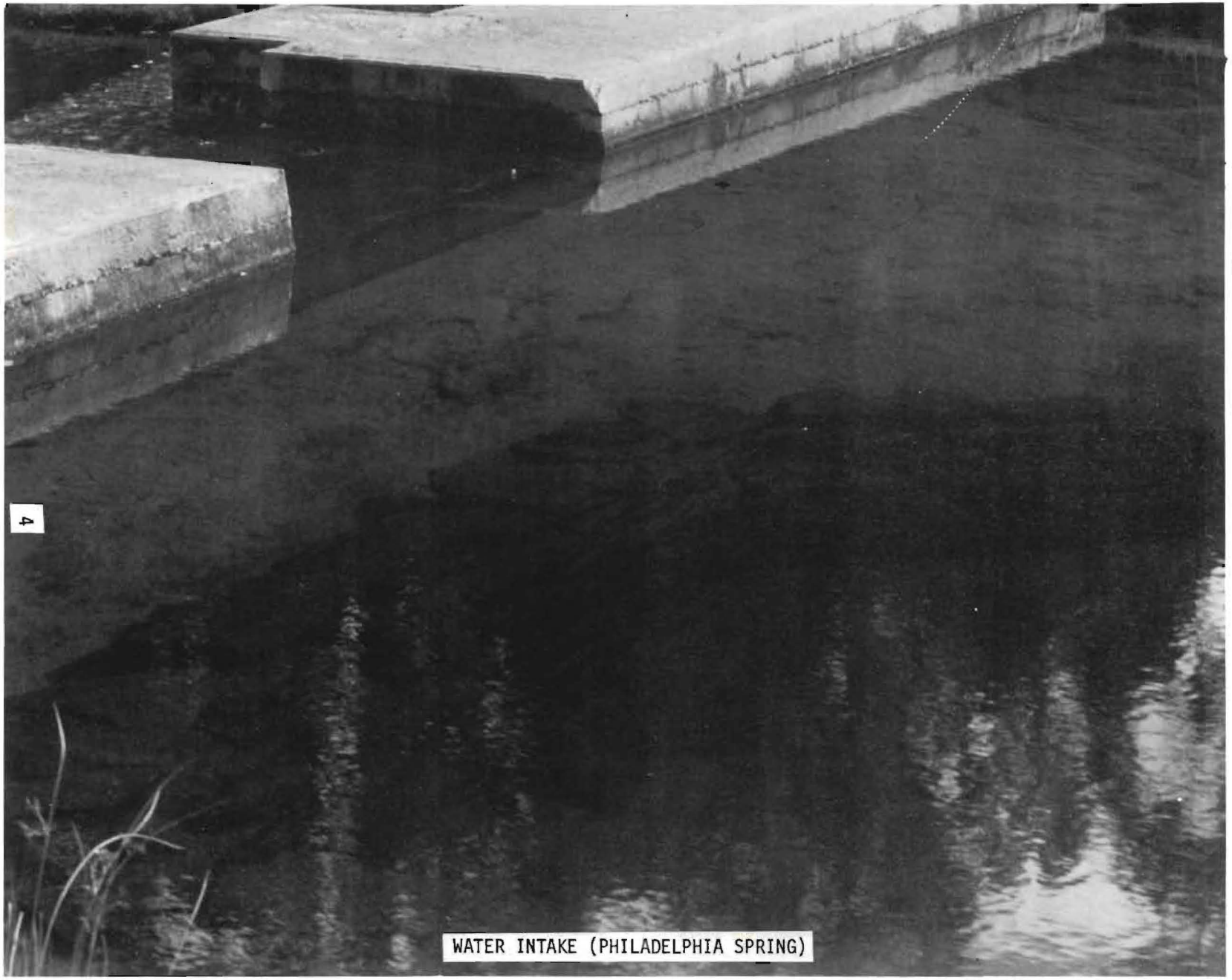
18. U.S. Department of Agriculture, "Soil Survey, Lewis County, N.Y.," Series 1954, No. 10, Washington, D.C., 1960.

APPENDIX A

PHOTOGRAPHS OF FORT DRUM

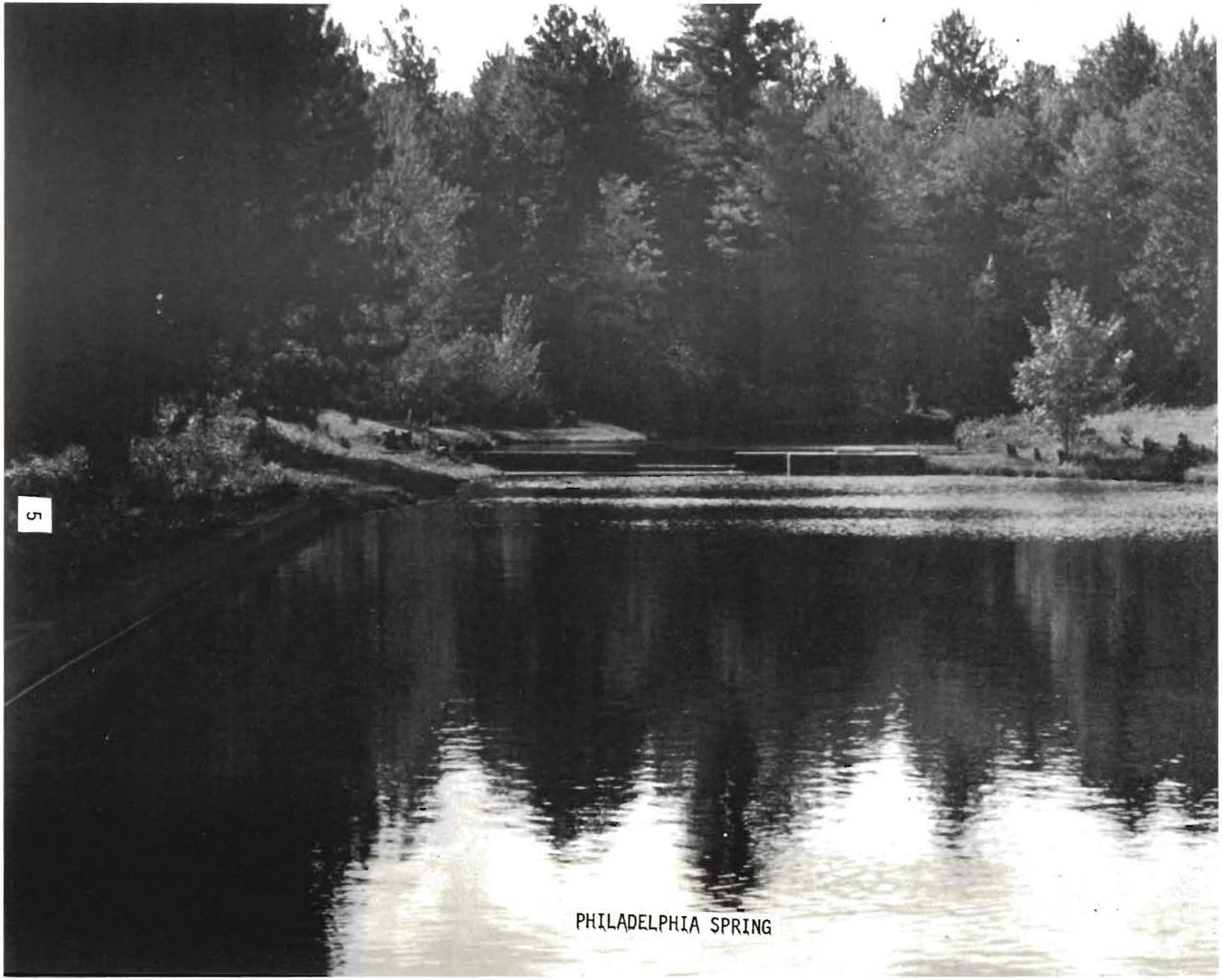

2
PHILADELPHIA SPRING


3
PHILADELPHIA SPRING



4

WATER INTAKE (PHILADELPHIA SPRING)



PHILADELPHIA SPRING

SPRING AREA (NORTH OF BLDG. 1595)


7
RANGE DUMP AREA


8
RANGE DUMP AREA


6
RANGE DUMP AREA

DUMP SITE ALONG HIGHWAY IN RANGE AREA

10


11
OLD SANITARY LANDFILL

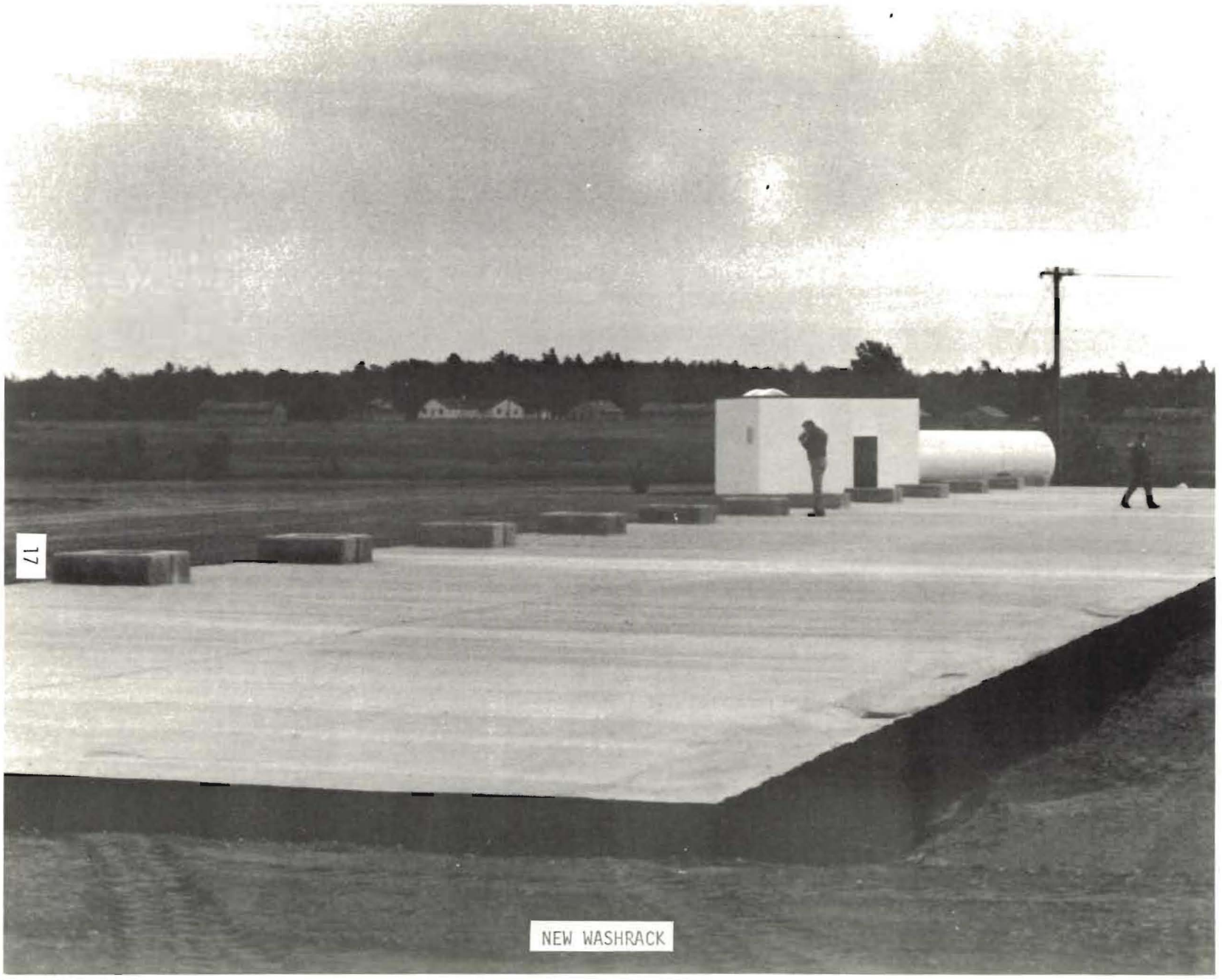

12
OLD SANITARY LANDFILL

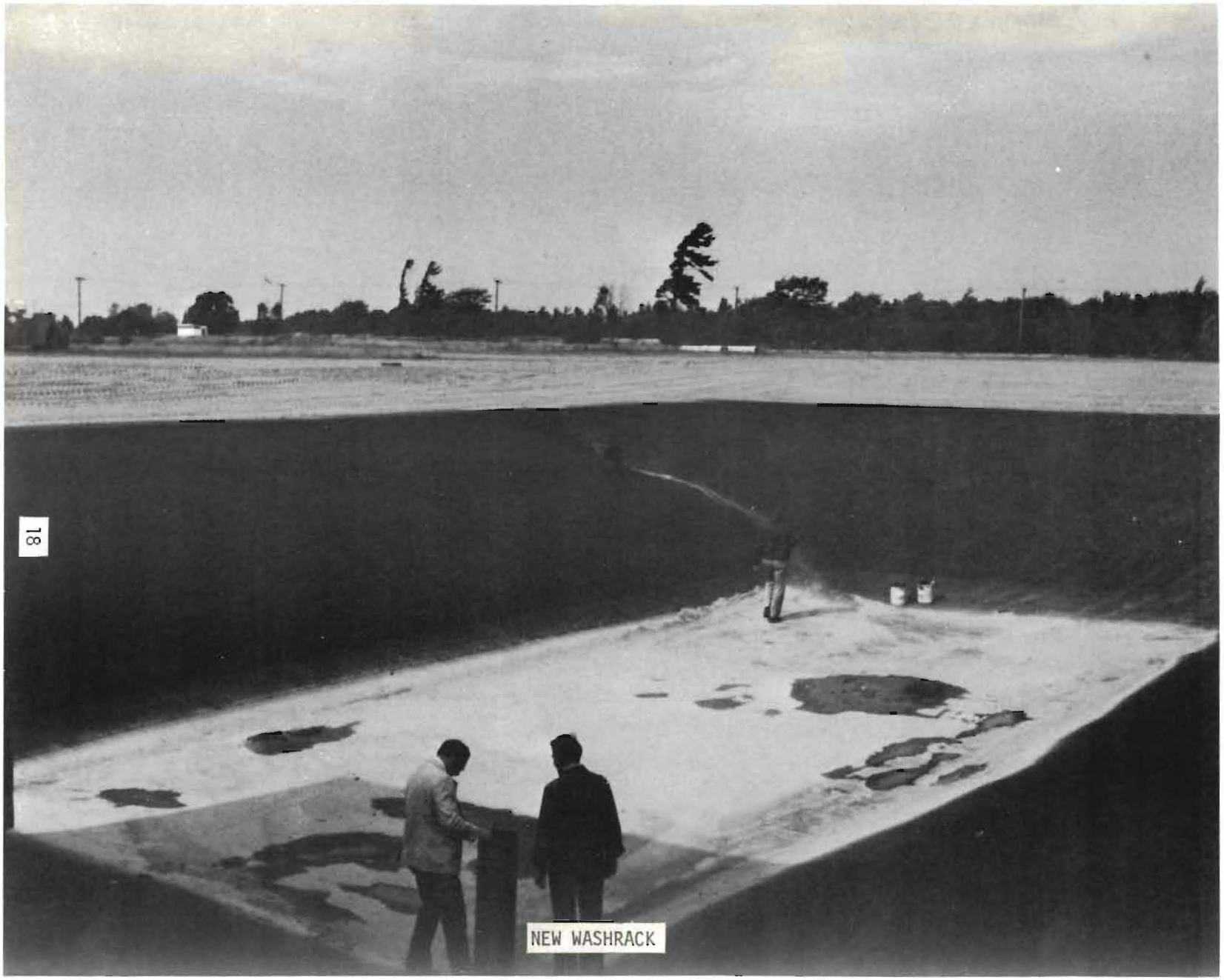
FIELD DUMP (LAKE SCHOOL ROAD)


14
CURRENT SANITARY LANDFILL

OIL CONTAMINATED SPRING (NORTH OF BLDG. 1595)


16
SEWAGE TREATMENT PLANT


17
NEW WASHRACK

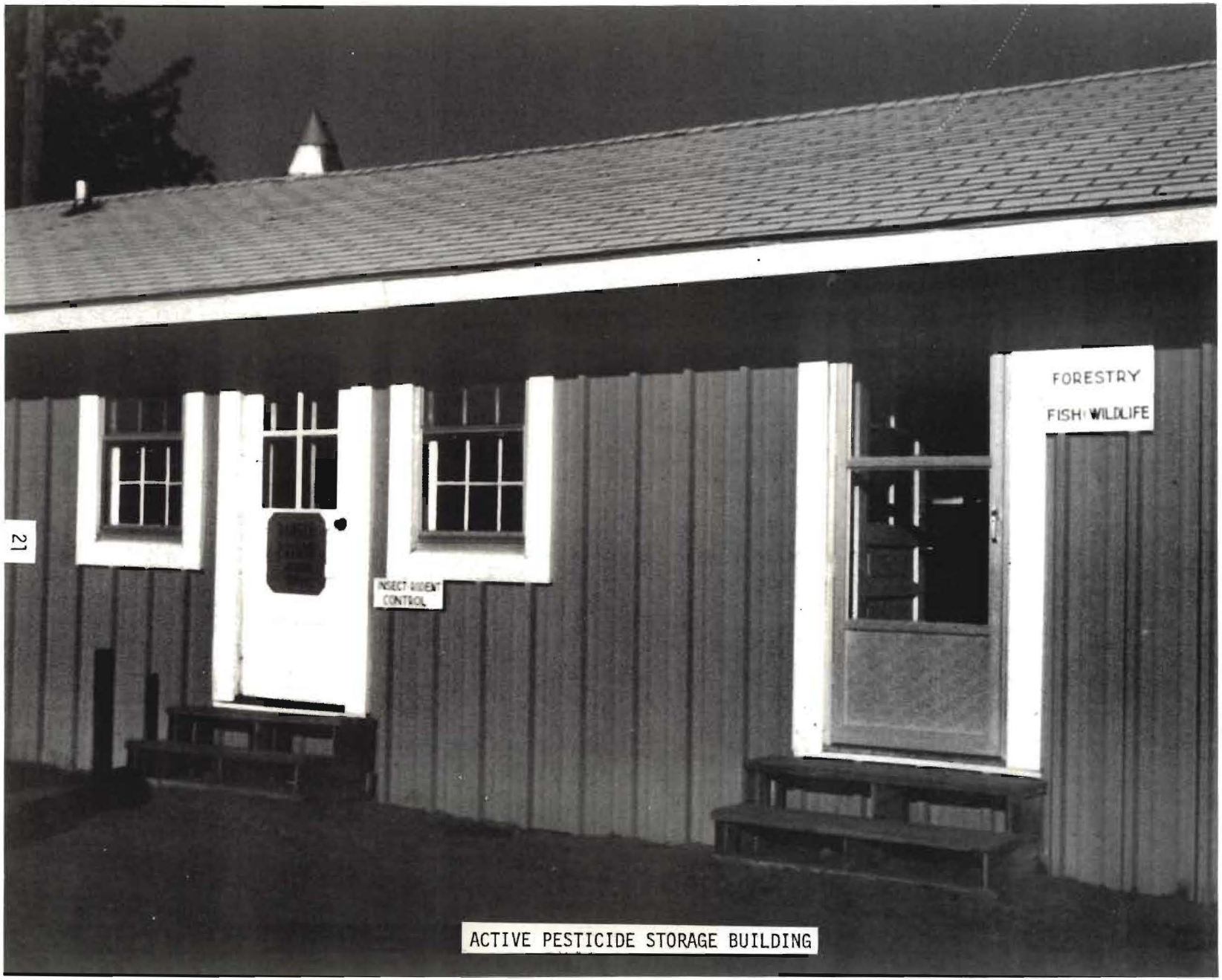

18
NEW WASHRACK

19

(OLD WASHRACK)

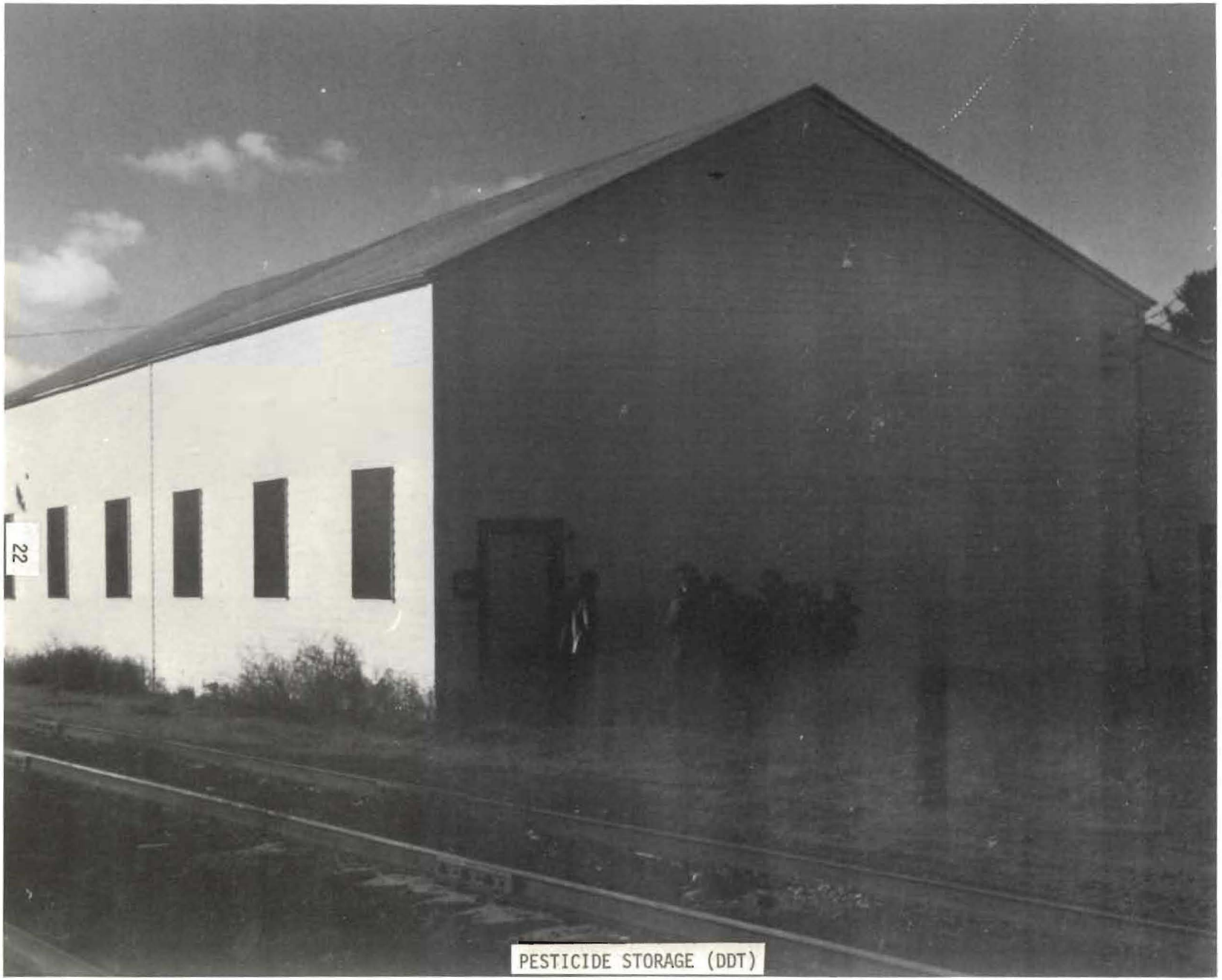
OIL/GREASE TRAP AND PERCULATION POND

PERCULATION POND (OLD WASHRACK)



21

ACTIVE PESTICIDE STORAGE BUILDING



PESTICIDE STORAGE (DDT)

APPENDIX B

BIOTA OF FORT DRUM

NEW YORK STATE PROTECTED NATIVE PLANTS

Scientific Name	Common Name
Arisaema dracontium	Green-dragon (Dragonroot)
Asclepias tuberosa	Butterfly-weed (Chigger-flower; Orange Milkweed; Pleurisy - root)
Companula rotudifolia	*Bluebell-of-Scotland (Harebell)
Celastrus scandens	*American Bittersweet (Waxwork)
Chimaphila spp.	Pipsissewa (Prince's-pine*; Was-flower*) Spotted Evergreen (Spotted Wintergreen*)
Cornus florida	*Flowering Dogwood
Drosera spp.	Sundew (Daily-dew; Dewthread)
Epigaea repens	Trailing Arburus (Ground Laurel*; Mayflower)
Euonymus spp. (Native)	Burning-bush (Wahoo) Strawberry-bush (Bursting-heart)
Filices (Filicinae; Ophioglossales and Filicales) (Native)	All ferns, including: Adder's-tongue Azolla *Bracken Buckhorn *Cliff Brake Curly-grass *Fiddleheads Hart's-tongue *Maindenhair Moonwort Polypody *Rock Brake Salvinia Spleenwort Walking-leaf Wall-rue Water-spangle Woodsia

NEW YORK STATE PROTECTED NATIVE PLANTS (Continued)

Scientific Name	Common Name
	But excluding Bracken (Pteridium acquilinum); Hay-scented Fern* (Dennstaedtia punctilobula); Sensitive Fern (Onoclea sensibilis)
Gentiana spp.	Aque-weed Blue-bottles Gentian (Gall-of-the-earth)
Hydrastis canandensis	Golden-Seal (Orange-root; Yellow Puccoon*)
Ilex spp. (Native)	Holly (Hulver) *Inkberry (Bitter Gallberry) Winterberry (Black Alder)
Kalmia spp.	Laurel Spoonwood (Calico-bush) Wicky (Lambkill)
Lelium spp. (Native)	Lily *Turk's-Cap
Lobelia cardinalis	Cardinal-flower (Red Lobelia*)
Lycopodium spp.	All clubmosses, including: Bears-bed (Christmas-green, Running Evergreen*; Trailing Evergreen; Ground Pine) Bunch Evergreen Festoon Pine (Coral Evergreen; Buckhorn; Staghorn Evergreen; Wolf's-claws) Ground Cedar (Creeping Jenny*) *Ground Fir Heath Cypress
Mertensia virginica	Bluebell (Roanoke-bells; Tree Lungwort; Virginia Bluebell; Virginia Lungwort; Virginia Cowslip*)
Monarda didyma	American Bee-balm Oswego Tea (Indian-heads; Scarlet Bee-balm)
Myrica pensilvanica	Bayberry (Candleberry*)

NEW YORK STATE PROTECTED NATIVE PLANTS (Continued)

Scientific Name	Common Name
Nelumbo lutea	Lotus (Lotus Lily; Nelumbo; Pond-nuts*; Water Chinquapin; Wonkapin; Yellow Lotus)
Opuntia humifusa (O. compressa, p.p.)	Prickly Pear (Wild Cactus; Indian Fig)
Orchidaceae	All Native Orchids, including: Adder's-mouth (Malaxis) Arethusa (Dragon's-mouth) Bog-candle Calopogen (Grass-pink; Swamp-pink) *Calypso (Fairy-slipper) Goodyera (Lattice-leaf; Rattlesnake-plantain) Kirtle-pink Ladies'-tresses (Pearl-twist; screw-auger) Moccasin-flower (Nerve-root) Orange-plume Orchis Pogonia (Beard-flower; Snake-mouth) Putty-root (Adam-and-Eve) Scent-bottle Soldier's-Plume Three-birds Twayblade Whipporwill-shoe
Orontium aquaticum	Golden-club
Panax quinquefolius	*Ginsen (Slang)
Pyrus coronaria	*Wild Crab Apple
Rhododendron spp. (Native)	*Azalea Great Laurel (White Laurel) *Honeysuckle Pinster (Election-pink; pinxter-bloom) *Rhododendron (Rosebay) Rhodora
Sabatia spp.	Bitterbloom (Marsh-pink; Rose-pink; Sabatia; Sea-pink)
Sanguinaria	Bloodroot (Puccoon-root; Red Puccoon)

NEW YORK STATE PROTECTED NATIVE PLANTS (Continued)

Scientific Name	Common Name
Sarracenia purpurea	Pitcher-plant (Huntsman's-cup*; Sidesaddle-flower)
Silene caroliniana	Wild Pink
Trillium spp.	Bethroot (Birthroot; Squawroot; Stinking Benjamin; Wake-robin) Toadshade *Trillium
Trollius laxus	Globe-flower (Trollius)
Viola pedata	Bird's-foot Violet

NOTES:

1. In the list above, common names are not included if they repeat the generic common name with a modifier (e.g., "Trillium" is understood to include "Pointed Trillium," "White Trillium," "Nodding Trillium" and all others.) Names appearing within parenthesis are less familiar synonyms for the principal common names of each species listed.

2. * Those common to Fort Drum.

SOURCE: New York State Department of Environmental Conservation, January 1975.

TREES AT FORT DRUM

Scientific Name	Common Name
Abies balsamea	Balsam Fir
Acer negundo	Box Elder
Acer rubrum	Red Maple
Acer saccharum	Sugar Maple
Alnus incana	Speckled Alder
Amelanchier canadensis	Shadbush
Betula lutca	Yellow Birch
Betula papyritera	Paper Birch
Betula populifolia	Gray Birch
Carya cordiformus	Bitternut Hickory
Cratagus	Thornapple
Fagus grandifolia	Beech
Fraxinus americana	White Ash
Juglans cineria	Butternut
Juglans nigra	Black Walnut
Picea abies	Norway Spruce
Picea glauca	White Spruce
Picea yubra	Red Spruce
Pinus banksiana	Jack Pine
Pinus rigida	Pitch Pine
Pinus resinosa	Red Pine
Pinus strobus	White Pine
Pinus sylvestris	Scotch Pine
Populus detloides	Eastern Cottonwood
Populus grandidentata	Big Tooth Aspen
Populus tremuloides	Trembling Aspen
Prunus pennsylvanica	Fire Cherry
Prunus serotina	Black Cherry
Prunus virginiana	Choke Cherry
Quercus alba	White Oak
Quercus borealis	Red Oak
Robinia pseudocacia	Black Locust
Salix nigra	Black Willow
Thuja occidentalis	N. White Cedar
Tilia americana	Basswood
Tsuga canadensis	Hemlock
Ulmus americana	American Elm
Ulmus fulva	Red Elm

FISH AND WILDLIFE AT FORT DRUM

Game Species

Species	Estimated No.'s 1979
Virginia White Tail Deer	1,100-1,300
Black Bear	18
Varying Hare	3,200
Cottontail Rabbit	2,200
Grey Squirrel	700
Ruffed Grouse	5,000
Pheasants - Chinese and Korean Ringneck	70
Eastern Coyote	100
Bobcat	25
Red Fox	30
Raccoon	1,300
Mink	750
Otter	550
Beaver	4,000
Muskrat	3,600
Weasel	250
Woodcock	1,700
Ducks - Migratory	14-16,000
Geese (Canada) - Migratory	6-7,000

Fish Species

Species	No. of Fish Stocked Per Year
Speckled Trout	1,900
Rainbow Trout	350
Brown Trout	3,600
Walleyed Pike (not since 1975)	None
Black Bass	None
Northern Pike	None
Common Sucker	None
Sunfish	None
Perch	None
Bullheads	None
Shiners, Chubs	None

FISH AND WILDLIFE AT FORT DRUM (Continued)

Nongame Birds Common to the Area

Species

Robins
Starlings
Martens
Swallows
Red Winged Black Birds
Purple Grackle
Crows
Hawks
Others

APPENDIX C

BORING LOGS OF FORT DRUM

EXISTING LANDFILL 1

Description of Material

ATTEMPT #1
Drilled 50.0' - Moist on bottom - installed temporary wellpoint - no water

ATTEMPT #2
Drilled 60.0' - Installed temporary wellpoint - no water

ATTEMPT #3
Drilled 75.0' - Unable to install wellpoint beyond 62.0' - no water in well.

ATTEMPT #4
Tried to wash down from 50.0' at 2nd hole - Unsuccessful.

ATTEMPT #5
Tried to start hole from surface and wash in, but unsuccessful.

Brown moist fine to medium SAND to 65.0', wet from 65.0' to 75.0'

EXISTING LANDFILL 2

Description of Material

ATTEMPT #1
Drilled hole to 50.0' - Moist
Static water level 61.8' - 4-12-79

ATTEMPT #2
Redrilled to 70.0' - Saturated at approximately 65.0' - Installed approximately 68.0' P.V.C. pipe and 2.0' of #15 stainless steel well screen.

Brown fine to medium SAND 0.0' - 70.0'

EXISTING LANDFILL 3

Description of Material

Brown fine medium SAND
Static water level 48.5' - 4-12-79

Drilled hole to 70.0' - installed approximately 58.0' of schedule 80 P.V.C. riser pipe and 2.0' of #10 slot stainless steel well screen.

COAL PILE STUDY

CP-1

Description of Material

0'

Brown dry fine to medium SAND

10.4 ▼
4-18-79

18.6 ▼ 18.6'
4-18-79 Brown wet fine to medium SAND

23.0'

Gray moist CLAY, little fine to medium gravel

Bottom of Boring 26.0'

Note: Installed approximtely 24.6' observation well including 2.0' of #10 slot stainless steel well screen.

CP-2

Description of Material

0'

Brown dry fine to medium SAND

18'

Brown wet fine to medium SAND

30'

Bottom of Boring

Note: Installed approximately 21.6' observation well including 2.0' of #10 slot stainless steel well screen.

OIL POLLUTION CONTROL

PC-1

Description of Material	
	0
Brown moist fine to medium SAND	

5.8' ▼ 4-17-79

	15'
Brown wet fine to medium SAND	
	20'
Bottom of Boring	

Note: Temporary well point installed with 2.0" riser pipe TO 15.0'±.

PC-2

Description of Material	
	0'
Brown moist fine to medium SAND	

9.8' ▼ 4-17-79

	15'
Gray wet fine to medium SAND (strong gas odor detected and sand sample looked shiny)	
	20'
Bottom of Boring	

Note: Installed temporary wellpoint with 2" riser pipe to 20.0' on completion.

PC-3

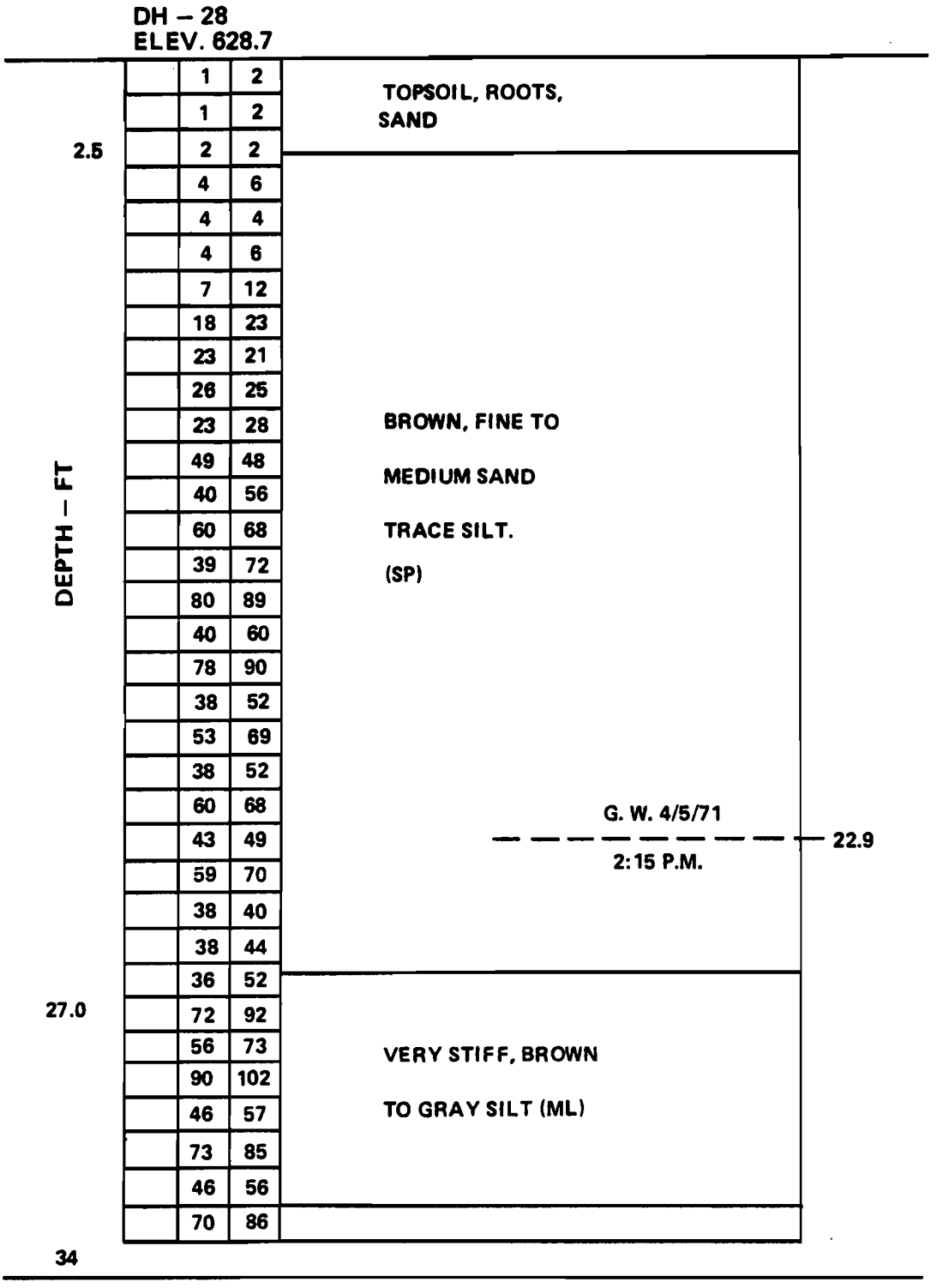
Description of Material	
	0
Brown moist fine to medium SAND	

11.5' ▼ 4-17-79

	16'
Brown wet fine to medium SAND	
	30'
Bottom of Boring	

Note: First attempt hole caved at 15.0 Redrilled to 20.0'. Temporary wellpoint and 2" riser pipe installed to 20.0' on completion.

SEWAGE TREATMENT PLANT



OLD LANDFILL 1

	Description of Material
	Brown fine to medium SAND
36' ▼ 4-10-79	
	Bottom of Boring 50'

Note: Installed approximately 41.7' Sch. 80 P.V.C. riser pipe and 2.0' stainless steel well screen

OLD LANDFILL 2

	Description of Material
	0'
	Brown moist fine to coarse SAND
9' ▼ 4-18-79	
	19.0'
	Brown wet fine to medium SAND
	Bottom of Boring 25.0'

Note: Installed approximately 20.0' Sch. 80 P.V.C. riser pipe and 2.0' stainless steel well screen

OLD LANDFILL 3

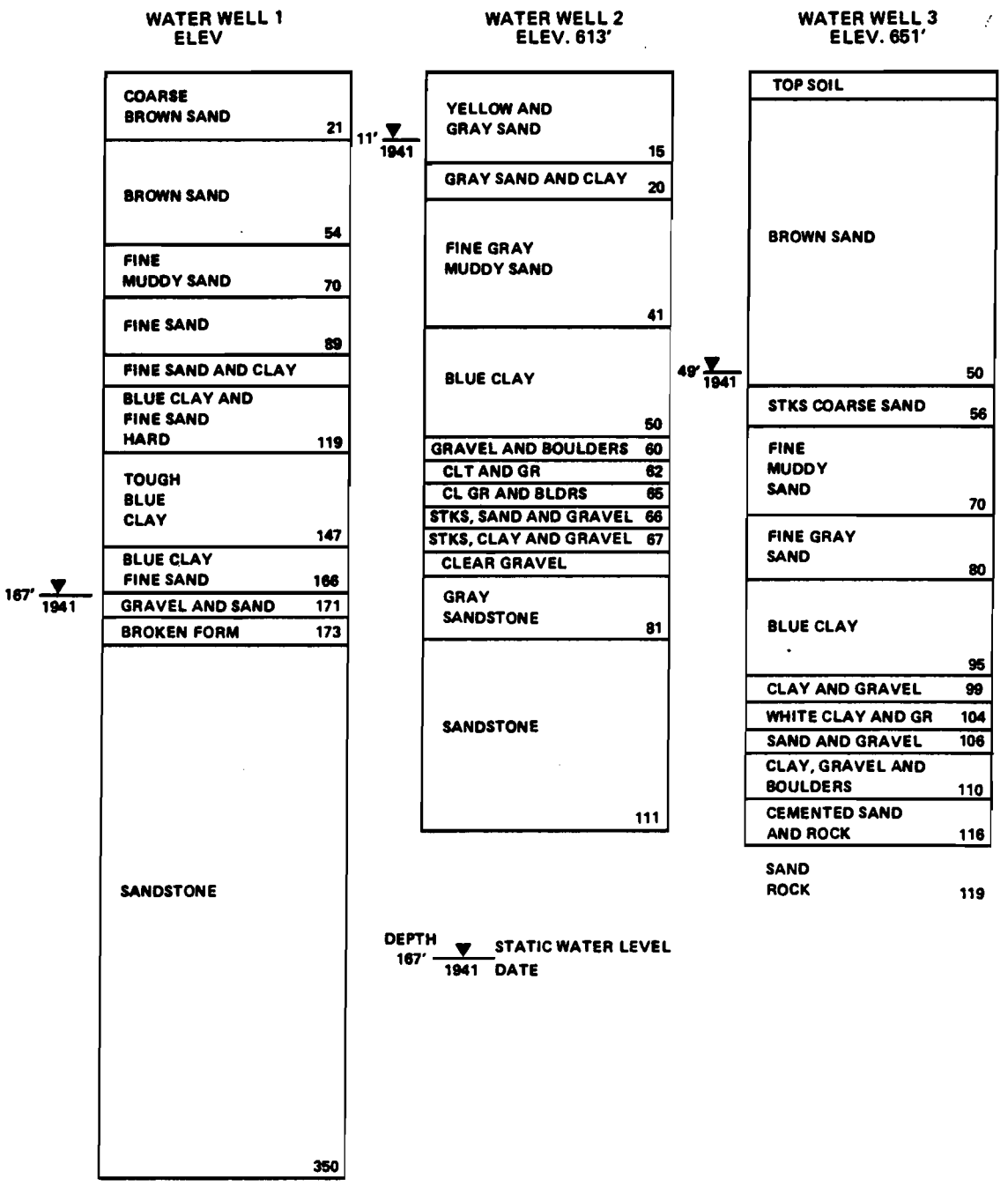
Description of Material	
	0'
Brown dry fine to medium SAND	
	14' ▼ 4-19-79
	20'
Brown wet fine to medium SAND	
	30'
Bottom of Boring	

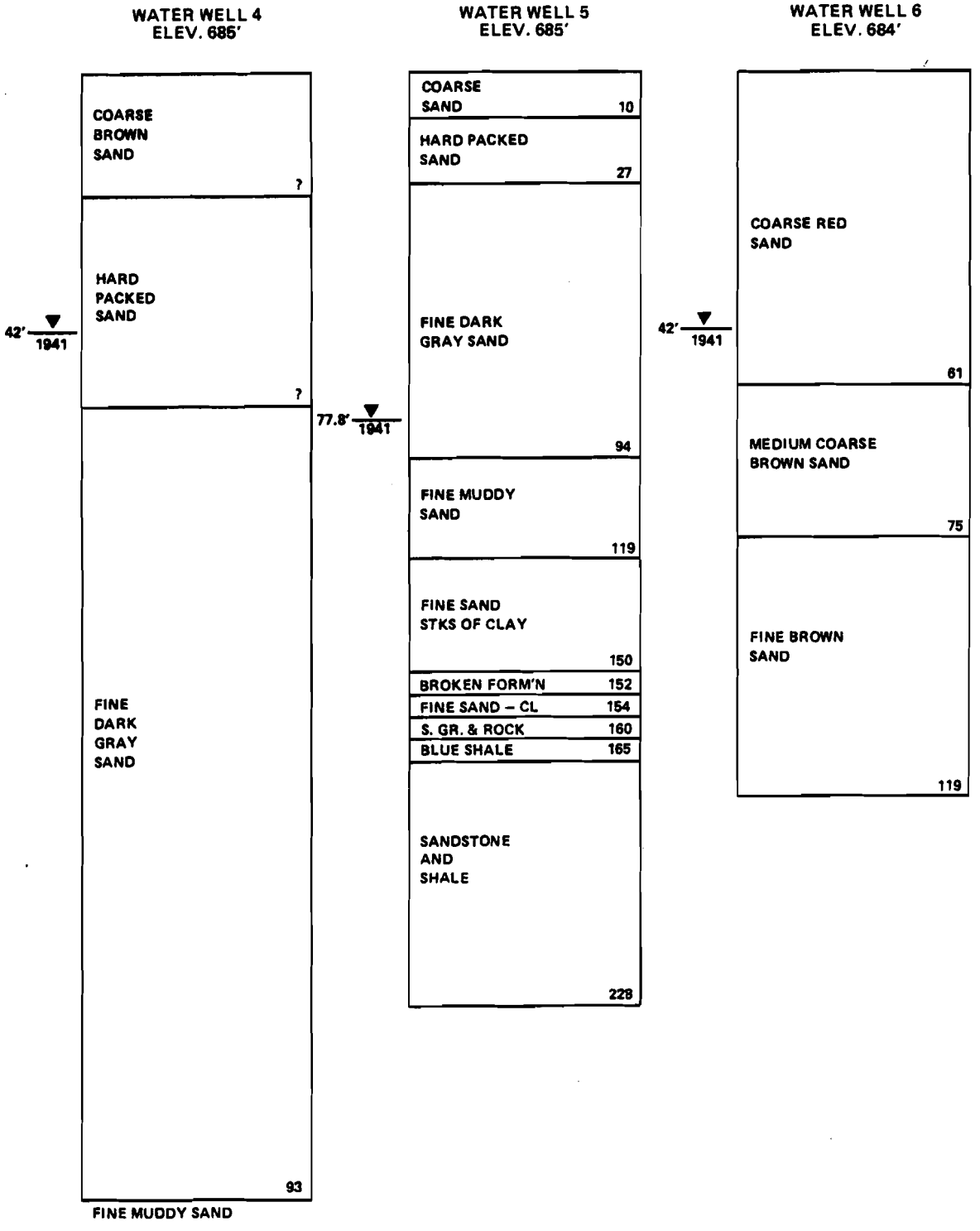
Note: Installed approximately 25.0' Sch. 80 P.V.C. riser pipe and 2.0' stainless steel well screen

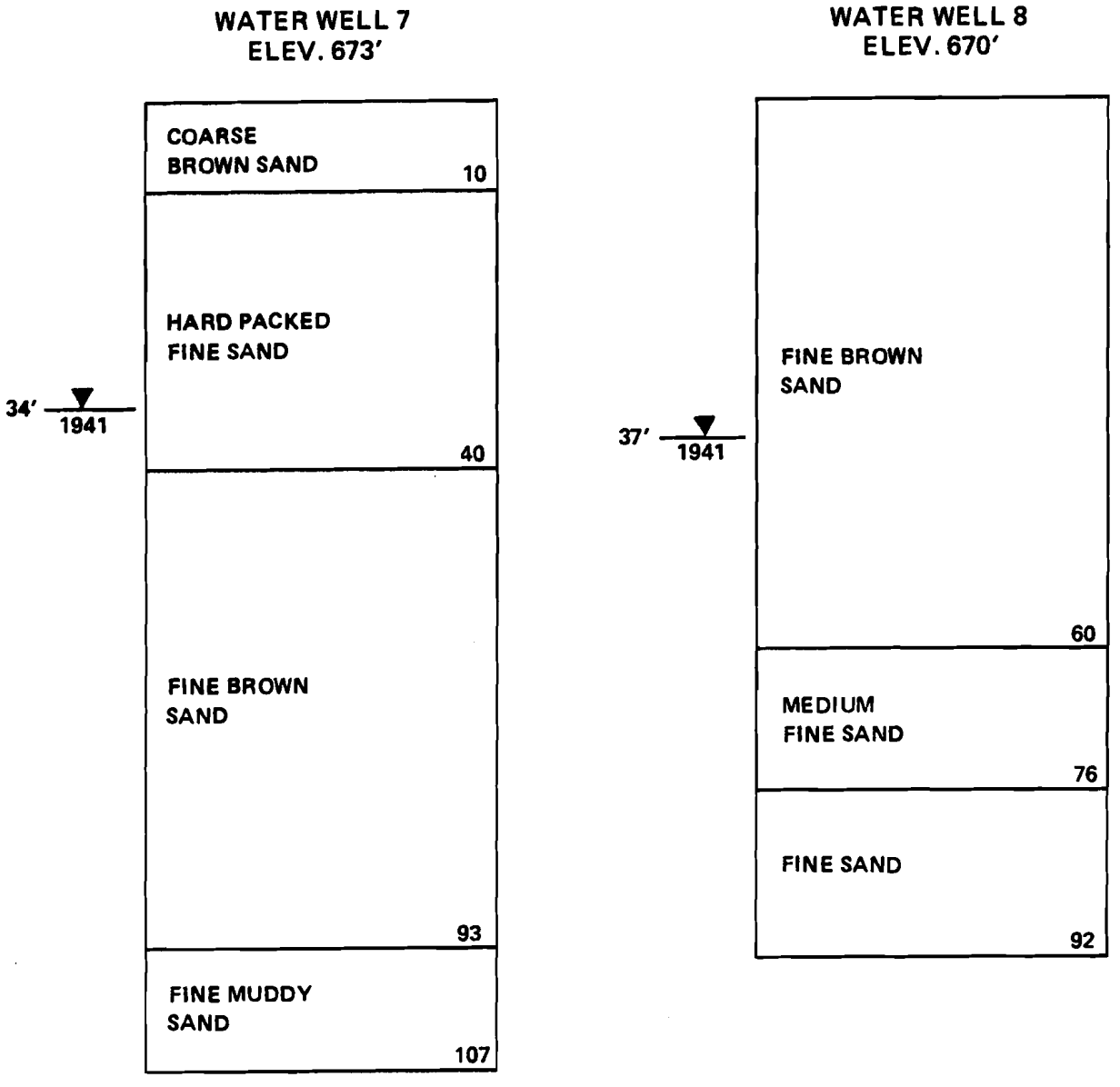
OLD LANDFILL 5

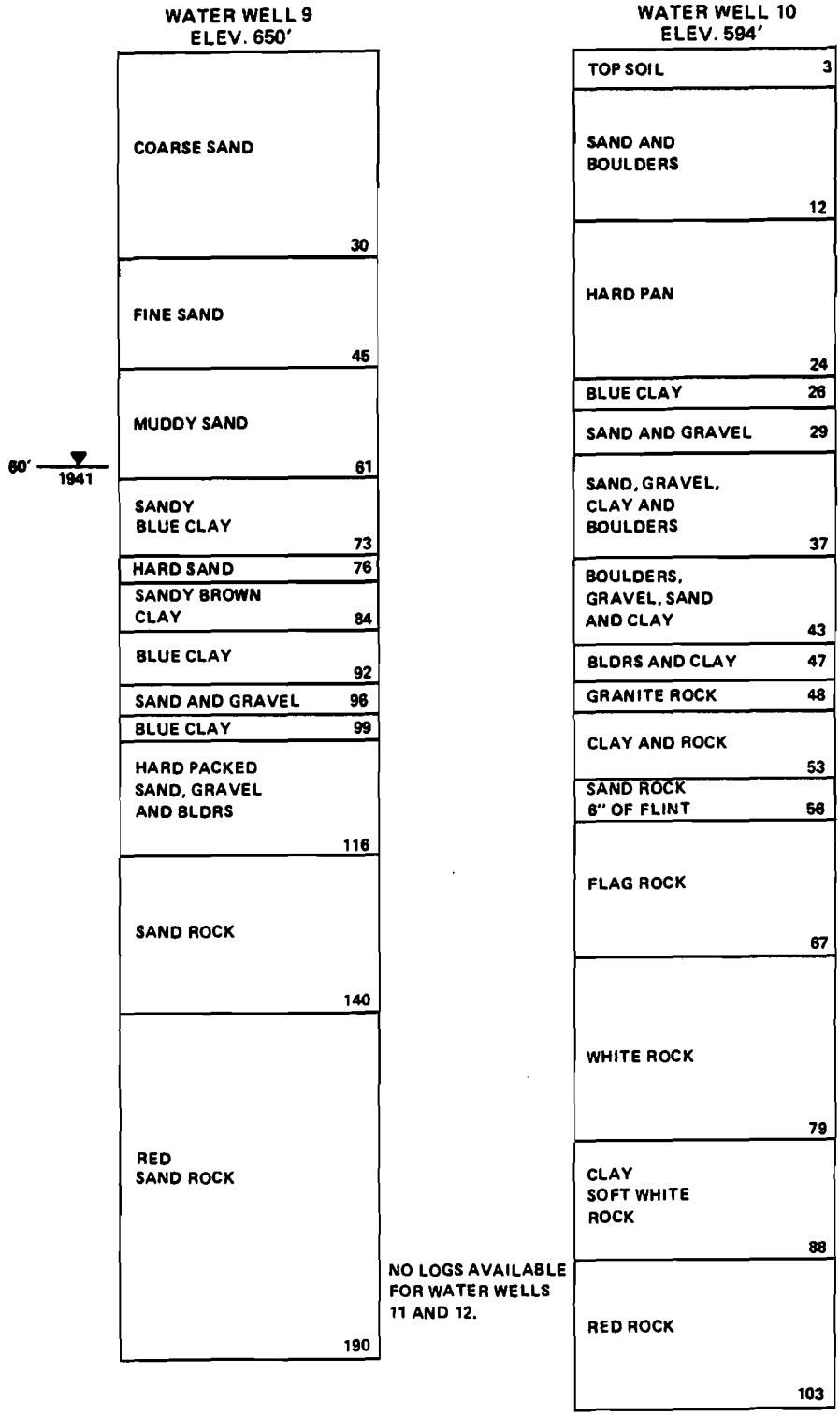
Description of Material	
	0'
Brown dry fine to medium SAND	
	10.4' ▼ 4-18-79
	18.0'
Brown wet fine to medium SAND	
Bottom of Boring	30.0'

Note: Installed approximately 21.6' observation well including 2.0' of #10 slot stainless steel well screen.


WATER WELL 1
ELEV
COARSE BROWN SAND 21
BROWN SAND 54
FINE MUDDY SAND 70
FINE SAND 89
FINE SAND AND CLAY
BLUE CLAY AND FINE SAND HARD 119
TOUGH BLUE CLAY 147
BLUE CLAY FINE SAND 166
GRAVEL AND SAND 171
BROKEN FORM 173
SANDSTONE 350
167' 1941
WATER WELL 2
ELEV. 613'
11' 1941
YELLOW AND GRAY SAND 15
GRAY SAND AND CLAY 20
FINE GRAY MUDDY SAND 41
BLUE CLAY 50
GRAVEL AND BOULDERS 60
CLT AND GR 62
CL GR AND BLDRS 65
STKS, SAND AND GRAVEL 66
STKS, CLAY AND GRAVEL 67
CLEAR GRAVEL
GRAY SANDSTONE 81
SANDSTONE 111
WATER WELL 3
ELEV. 651'
49' 1941
TOP SOIL
BROWN SAND 50
STKS COARSE SAND 56
FINE MUDDY SAND 70
FINE GRAY SAND 80
BLUE CLAY 95
CLAY AND GRAVEL 99
WHITE CLAY AND GR 104
SAND AND GRAVEL 106
CLAY, GRAVEL AND BOULDERS 110
CEMENTED SAND AND ROCK 116
SAND ROCK 119
DEPTH 167' 1941 STATIC WATER LEVEL DATE


WATER WELL 4
ELEV. 685'
COARSE BROWN SAND
?
HARD PACKED SAND
?
42' 1941
FINE DARK GRAY SAND
93
FINE MUDDY SAND
WATER WELL 5
ELEV. 685'
COARSE SAND 10
HARD PACKED SAND 27
FINE DARK GRAY SAND 94
77.8' 1941
FINE MUDDY SAND 119
FINE SAND STKS OF CLAY 150
BROKEN FORM'N 152
FINE SAND – CL 154
S. GR. & ROCK 160
BLUE SHALE 165
SANDSTONE AND SHALE 228
WATER WELL 6
ELEV. 684'
COARSE RED SAND 61
42' 1941
MEDIUM COARSE BROWN SAND 75
FINE BROWN SAND 119


WATER WELL 7
ELEV. 673'
COARSE
BROWN SAND
10
HARD PACKED
FINE SAND
34'
1941
40
FINE BROWN
SAND
93
FINE MUDDY
SAND
107
WATER WELL 8
ELEV. 670'
FINE BROWN
SAND
37'
1941
60
MEDIUM
FINE SAND
76
FINE SAND
92


WATER WELL 9
ELEV. 650'
COARSE SAND 30
FINE SAND 45
MUDDY SAND 61
60' 1941
SANDY BLUE CLAY 73
HARD SAND 76
SANDY BROWN CLAY 84
BLUE CLAY 92
SAND AND GRAVEL 96
BLUE CLAY 99
HARD PACKED SAND, GRAVEL AND BLDRS 116
SAND ROCK 140
RED SAND ROCK 190
NO LOGS AVAILABLE FOR WATER WELLS 11 AND 12.
WATER WELL 10
ELEV. 594'
TOP SOIL 3
SAND AND BOULDERS 12
HARD PAN 24
BLUE CLAY 26
SAND AND GRAVEL 29
SAND, GRAVEL, CLAY AND BOULDERS 37
BOULDERS, GRAVEL, SAND AND CLAY 43
BLDRS AND CLAY 47
GRANITE ROCK 48
CLAY AND ROCK 53
SAND ROCK 6" OF FLINT 56
FLAG ROCK 67
WHITE ROCK 79
CLAY SOFT WHITE ROCK 88
RED ROCK 103