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CITRUS COUNTY CENTRAL LANDFILL
GROUNDWATER MONITORING PLAN
LEACHATE DISPOSAL PERCOLATION PONDS

GROUNDWATER MONITORING PLAN
CITRUS COUNTY CENTRAL LANDFILL
LEACHATE DISPOSAL PERCOLATION PONDS

for

Citrus County, Florida

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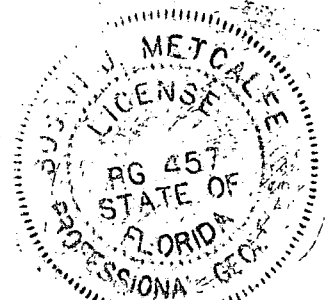
BY

DIVISION OF SOLID WASTE MANAGEMENT

Susan J. Metcalfe, P.G., Director
P.O. Box 340
Lecanto, Florida 34460

(904) 746-5000

August, 1993



SJ Metcalfe
7/29/93

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GROUNDWATER MONITORING PLAN
CITRUS COUNTY CENTRAL LANDFILL
LEACHATE DISPOSAL PERCOLATION PONDS

INTRODUCTION

PURPOSE AND SCOPE

The Citrus County Central Landfill operates under the Florida Department of Environmental Protection (FDEP) Permit No. S009-187229, issued April 29, 1993. Specific Condition 51 of that permit requires that a groundwater monitoring plan be submitted to the Solid Waste Section of the Southwest District of FDEP. The purpose of the plan is to monitor the zone of discharge of percolation ponds by which treated leachate effluent is disposed. This report is the proposed plan.

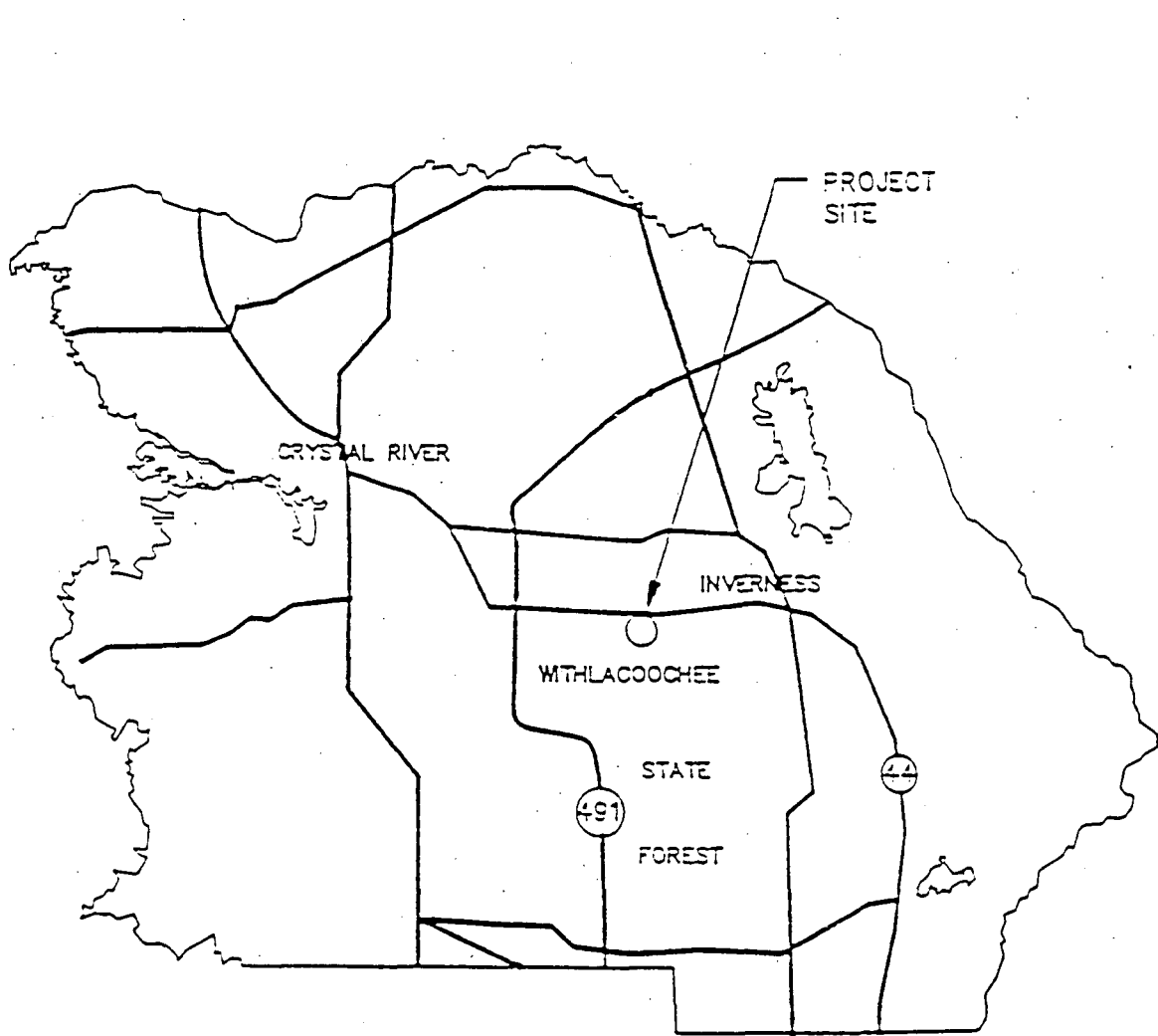
This monitoring plan is designed to be coordinated with the existing groundwater monitoring for the entire active landfill area and the adjacent closed landfill area. The data used to develop this plan were derived from previous investigations of the site, both for construction development and for groundwater monitoring. No additional data were collected to prepare this plan. Previous investigations include: the application for a permit to construct the landfill prepared by Post, Buckley, Schuh and Jernigan, Inc. (1988), the groundwater monitoring plan prepared to support that application (Post, Buckley, Schuh and Jernigan, 1988), and the

groundwater monitoring plan prepared by Seaburn and Robertson, Inc. (1985) for the adjacent 60-acre closed landfill site. Information gathered during implementation of the monitoring plans was also used to develop this plan.

LOCATION

The Citrus County Central Landfill is located in Section 1, Township 19 South, Range 18 East, approximately three miles east of Lecanto, Florida (Figure 1). The property is bounded on the east and south by the Withlacoochee State Forest, on the west by the previous County landfill and is accessed on the north off of State Road 44. Natural surface drainage before site development was to the southwest.

FIGURE ONE



LOCATION MAP

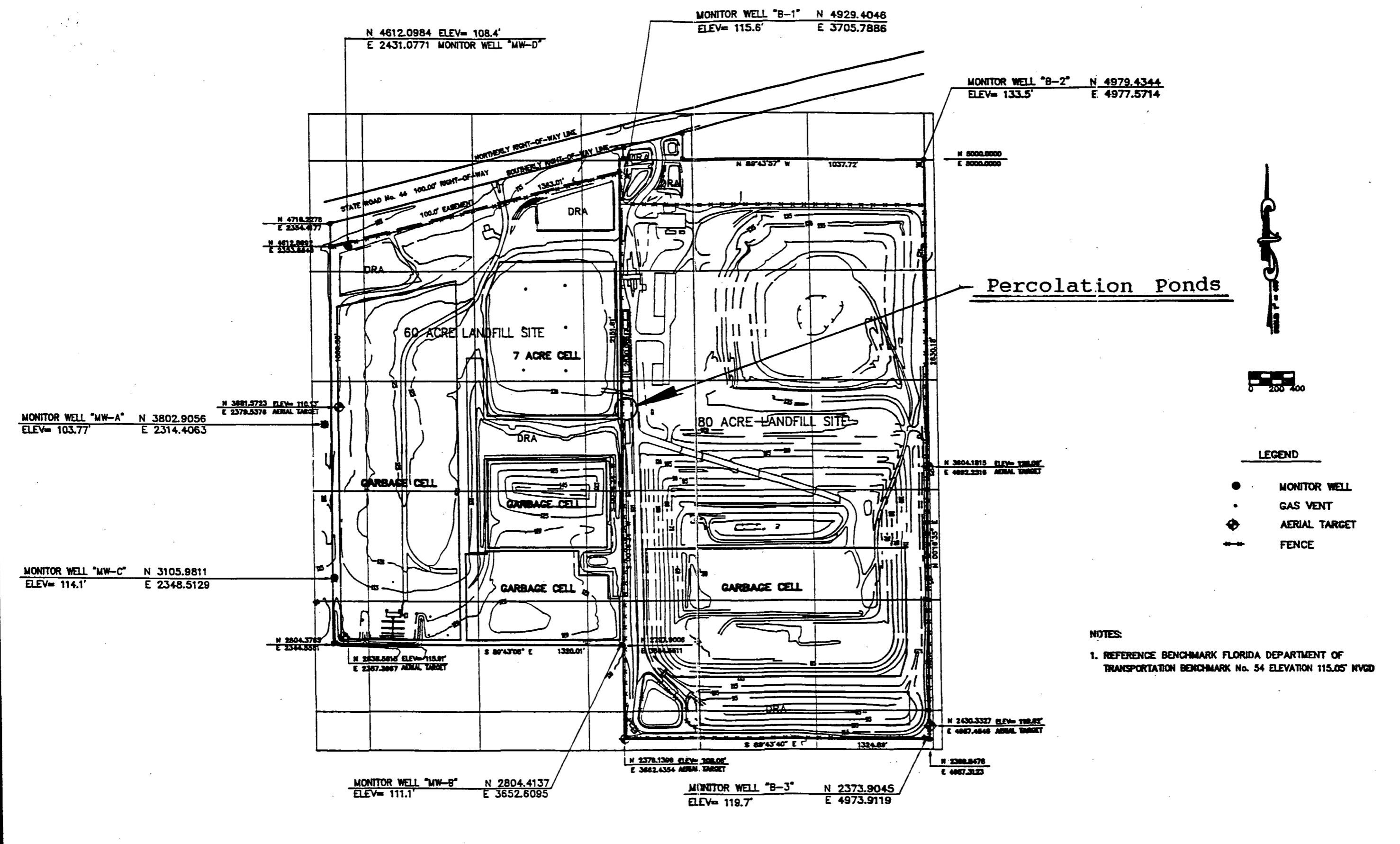
CITRUS COUNTY CENTRAL LANDFILL

SITE HISTORY

WASTE DISPOSAL, CLOSED AND ACTIVE SITES

The 60-acre landfill site, which is now closed, is immediately to the west of the active landfill. The location of filled cells was submitted to the Department as part of the long-term care permit application (PN 89-615, Sheet L-A1). Figure 2 shows the position of the percolation ponds relative to the closed cells. The general disposal method for that site was to dig a trench, place refuse and cover. Final closure included placement of a top cap consisting of a membrane covered by soil. The northern pond is directly east from the south end of the lined 7-acre cell, which has been capped. The southern pond is east from the drainage retention area No. 3, which was never filled with refuse and is unlined. This pond is normally wet, however it is thought that this represents a perched condition rather than the regional water table.

According to an aerial survey performed in 1992, the elevation of the access road beside the percolation ponds is approximately 120 feet NGVD, the percolation pond bottoms are approximately 113 feet NGVD and the drainage retention pond bottom (or water level) is approximately 108 feet NGVD. Excavation for the bottom of the active cell did not require dewatering, with depths to 30 feet NGVD in the internal drainage retention area.



Percolation Ponds



LEGEND

- MONITOR WELL
- GAS VENT
- ⊕ AERIAL TARGET
- FENCE

NOTES:

1. REFERENCE BENCHMARK FLORIDA DEPARTMENT OF TRANSPORTATION BENCHMARK No. 54 ELEVATION 115.05' NVGD

DEPARTMENT OF TECHNICAL SERVICES CITRUS COUNTY, FLORIDA ENGINEERING DEPARTMENT		APPROVED BY: _____ DATE: _____	PROJECT NUMBER: 89-615 SHEET 1 OF 5 SCALE: 1"=400' FILE:
REVISIONS BY: _____ DATE: _____ BY: _____ DATE: _____ BY: _____ DATE: _____	PRELIMINARY BY: _____ DATE: _____ CHECKED: _____ DATE: _____		

Figure Two

The disposal area on the active site is to the south of the percolation ponds. The active, 80-acre site design includes a membrane liner in the bottom and sides of the fill area, with a leachate collection system at the base of the fill. As the site expands, the fill area will move toward the north. The proposed Phase 3 area will be the first area in which refuse will be placed to the east of the percolation pond location. It is expected that will be at least 10 years from the start of operations at this site, 2001.

LEACHATE TREATMENT PLANT EFFLUENT DISPOSAL

After leachate has been treated in the PACT plant, the effluent is discharged to one of two percolation ponds. The use of ponds is rotated on an irregular basis. The plant has a capacity of treating 30,000 gallons per day in three batches. A second set of batches can be run if personnel are on site to monitor operation. Leachate treatment plant flow data are submitted monthly to the FDEP. Table 1 summarizes these flow data for the entire period of plant operation to date. Flow is somewhat related to rainfall, with the greatest amounts of leachate treated due to conditions when stormwater becomes contaminated with leachate, for example the three month period following the major rainstorm in early September 1992.

TABLE ONE
LEACHATE TREATMENT PLANT FLOWS
(In Thousands of Gallons)

<u>Mo./Yr.</u>	<u>Total Flow</u>	<u>Days/Mo.</u>	<u>Daily Avg.</u>	<u>Daily Max.</u>	<u>Daily Min.</u>
09/91	200	30	6.7	20	0
10/91	370	31	11.9	30	0
11/91	205	30	6.8	20	0
12/91	249	31	8.0	17	0
01/92	289	31	9.3	17	0
02/92	322	29	11.1	34	0
03/92	490	31	15.8	30	0
04/92	470	30	15.6	30	0
05/92	440	31	14.9	30	10
06/92	690	30	23.0	30	0
07/92	755	31	24.4	30	0
08/92	740	31	23.9	30	0
09/92	900	30	30.0	50	20
10/92	885	31	28.5	50	0
11/92	900	30	30.0	60	10
12/92	1390	31	44.8	60	0
01/93	1200	31	38.7	60	10
02/93	325	28	11.6	30	0
03/93	375	31	12.1	30	0
04/93	290	18	16.1	40	0
05/93	153	15	10.2	14	0

GEOLOGY

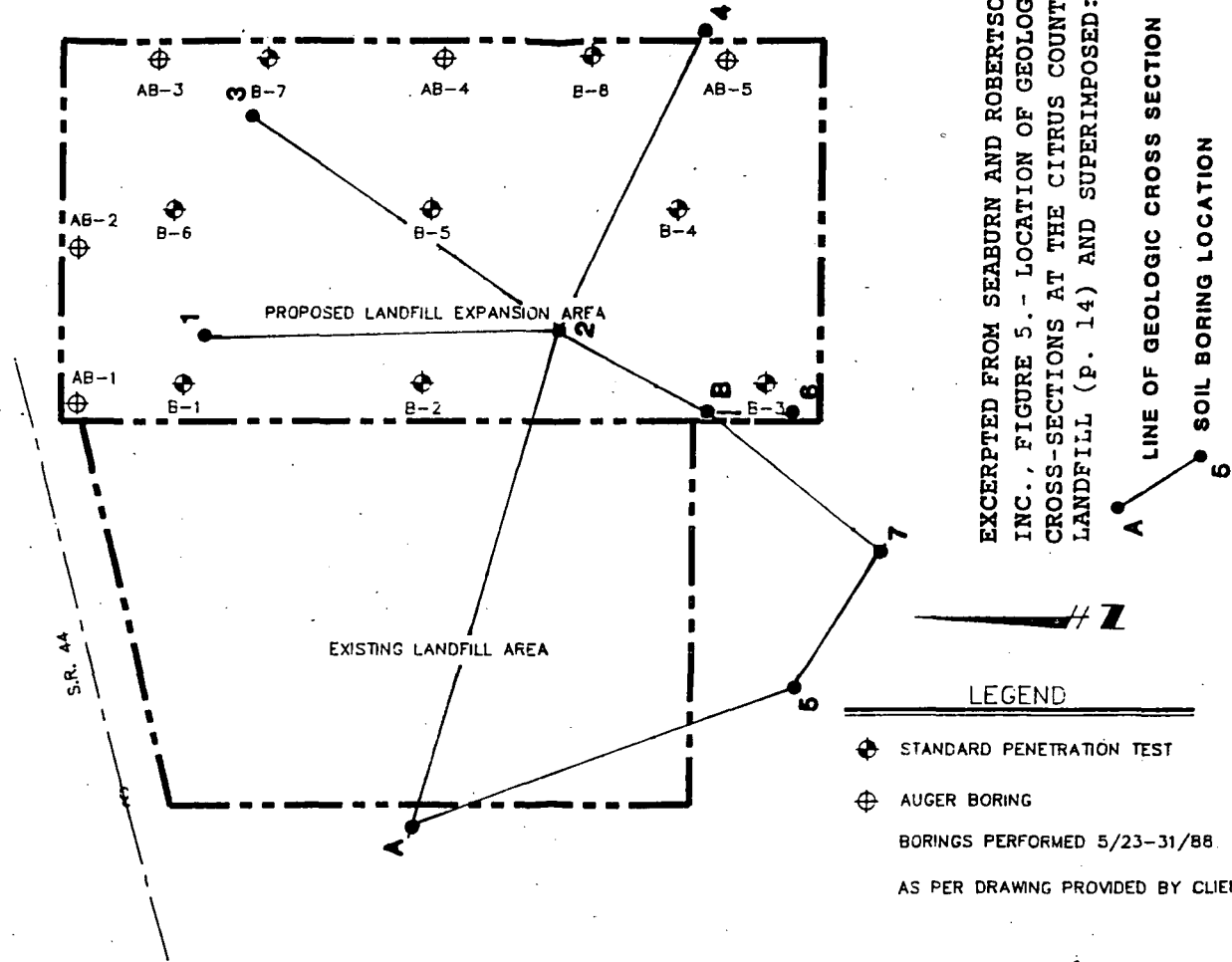
REGIONAL GEOLOGIC INFORMATION

The geology of Citrus County is characterized by thick, gently dipping Tertiary limestones with overlying sand and clay beds. The limestones are a part of a sequence which is in excess of 6,000 feet thick (Applin and Applin, 1944). The limestone units were deformed by the Ocala Uplift about 25 million years ago producing dips to the southwest in this area and fractures. In the area of the landfill, the uppermost limestone unit is probably the Suwannee Limestone, beneath which is the Crystal River Limestone.

Overlying the limestones are siliceous clastic units (Vernon, 1951). Deposition of the clastics took place on a karstic eroded surface of the limestones, therefore these units are discontinuous. The sand and clay unit above the limestone in the area of the landfill is probably the Alachua Formation, with the Coharie-Okefenokee Formation above that (Vernon & Puri, 1964).

SITE SPECIFIC INFORMATION

Geologic information available from the site comes from logs of borings performed as part of the construction investigation or groundwater monitor well drilling. A total of 17 locations (Figure 3) on or near the 60-acre and 80-acre sites were drilled, (Seaburn and Robertson, 1985) and (Post, Buckley, Schuh and Jernigan, 1988). The upper 100 feet, or total depth, of all borings consisted of sand or sand and clay, except A, 5, and 6 where limestone was encountered at 68.5 feet, 40 feet and 40 feet respectively. In boring B, the top of limestone was encountered at 176 feet. However, during excavation of the Phase 1 area, limestone was encountered near the west edge of the bottom at approximately elevation 40 (depth 80 feet). This limestone mass consisted of large boulders mixed with sand and smaller limestone fragments and may have been an erosional remnant of a karst pinnacle. Site investigation by the Engineer concluded that the mass was not continuous with deeper units.



EXCERPTED FROM SEABURN AND ROBERTSON, INC., FIGURE 5. - LOCATION OF GEOLOGIC CROSS-SECTIONS AT THE CITRUS COUNTY LANDFILL (P. 14) AND SUPERIMPOSED:

A LINE OF GEOLOGIC CROSS SECTION
 6 SOIL BORING LOCATION

UNIVERSAL ENGINEERING TESTING COMPANY Daytona Beach - Fort Myers - Gainesville Merritt Island - Orlando - West Palm Beach	CITRUS COUNTY LANDFILL EXPANSION S.R. 44 CITRUS COUNTY, FLORIDA	For: POST BUCKLEY SCHUH & JERNIGAN Drawn By: T.S. Date: 6/17/88 Checked By: S.D.H. Date: 7/8/88 Order No: 88-5508-1 Scale: 1" = 400' Report No: 2354 Page No: B-1 REVISED
	BORING LOCATION PLAN	

Figure Three

HYDROLOGY

HYDRAULIC CONDUCTIVITY

Field and laboratory testing of vertical and horizontal hydraulic conductivity of sediments was performed by Seaburn and Robertson (1985). Results indicated vertical conductivity ranged between 4.63×10^{-3} cm/sec for a sand sample to 2.55×10^{-8} cm/sec for a clay sample. Paired vertical and horizontal field measurements of conductivity on a silty sand show an order of magnitude difference (1.20×10^{-4} cm/sec and 1.15×10^{-5} cm/sec).

Investigations on the 80-acre site by Post, Buckley, Schuh and Jernigan (1988) included similar laboratory testing. Their results indicated a range of vertical hydraulic conductivity of 1.98×10^{-4} cm/sec to 5.0×10^{-7} cm/sec, a comparable set of values.

HYDRAULIC UNITS

Generally in Central Florida, there is an unconfined aquifer occupying the unconsolidated sands, which lie near land surface. Water levels in this surficial aquifer are generally at a higher elevation than those for deeper units. Continuous clay units act as confining layers to the underlying limestones which are part of the artesian Floridan aquifer. However, in areas where the clay units are not continuous, the aquifers are not separated and the Floridan is non-artesian. This is the case in most of Citrus County including the vicinity of the landfill.

The absence of continuous clay units in the surficial sediments indicates that the limestones of the Floridan aquifer are unconfined. The first water encountered at the site occurs either in unconsolidated sediments or in limestone as is the case with Monitor Well A located on the west side of the 60-acre site. In the percolation pond area, it is believed that no limestone occurs above the water levels.

WATER LEVELS AND FLOW DIRECTION

Water level measurements have been made in some existing monitoring wells on the 80-acre and 60-acre sites recently. Table 2 lists the available water level data. All measurements are between 1.5 and 8.5 feet. The differences between the monthly measurements in MW-A and MW-2 may indicate measurement errors, given that the other wells are more consistent from one month to the next. Water levels are highest in MW-B (at the south-central part of the site) and the lowest in MW-C (at the southwest corner of the site) for both months, suggesting a westward gradient. Contouring of the data also shows a northward component. A longer period of record is needed to evaluate site specific flow.

Figure 4 depicts the potentiometric surface of the Floridan aquifer in the Citrus County area in May 1991. The potentiometric surface of the Floridan is at about 5 feet and regional groundwater flow direction is toward the west. The site specific data are consistent with the concept of a single unconfined aquifer with water levels reflecting Floridan aquifer levels.

TABLE TWO

CITRUS COUNTY CENTRAL LANDFILL

WATER LEVEL ELEVATION

<u>Monitoring Wells:</u>	<u>Water Level 6/93</u>	<u>Water Level 7/93</u>
<u>60 Acre Site:</u>		
MW-A	4.66	2.07
MW-B	8.38	8.09
MW-C	1.78	1.53
MW-D	NO ACCESS	4.66
<u>80 Acre Site:</u>		
MW-1	5.15	4.97
MW-2	7.39	3.45
MW-3	6.66	6.22

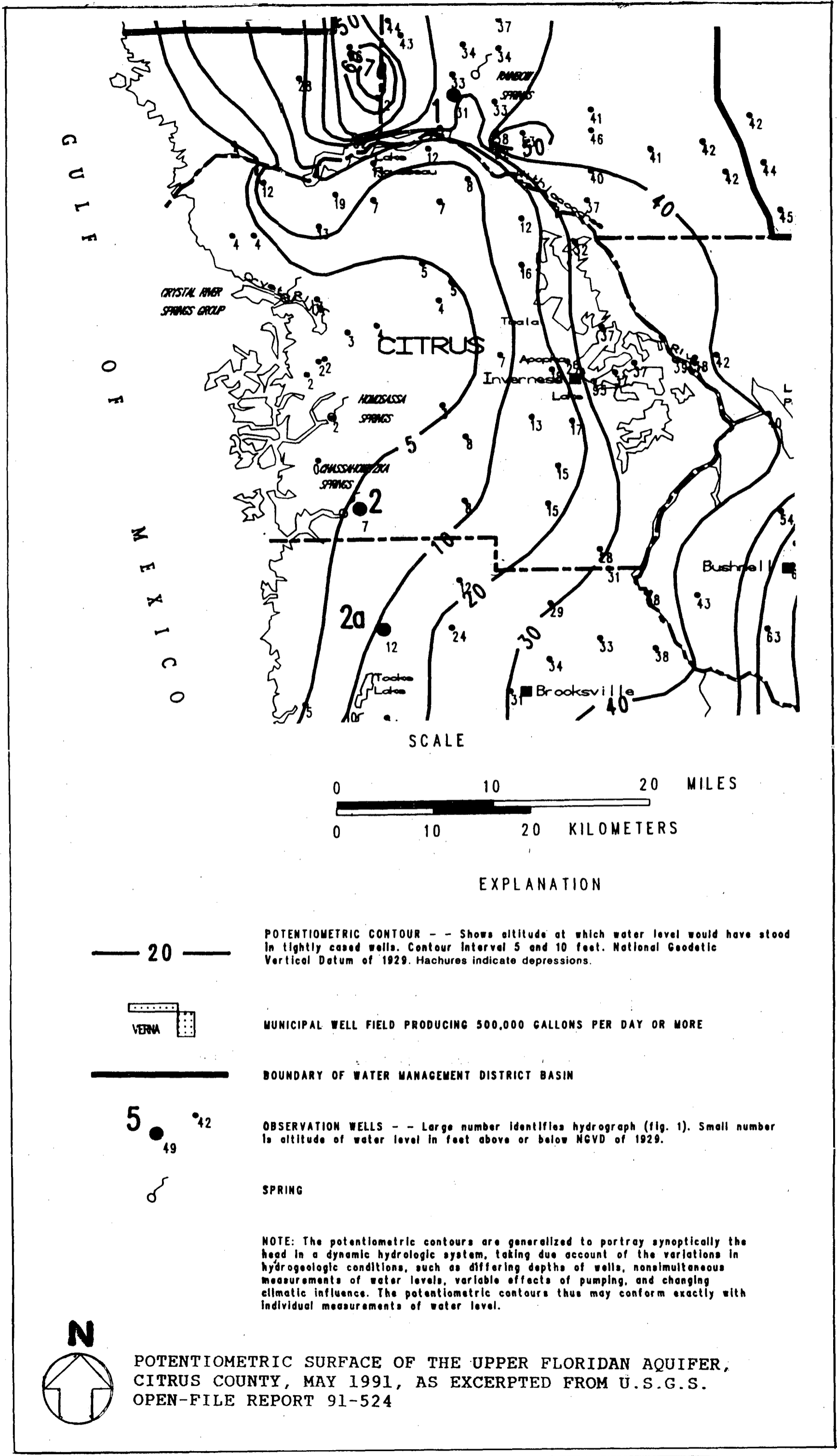


Figure Four

AREA WATER USE INFORMATION

Previous groundwater monitoring plans have submitted listings of wells located within the vicinity of the two landfill properties. There is no public water supply system available in this section of the County, therefore any dwelling or business has its own well. The wells are all 3-inch or 4-inch diameter wells. The closest wells are located to the north, across SR 44. All land south of SR 44 for two miles to the west of the landfill and two and a half miles to the east, extending south about 11 miles to the county line, is within the Withlacoochee State Forest. The closest wells to the west are at least two miles from the landfill property.

MONITORING PLAN

WELL LOCATION AND CONSTRUCTION

The monitoring system proposed for this site will include three wells. The upgradient well will be located between the ponds and across the landfill access road, a distance of about 30 feet to the east of the ponds. This is the maximum distance available without interfering with the cell expansion area. A detection well will be located on the downgradient (west) side of each pond a distance of about 15 feet. Shifting the well farther to the west for the north pond would put the monitoring point in a drainage swale or at the edge of the cap for the 7 Acre Cell. Shifting the south pond well further to the west by 15 feet would place it in the drainage retention area 3 feet vertically above the current water level. During the October, 1992 storm, water levels were probably at that level in the drainage retention area. The proposed well locations are shown on Figure 5. The proposed designations are MW-4 (updradiant), MW-5 (north pond, downgradient) and MW-6 (south pond, downgradient).

The wells to be installed at these locations are proposed to be constructed to a total depth of about 130 feet (to -10 feet NGVD) with the bottom 20 feet (+10 to -10 NGVD) of the well screened. The wells will be constructed with 2-inch Schedule 40 PVC well casing and screen with threaded couplers. Screen slot size will be 0.01 inch.

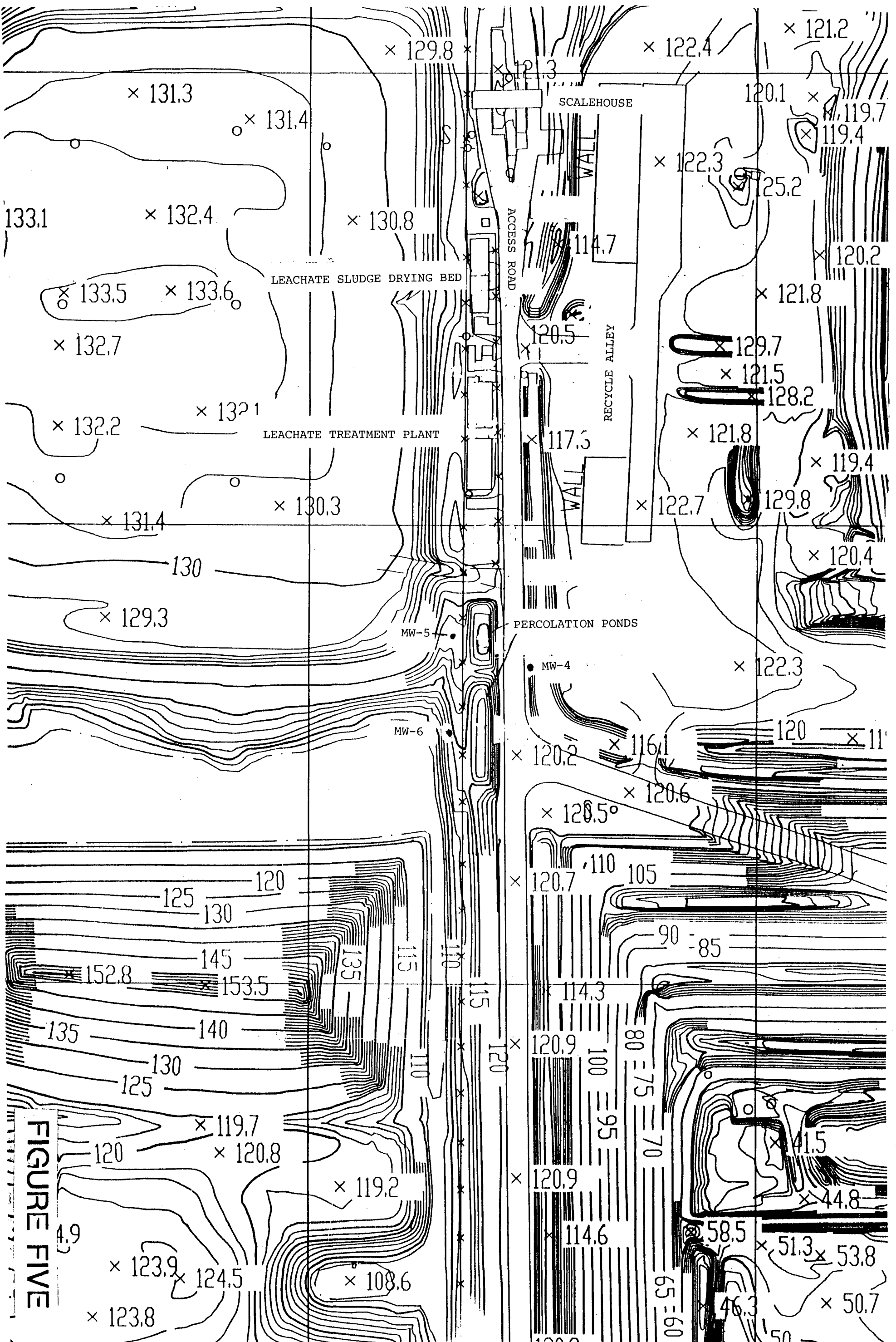


FIGURE FIVE

Before wells are installed, standard penetration test borings with split spoon samples will be drilled at each location to determine the sediment/rock sequence. A log of each boring will be submitted. Wells will be installed in six-inch diameter holes drilled by the mud rotary method using bentonite drilling fluid, as thin a mix a possible. The screened section annulus will be packed with clean 20/30 silica sand. The remainder of the borehole will be grouted. The well top will be fitted with a screw cap. The wells will be developed by pumping, bailing, surging or compressed air before the initial sampling episode.

The surface finish of the wells will consist of a concrete pad, with a metal box cover which can be secured to the pad and locked. Concrete-filled metal posts will be placed to protect the wells from traffic and heavy equipment.

SAMPLING PROCEDURES

The wells will be sampled by the County's contracted laboratory. At present this is Savannah Laboratories and Environmental Services, Inc., Tampa Bay Division. Their Comprehensive Quality Assurance Plan submitted December 1991 was approved by the FDER. The sampling procedure will follow Section 6 of that Plan.

ANALYSIS PARAMETERS AND FREQUENCY

Analysis of the groundwater samples taken from these wells will be performed by Savannah Laboratories according to the procedures described in their Comprehensive Quality Assurance Plan (1991). The proposed analysis schedule will begin with a comprehensive parameter list for initial sampling, followed by an abbreviated parameter list for quarterly sampling based on indicators of leachate effluent. The schedule for sampling will coincide with sampling for other wells and leachate effluent at the site.

The parameters to be included in the initial sampling are Primary and Secondary Drinking Water Standards listed in 17-550.310 and 17-550.320, plus fecal coliform and EPA Priority Pollutants. Quarterly sampling parameters will include total dissolved solids, sodium, chloride, nitrate, and fecal coliform.

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