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REMEDIAL INVESTIGATION/FEASIBILITY STUDY OPERABLE UNIT 5 (OU5) WORK PLAN ADDENDUM FOR ADDITIONAL MONITORING WELLS MAY 1992

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ADDENDUM

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FERNALD ENVIRONMENTAL MANAGEMENT PROJECT (FEMP)

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

OPERABLE UNIT 5 (OU5)

WORK PLAN ADDENDUM

FOR ADDITIONAL MONITORING WELLS

May, 1992

Prepared by

Advanced Sciences Incorporated/International Technology (ASI/IT)

for the

Department of Energy

under contract

No. DE-AC05-860R216959

INTRODUCTION

This proposal presents the justification for additional monitoring wells required for the remedial investigation at the FEMP site. These wells are required to define the extent of the uranium plume and assure that a complete monitoring network is in place. These recommendations are the result of changing conditions in the environment over the course of the remedial investigation and additional information gained during the remedial process. Initial sampling and data collection were conducted in 1988, which was an extremely dry year. Data collected in 1989, a year of relatively normal rainfall, and 1990, an extremely wet year, indicate that the patterns of groundwater flow are strongly influenced by rainfall and the resultant recharge of the aquifer by Paddys Run.

The proposed wells will be used to define the boundaries of the uranium plume in the areas east of the Storm Sewer Outfall Ditch, near the Southfield and fly ash piles, east and north of the Production Area, and will provide a better understanding of the background groundwater flow and quality from the Shandon area north-northwest of the property. The need for these wells has been developed from the data analysis performed during the preparation of the Groundwater Report and the Operable Unit 5 RI Report.

All well installation procedures, sampling procedures, and laboratory analyses will follow the guidelines presented in the March 1988 RI/FS Work Plan and subsequent addenda unless specifically altered in this addendum. Samples will be collected from each well at the time the well is installed and again approximately two months later. Each well will be sampled for full radiological and general groundwater parameters which includes inorganic constituents.

At locations where contingency wells are proposed, a split of the initial groundwater sample from the shallow well will be sent to the on-site laboratory for total uranium analysis on a "rush" basis. The need for the installation of each deeper contingency well will be based on the results of that analysis. A value of greater than or equal to 20 micrograms per liter is an 2000-series well will necessitate the installation of a 3000-series well at any given location. Water analyses for total uranium have been very consistent between the on-site laboratory and the contract laboratory. If the contract laboratory

value is above 20 µg/l and the on-site laboratory value was not, then the laboratory work will be checked at both laboratories for errors, in keeping with the project QA/QC procedures. If no laboratory errors are found, the well will be resampled and the analysis will be performed on a rush basis at the contract laboratory. If this analysis confirms that the level is greater than 20 µg/l, the 3000-series well will be installed and sampled.

The use of the on-site laboratory for this determination is necessary due to the sample turnaround time at the RI/FS contract laboratory. The present Consent Agreement schedules provide time for the installation of the wells in this program in one phase while this Work Plan addendum calls for two phases. With the use of the on-site laboratory for contingency well installation determination, both the Consent Agreement schedules and the requirements of this addendum will be met.

Figure 1 shows the locations of the proposed wells in addition to the existing wells on site. Table 1 summarizes the wells and the respective analyses required, by area. The target analyte lists (TALs) are provided in Tables 2 and 3. The following sections of this plan provide the reasoning and justification for the installation of the proposed wells.

AREA EAST OF THE OUTFALL DITCH

The data from the 31-Well Program has confirmed the prediction that there is uranium in the groundwater east of the outfall ditch. A sample from Monitoring Well 2387, located east of the Storm Sewer Outfall Ditch, contained 492 ppb of total uranium. The particle tracking from the SWIFT III groundwater model, as presented in the South Plume EE/CA, shows that uranium will migrate from the location of Well 2387 along an arc that will intersect the south boundary of the FEMP site. The residences on the south side of Willey Road, west of the entrance to the FEMP, are currently the most likely off-site receptors of uranium in their drinking water wells as a result of the plume migrating from the FEMP site.

Well 2386 is located northeast of Well 2387 near the southeast corner of the east cell of the Storm Water Retention Basin. The sample result of 6.7 µg/L and a second sample result of 5.0 µg/L total

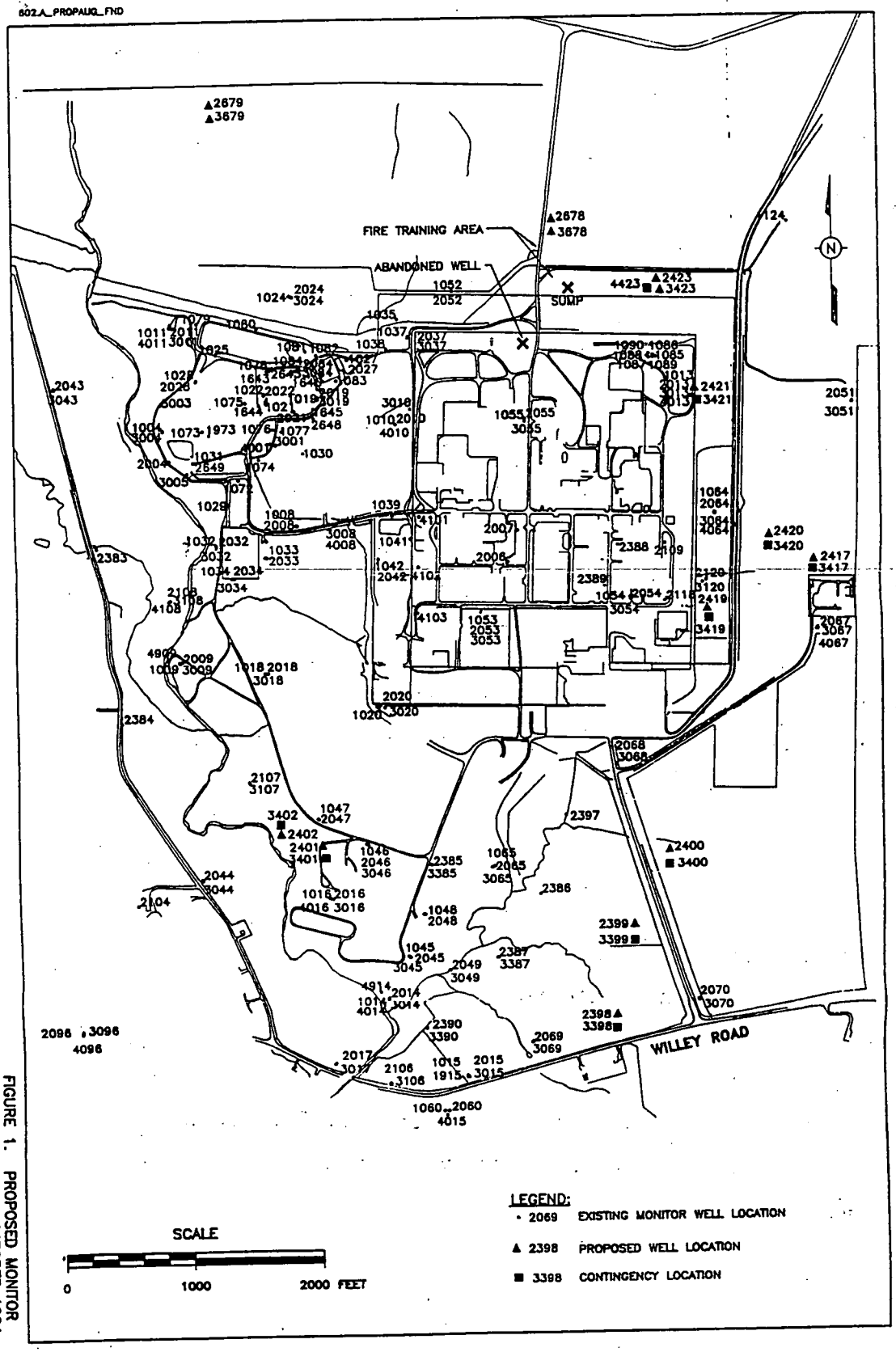

FIGURE 1. PROPOSED MONITOR WELL LOCATIONS – OCTOBER 1991

Table 1

Proposed Sampling Locations and Analyses

Area	Wells/Borings	Required Analyses
East of the Outfall Ditch	2398 3398* 2399 3399* 2400 3400*	Two rounds of general groundwater and full radiological. Rush analysis for Total U. TAL provided in Table 2.
Southfield	2401 3401* 2402 3402*	Two rounds of general groundwater and full radiological. Rush analysis for Total U. TAL provided in Table 2.
East of Plant 6	2417 3417* 2419 3419* 2420 3420*	Two rounds of general groundwater and full radiological. Rush analysis for Total U. TAL provided in Table 2.
Location 013	2421 3421	Two rounds of general groundwater and full radiological. TAL provided in Table 2.
Fire Training Area	2423 3423 4423*	Two rounds extended HSL, full radiological and general groundwater. Rush analysis for Total U. TAL provided in Table 3.
North of Fire Training Area	2678 3678	Two rounds of general groundwater and full radiological. TAL provided in Table 2.
Background Area	2679 3679	Two rounds of general groundwater and full radiological. TAL provided in Table 2.

* Contingency wells to be installed if rush analytical results of Total U from upper zones indicate the need for them.

TABLE 2

ADDITIONAL MONITORING WELLS
OPERABLE UNIT 5

EAST OF THE OUTFALL DITCH, SOUTH FIELD, EAST OF PLANT 6, LOCATION 013, NORTH OF FIRE TRAINING AREA, AND BACKGROUND AREA.

TAL 50.03.08 A

FEMP RI/FS - GENERAL GROUNDWATER QUALITY - ANALYTICAL PARAMETERS

INORGANICS

1	Aluminum
2	Arsenic
3	Barium
4	Cadmium
5	Calcium
6	Chromium
7	Copper
8	Iron
9	Lead
10	Magnesium
11	Manganese
12	Mercury
13	Molybdenum
14	Nickel
15	Potassium
16	Selenium
17	Silicon
18	Silver
19	Sodium
20	Vanadium

MISCELLANEOUS

1	Ammonia
2	Chloride
3	Fluoride
4	Nitrate
5	Phenols
6	Phosphorus (total)
7	Sulfate
8	Sulfide
9	Total Organic Carbon (TOC)
10	Total Organic Halogens (TOX)
11	Total Organic Nitrogen (TON)

FEMP RI/FS - FULL RADIOLOGICAL - ANALYTICAL PARAMETERS

1	Cesium 137
2	Gross alpha
3	Gross beta
4	Neptunium 237
5	Plutonium 238
6	Plutonium 239/240
7	Radium 226
8	Radium 228
9	Ruthenium 106
10	Strontium 90
11	Technetium 99
12	Thorium 228
13	Thorium 230
14	Thorium 232
15	Total Thorium
16	Total Uranium
17	Uranium 234
18	Uranium 235/236
19	Uranium 238

TABLE 3

ADDITIONAL MONITORING WELLS
OPERABLE UNIT 5

LOCATION 0423

3925

TAL 50.03.08 B

FEMP RI/FS - HSL PLUS - ANALYTICAL PARAMETERS

INORGANICS

1	Aluminum
2	Antimony
3	Arsenic
4	Barium
5	Beryllium
6	Cadmium
7	Calcium
8	Chromium (Total)
9	Cobalt
10	Copper
11	Cyanide
12	Iron
13	Lead
14	Magnesium
15	Manganese
16	Mercury
17	Molybdenum
18	Nickel
19	Potassium
20	Selenium
21	Silicon
22	Silver
23	Sodium
24	Thallium
25	Vanadium
26	Zinc

VOLATILE ORGANICS

1	1,1-Dichloroethane
2	1,1-Dichloroethene
3	1,1,1-Trichloroethane
4	1,1,2-Trichloroethane
5	1,1,2,2-Tetrachloroethane
6	1,2-Dichloroethane
7	1,2-Dichloroethene (total)
8	1,2-Dichloroethylene
9	1,2-Dichloropropane
10	2-Butanone
11	2-Hexanone
12	4-Methyl-2-pentanone
13	Acetone
14	Benzene
15	Bromodichloromethane
16	Bromoform
17	Bromomethane
18	Carbon disulfide
19	Carbon tetrachloride
20	Chlorobenzene
21	Chloroethane
22	Chloroform
23	Chloromethane
24	cis-1,3-Dichloropropene
25	Dibromochloromethane
26	Ethylbenzene
27	Methylene chloride
28	Styrene
29	Tetrachloroethene
30	Toluene
31	Total xylenes
32	trans-1,3-Dichloropropene
33	Trichloroethene
34	Vinyl acetate
35	Vinyl chloride

SEMIVOLATILE ORGANICS

1	1,2-Dichlorobenzene
2	1,2,4-Trichlorobenzene
3	1,3-Dichlorobenzene
4	1,4-Dichlorobenzene
5	2-Chloronaphthalene
6	2-Chlorophenol
7	2-Methylnaphthalene
8	2-Methylphenol
9	2-Nitroaniline
10	2-Nitrophenol
11	2,4-Dichlorophenol
12	2,4-Dimethylphenol
13	2,4-Dinitrophenol
14	2,4-Dinitrotoluene
15	2,4,5-Trichlorophenol
16	2,4,6-Trichlorophenol
17	2,6-Dinitrotoluene
18	3-Nitroaniline
19	3,3'-Dichlorobenzidine
20	4-Bromophenyl phenylether
21	4-Chloro-3-methylphenol
22	4-Chloroaniline
23	4-Chlorophenyl-phenyl ether
24	4-Methylphenol
25	4-Nitroaniline
26	4-Nitrophenol
27	4,6-Dinitro-2-methylphenol
28	Acenaphthene
29	Acenaphthylene
30	Anthracene
31	Benzoic acid
32	Benzo(a)anthracene
33	Benzo(a)pyrene
34	Benzo(b)fluoranthene
35	Benzo(g,h,i)perylene
36	Benzo(k)fluoranthene
37	Benzyl alcohol
38	bis(2-Chloroethoxy)methane
39	bis(2-Chloroethyl)ether
40	bis(2-Chloroisopropyl) ether
41	bis(2-Ethylhexyl)phthalate
42	Butyl benzyl phthalate
43	Carbazole
44	Chrysene
45	Dibenzofuran
46	Dibenzo(a,h)anthracene
47	Diethylphthalate
48	Dimethylphthalate
49	Di-n-butyl phthalate
50	Di-n-octyl phthalate
51	Fluoranthene
52	Fluorene
53	Hexachlorobenzene
54	Hexachlorobutadiene
55	Hexachlorocyclopentadiene
56	Hexachloroethane
57	Indeno(1,2,3-cd)pyrene
58	Isophorone
59	Naphthalene
60	Nitrobenzene
61	N-Nitroso-di-n-propylamine
62	N-Nitrosodiphenylamine
63	Pentachlorophenol
64	Phenanthrene
65	Phenol
66	Pyrene

PESTICIDES / PCBs

1	4,4'-DDD
2	4,4'-DDE
3	4,4'-DDT
4	Aldrin
5	alpha-BHC
6	alpha-Chlordane
7	Aroclor 1016
8	Aroclor 1221
9	Aroclor 1232
10	Aroclor 1242
11	Aroclor 1248
12	Aroclor 1254
13	Aroclor 1260
14	beta-BHC
15	delta-BHC
16	Dieldrin
17	Endosulfan sulfate
18	Endosulfan-I
19	Endosulfan-II
20	Endrin
21	Endrin aldehyde
22	Endrin ketone
23	gamma-BHC
24	gamma-Chlordane
25	Heptachlor
26	Heptachlor epoxide
27	Methoxychlor
28	Toxaphene

ORGANOPHOSPHORUS PESTICIDES

1	Azinphosmethyl
2	Demeton
3	Diazinon
4	Disulfoton
5	Ethion
6	Malathion
7	Parathion, ethyl
8	Parathion, methyl

DIOXINS / FURANS

1	1,2,3,4,6,7,8-Heptachlorodibenzofuran
2	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin
3	1,2,3,4,7,8-Hexachlorodibenzofuran
4	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin
5	1,2,3,4,7,8,9-Heptachlorodibenzofuran
6	1,2,3,6,7,8-Hexachlorodibenzofuran
7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin
8	1,2,3,7,8-Pentachlorodibenzofuran
9	1,2,3,7,8-Pentachlorodibenzo-p-dioxin
10	1,2,3,7,8,9-Hexachlorodibenzofuran
11	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin
12	2,3,4,6,7,8-Hexachlorodibenzofuran
13	2,3,4,7,8-Pentachlorodibenzofuran
14	2,3,7,8-TCDD
15	2,3,7,8-TCDF
16	Octachlorodibezofuran
17	Octachlorodibezo-p-dioxin
18	Total Heptachlorodibenzofuran
19	Total Heptachlorodibenzo-p-dioxin
20	Total Hexachlorodibenzofuran
21	Total Hexachlorodibenzo-p-dioxin
22	Total Pentachlorodibenzofuran
23	Total Pentachlorodibenzo-p-dioxin
24	Total Tetrachlorodibenzofuran
25	Total Tetrachlorodibenzo-p-dioxin

TABLE 3 (CONTINUED)

ADDITIONAL MONITORING WELLS
OPERABLE UNIT 5

LOCATION 0423

TAL 50.03.08 B

FEMP RI/FS - GENERAL GROUNDWATER QUALITY - ANALYTICAL PARAMETERS

MISCELLANEOUS

1	Ammonia
2	Chloride
3	Fluoride
4	Nitrate
5	Phenols
6	Phosphorus (total)
7	Sulfate
8	Sulfide
9	Total Organic Carbon (TOC)
10	Total Organic Halogens (TOX)
11	Total Organic Nitrogen (TON)

FEMP RI/FS - FULL RADIOLOGICAL - ANALYTICAL PARAMETERS

1	Cesium 137
2	Gross alpha
3	Gross beta
4	Neptunium 237
5	Plutonium 238
6	Plutonium 239/240
7	Radium 226
8	Radium 228
9	Ruthenium 106
10	Strontium 90
11	Technetium 99
12	Thorium 228
13	Thorium 230
14	Thorium 232
15	Total Thorium
16	Total Uranium
17	Uranium 234
18	Uranium 235/236
19	Uranium 238

uranium from Well 2386 indicate that the well is near the northern boundary of the plume east of the outfall ditch. Unfortunately, this is also where water table gradients shift through the course of the year and it cannot be determined with any degree of certainty that the sample results are an accurate representation of conditions throughout the year.

Figure 2 is the same as Figure 12-11 from the Groundwater Report where a full explanation of this particle tracking interpretation is presented in Section 12. Figure 2 shows monthly particle tracking for groundwater in 2000-series wells from September 1988 to April 1990 for locations in the southern half of the FEMP. Calendar year 1989 is a reasonable representation of a typical rainfall year. Rainfall was heaviest in the first six months of the year and lightest in the late summer and early fall. The start and end of 1989 are shown on each of the tracks for comparison.

The tracks in Figure 2 are calculated by taking an arbitrary starting point on a monthly water table map. Given the properties of the aquifer and the water table gradient for the month, the distance and direction a water particle would move in a month can be calculated and plotted. The resulting point is plotted on the water table map for the next month and the calculation is repeated using the gradient and flow direction for that month. The process is repeated for succeeding months and produces the tracks shown in Figure 2.

This presentation provides a method for evaluating the effects of changing groundwater conditions on the migration path in the area. Figure 2 also shows the particle tracks for uranium. Since uranium travels at one-twelfth the velocity of the groundwater in this aquifer, the total distance traveled is much shorter than for a water particle over the same time interval.

At Location J, east of the outfall ditch in Figure 2, migration was to the east and north east until April 1989, when the direction of flow abruptly turned south as the recharge from Paddys Run began to influence the gradients in this area. The direction of migration turned back to the east in the latter part of the year when conditions were more typical of no recharge from Paddys Run. The particle track for uranium at Location J is very short in comparison to the particle track for water. Both tracks

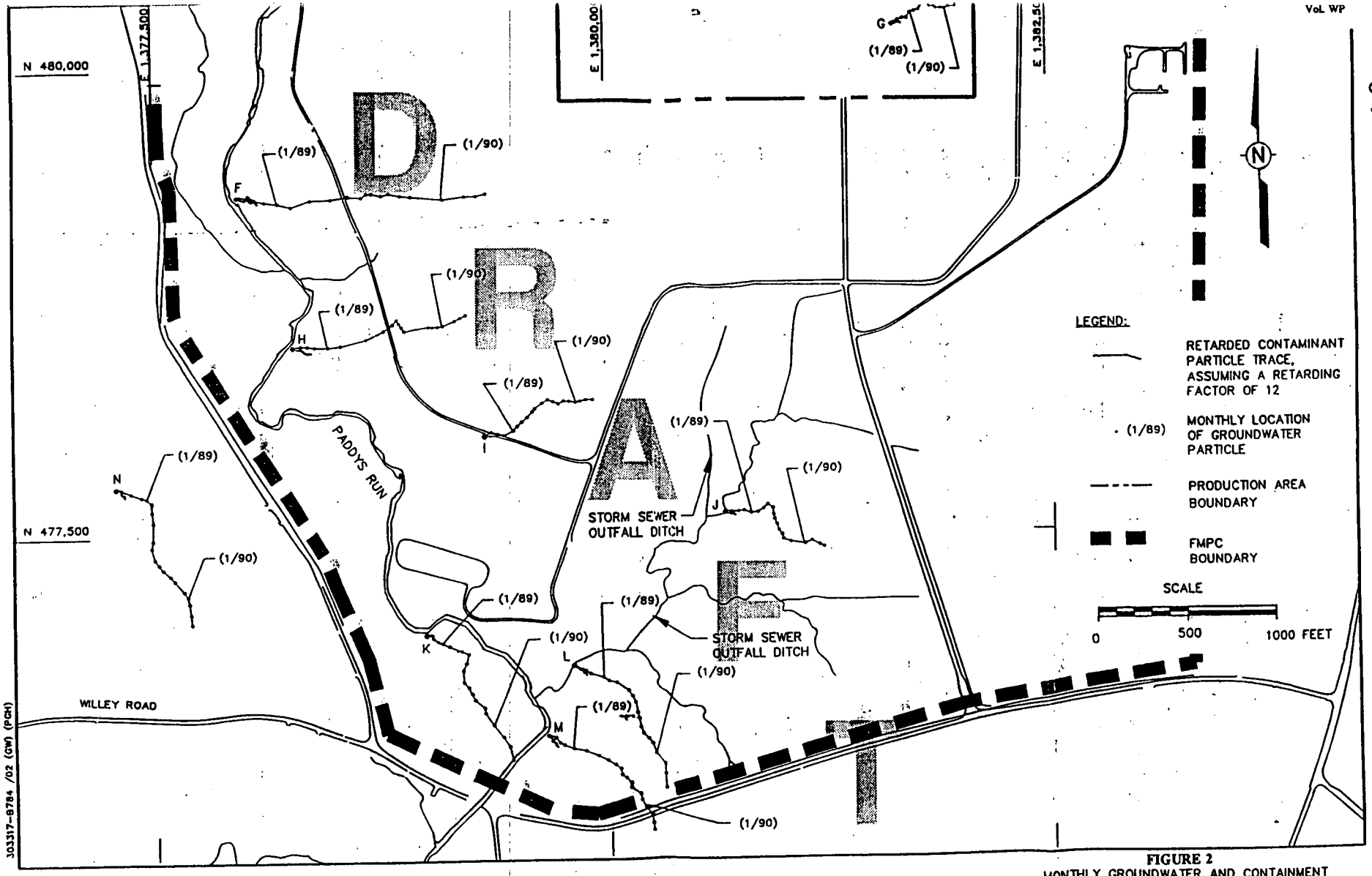

FIGURE 2
MONTHLY GROUNDWATER AND CONTAINMENT PARTICLE MOVEMENT IN UPPER GREAT MIAMI AQUIFER AT SELECTED LOCATIONS OF SOUTHERN PORTION OF FMPC FROM SEPTEMBER 1988 TO APRIL 1990

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result in an east-southeast migration path over the course of 1989. If the year had been wetter the net migration would have been more to the south; if the year had been dryer the migration would have been more to the east.

At Locations M and L near the confluence of the outfall ditch and Paddys Run, the tracks converge south of the FEMP site at the approximate location of Well 2060, where uranium contamination was first discovered. As at Location J, during the wet, early part of 1989 the contamination migrated to the east and turned south in the dryer, later half of the year.

In recent months, WEMCO monitoring of the water quality from the well which serves two houses along the south side of Willey Road indicated rising uranium concentrations. It is unclear if this is due to migration to the east or to the south; however, it is clear from the water level data collected in the last year that migration patterns are different than those established in the 1988 field season. There are neither enough wells between the outfall ditch and the entrance road or Willey Road to accurately determine the gradients in this critical area, nor enough wells to provide the necessary sampling points to define the edge of the uranium plume in an area where it could easily migrate off FEMP property.

Proposed Monitoring Wells

Wells 2398, 2399, and 2400 shown in Figure 1 should be installed at the locations between the outfall ditch and the entrance road to the FEMP site. The wells at these three locations should also complete the definition of the eastern and southern extent of the uranium plume east of the outfall ditch. Each of these locations may require a 3000-series well if contamination is found in the respective 2000-series well. The need for contingency wells will be established on the basis of rush analysis of groundwater for total uranium at the on-site laboratory.

The proposed wells will complete the monitoring well network that has been established along the southern boundary of the FEMP site. The wells at Locations 398 will serve as early warning locations to alert the DOE of an imminent threat to receptors on the south side of Willey Road. The wells at

Location 399 and 400 will determine the magnitude of the eastward gradient that is moving contamination toward the receptors near the southeast corner of the property.

THE SOUTHFIELD

Samples from Well 2046 have shown erratic and unexpectedly high uranium values ranging from 232 to 907 µg/L. These are the highest uranium values recorded from 2000-series wells and there is not at present a defensible explanation for the magnitude of these readings. It is not certain if the source of these values is recharge from Paddys Run or from an as yet unidentified source in the area of the inactive fly ash pile. The particle tracking shown in Figure 2 indicates that at Point I in the vicinity of Well 2046 groundwater moves to the east during dry conditions and to the northeast during recharge conditions. The uranium levels could be from either the fortuitous addition of multiple contamination pathways converging on the area, or leachate from an as yet unidentified source.

If the uranium values in Well 2046 are the result of recharge from Paddys Run, then some of the following theories would have to be proven. There is a stretch of Paddys Run west of Well 2046 which is oriented so that the bed of Paddys Run is roughly parallel to the direction of groundwater flow during dry conditions. It could be that the recharge along this stretch of the stream produces exceptionally high values of uranium in the groundwater because of the parallel between groundwater flow and the stream axis.

The levels of uranium in Wells 2047 and 2016, located west and south respectively from Well 2046, have not exceeded 30 µg/L. Paddys Run is probably the source of contamination of both of these wells. Both wells are in closer proximity to the stream than is Well 2046. It is difficult to see how present conditions would result in the uranium concentrations found in Well 2046; however, it is possible that conditions in the past may have created these levels.

Since uranium was found in the perched groundwater in the glacial overburden at Location 048, there is the possibility that the source is due to lateral migration within the glacial overburden from the

Production Area or the storm water retention basin. The installation of monitoring wells in the glacial overburden near the storm water retention basin is being investigated.

It is possible that the inactive fly ash pile is contributing contamination to the groundwater system. There is also the possibility that there is some other unidentified buried source in the vicinity of and upgradient to Well 2046. Well 2046 was installed because of early high readings in samples from Well 1046.

The CIS report indicates that U-238 is present in the inactive fly ash at levels of 3.1 to 50 pCi/g or approximately 9 to 150 µg/g. It is quite conceivable that concentrations of 150 µg/g in dry material could produce a leachate that would result in 900 µg/L levels of contamination in the underlying groundwater. Therefore, although other scenarios are possible, leachate moving through the flyash is the most likely source of the uranium in Well 2046. This does not require an additional unknown source.

There are not enough wells in the area to accurately determine the gradient or provide the sufficient sampling points to determine the source of the uranium in Well 2046.

Proposed Wells

It is proposed that two 2000-series wells be installed on either side of the inactive fly ash pile along the dry condition flow path between Paddys Run and Well 2046. Wells 2401 and 2402 are shown in Figure 1 in the recommended locations on either side of the inactive fly ash pile. Well 2401 is also located in a downgradient position under either the wet or dry condition flow path from the fly ash.

If contamination is found in the 2000-series wells, then 3000-series wells will be installed to determine the vertical extent of the contamination. A decision to install 3000-series wells will be based on total uranium rush analysis of groundwater from the 2000-series wells.

AREA EAST OF PLANT 6

Wells 2120 and 3120 were installed to determine the eastern extent of the groundwater contamination that appears to be associated with Plant 6. It was thought that these wells would serve as downgradient clean monitoring wells for the relatively low level uranium plume associated with Plant 6. The initial sample from Well 2120 contained 15.9 and 17.3 µg/L total uranium on successive sampling. Well 3120 contained 1.1 and 1.6 µg/L total uranium each time it was sampled. This indicates that there is not deep contamination in the area.

However, Well 2120 is not a clean downgradient well that defines the edge of the plume coming from the Plant 6 area. The presence of uranium in Well 2120 is somewhat surprising since the concentrations in the wells near Plant 6 were only in the mid-30 µg/L range. Figure 2 shows the particle track for water at Location G in the Plant 6 area. The particle track shows that the migration path is shortest of all the paths plotted. This is because the gradient in this area is always very low. The net direction of travel is also to the east-northeast because of the influence of the collector wells along the Great Miami River. To have relatively high readings in Well 2120 with this low gradient indicates that the source for the contamination has been present for a considerable length of time.

Although these levels of uranium may not require immediate remediation, the size and direction of migration of the plume must be defined. The DOE must be able to monitor adequately the leading edge of the plume in order to determine if actions should be taken to prevent the introduction of contamination into private wells located off-site.

In addition to Plant 6, there is also a potential source of uranium contamination to the aquifer in the area around and south of the garage. As reported in the draft Operable Unit 3 RI Report, samples containing average total uranium values of 575 and 573 µg/L have been collected from Piezometers 1173 and 1175, respectively, on the south side of the vehicle maintenance shop. The source of this uranium has not been identified. This material could be leaking through to the aquifer below.

Quarterly groundwater samples have been collected from Well 2067 located about 130 feet south of Manhole 175. Figure 3 is a hydrograph for Wells 2067 and 3067 showing both water level and total uranium values versus time for the period from January, 1988 through September, 1990. The hydrograph shows that total uranium concentrations in 1988 samples were below the analytical detection limit. Samples collected in late 1989 and early 1990 from Well 2067 show an increasing level of uranium.

Well 2064 is located slightly north and east of the north end of Plant 6. Figure 4 is a hydrograph of the water levels and uranium data from Wells 2064 and 3064. It appears that Well 2064 is located near the northern boundary of the plume coming from the Plant 6 area. Uranium levels have been at or slightly above background in Well 2064 throughout the sampling history. This is precisely what is expected to occur if a well is defining the boundary of a plume.

Because there are no wells between Wells 2120 and 2067 it is impossible to determine if the uranium found in Well 2067 is part of a plume originating under the Production Area, or from a leak in the waste water pipes between the Production Area and the Sewage Treatment Plant. The width and extent of the plume east of Plant 6 and the southeast corner of the Production Area has to be precisely defined to determine if any remedial action is required to prevent the contamination of wells off of the FEMP site.

Proposed Wells

Three 2000-series wells are proposed for the area east of Plant 6 as indicated in Figure 1. Well 2417 should be installed on a line east of Well 2120 near the northwest corner of the Sewage Treatment Plant enclosure. The well should be placed on the western edge of the area where surface soil contamination is known to exist. Well 2417 should serve as the clean downgradient monitoring well that will define the eastern extent of contamination from the Plant 6 area. Well 2419 should be installed south of Well 2120 to determine the width of the plume in the Plant 6 area. By installing Well 2419 east of the area where elevated uranium has been found in the glacial overburden, it will also serve to determine if uranium is reaching the aquifer from that area.

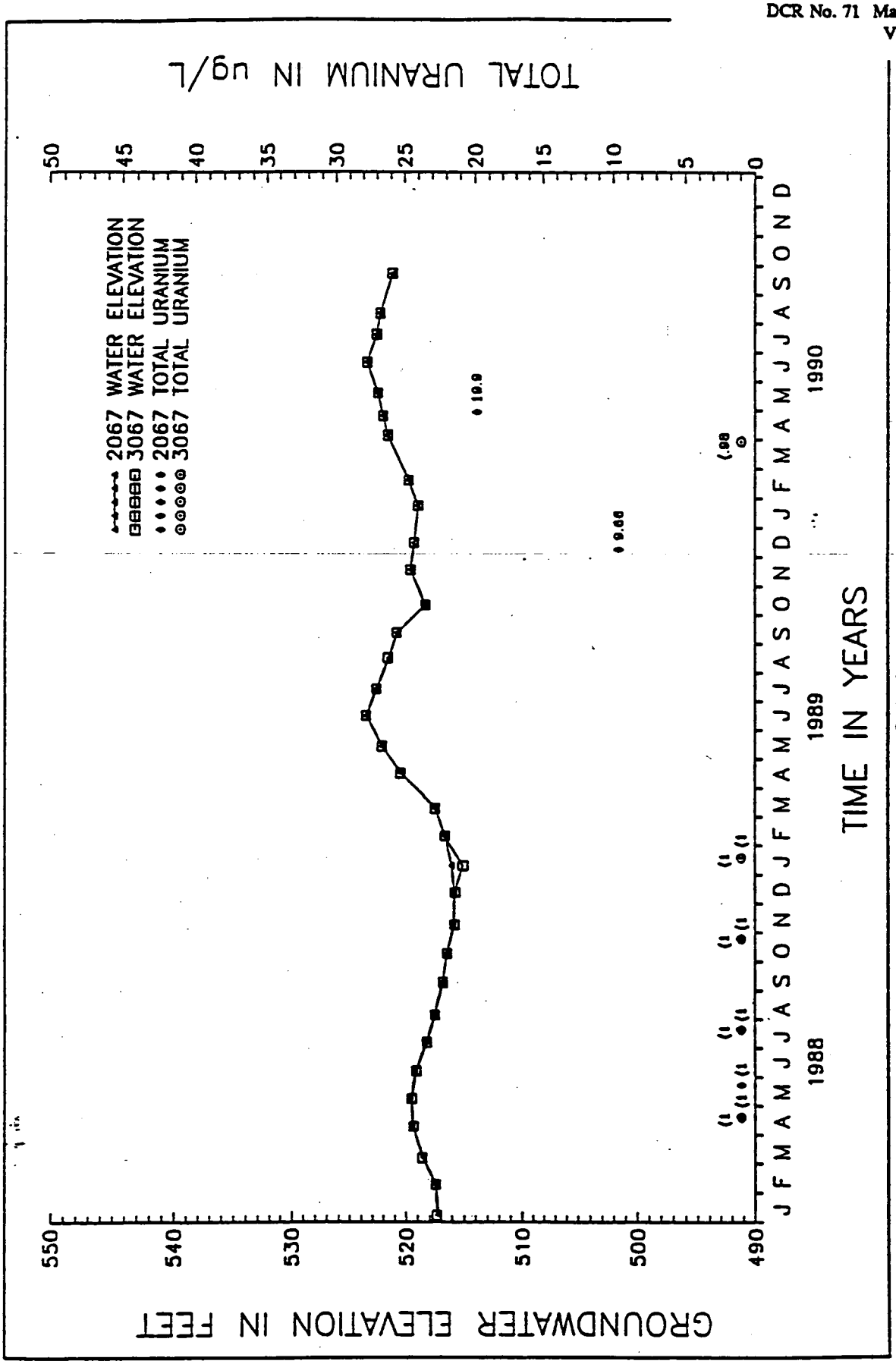

FIGURE 3
HYDROGRAPH AND TOTAL URANIUM FOR WELL CLUSTER AT LOCATION 067

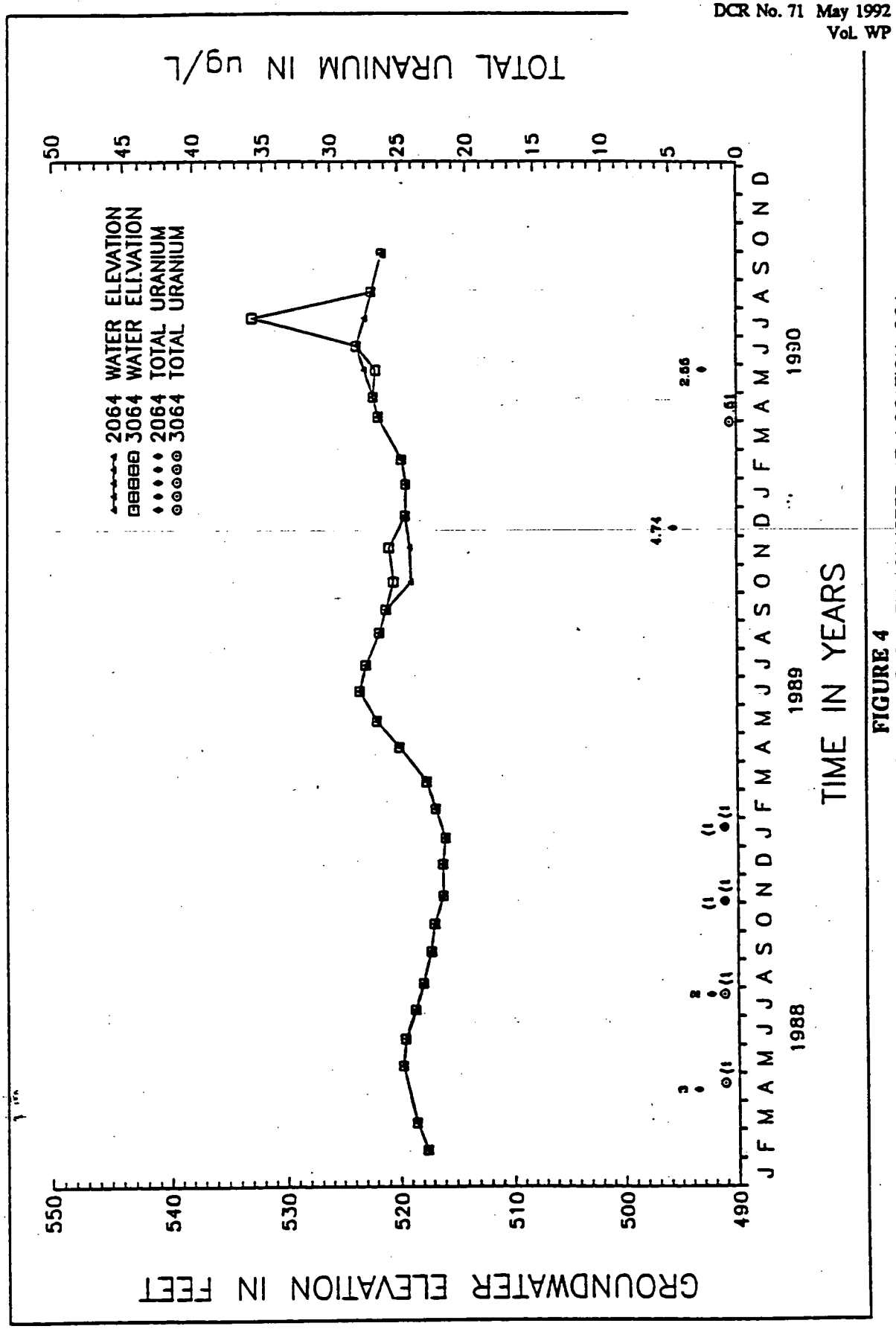

FIGURE 4
HYDROGRAPH AND TOTAL URANIUM FOR WELL CLUSTER AT LOCATION 064

Well 2420 should be installed half way between Wells 2120 and 2064, directly east of Well 2109. Well 2420 will serve as a monitor for the eastward boundary of the plume from the area around Well 2109 and determine the northeastern extent of the plume seen in Well 2120.

The present groundwater data do not indicate any contamination in the 3000-series wells in this area. If contamination is encountered in any of these proposed 2000-series wells, 3000-series wells will be required to determine the vertical extent of the contamination. A decision to install 3000-series wells will be made on the basis of analytical results from rush analysis of groundwater for total uranium.

WELL CLUSTER AT LOCATION 013

Four wells were installed at this location prior to the RI/FS. Two of these wells were installed in the glacial overburden; however, neither has ever yielded any water for sampling. The other two wells are designated 2013 and 3013 as they were completed at depths roughly equivalent to those used in the RI/FS. These wells are equipped with dedicated pumps. In part as a result of erratic uranium values from samples from the 2000- and 3000-series wells, Well 4013 was installed in February, 1989.

Table 4 shows the uranium results from Wells 2013, 3013 and 4013. These results are extremely erratic. Especially puzzling is the continued occurrence of uranium values in the 3000- and 4000-series wells that are higher than the values in the 2000-series well. The wells at Location 055, upgradient of Location 013, have not shown any contamination; therefore, the uranium does not appear to be migrating from the waste storage area.

ASI/IT personnel proposed that the erratic analytical results in Wells 2013 and 3013 were due to damaged well casings, allowing contamination to migrate from the till to the aquifer. WEMCO personnel conducted a camera survey of the subject wells in September 1991. The inspection showed that in all four wells, a number of couplings between casing sections have deteriorated and are leaking.

3925

Table 4

Uranium Results From the 013 Well Cluster

Well No.	Date Sampled	Total Uranium in ppb
2013	5-3-88	< 1
	8-7-88	< 1
	11-15-88	8
	2-22-89	36
	2-28-89	< 1
	6-15-89	< 1
	8-11-89	< 1
	11-16-89	< 1
3013	5-3-88	4
	8-7-88	4
	11-14-88	11
	11-15-88	8
	2-22-89	490
	2-28-89	4
	6-15-89	12
	8-11-89	10
	11-16-89	5
	8-13-90	12
4013	2-28-89	< 1
	6-06-89	86
	6-15-89	3
	8-11-89	5
	11-16-89	5
	8-13-90	3

Recommended Action

Drill out and plug with bentonite all wells at Location 013, except the stainless steel 4000-series well installed in February 1989. Install two replacement wells, 2421 and 3421, at locations 30 feet downgradient of the original wells.

NORTHEAST CORNER OF THE PRODUCTION AREA

The fire training area has been classified as an "Out-of-Service Hazardous Waste Management Unit" due to the historic use of RCRA materials in the area. Recent investigation has shown a need for additional information to evaluate the release of liquids from the oil fire pond. Interviews with site personnel have revealed that liquids in the oil fire pond were periodically drained off to a sump southeast of the pond. Field observations have confirmed some type of sump or hole in the ground, which is presently covered with plywood.

This sump was reported to be the old administration building water supply well. Further investigation revealed that the location of the old administration building well is to the southwest of the fire training area near the inner Production Area security fence. A pump is presently lodged in this well above the water table, thus preventing sampling of the well.

The sump where liquids were disposed of in the fire training area is clearly not the old administration building well. The sump is possibly part of the surface water runoff control system and may be connected to a storm sewer line that discharges into the stream located on the north side of the sanitary landfill. In either case it is a location where hazardous liquids used in the fire training area were introduced into the environment. There are no monitoring wells in the aquifer downgradient from the location of this sump. The Production and Additional Suspect Area Investigation has revealed that there are hazardous substances in the glacial overburden on the southwest side of the fire training area.

There is a potential that uranium from the waste pit area is migrating along the northern edge of the Production Area. Figure 5 shows the maximum uranium concentration in 2000-series wells from the

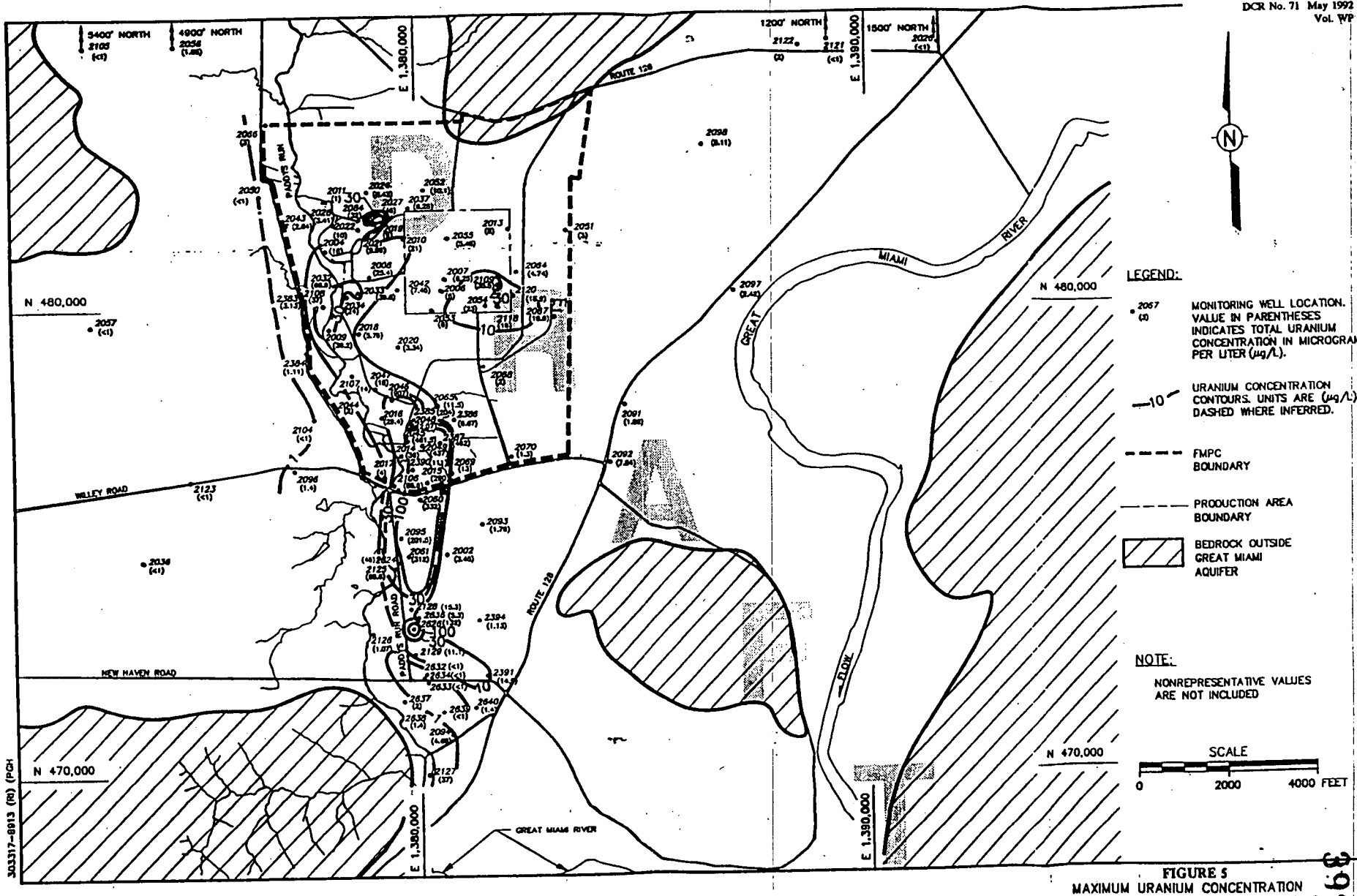

FIGURE 5
MAXIMUM URANIUM CONCENTRATION IN GROUNDWATER, 2000 SERIES WELLS, SECOND QUARTER 1988 THROUGH SECOND QUARTER 1990

second quarter of 1988 through the second quarter of 1990. Wells 2024, 2037 and 2052 are all located north of the waste storage area where there should not be any uranium contamination if the gradients are from the west and northwest. Figure 6 is the maximum concentration map for the 3000-series wells and it shows a 14 µg/L reading from Well 3024.

The uranium appears to be migrating north of the waste storage area because of the influence of recharge from Paddys Run. Figure 7 is the water table map for May 1990, which shows the extreme condition of mounding from Paddys Run recharge. The contours in the waste storage area show that the gradient is actually to the north. These uranium values and water table conditions clearly indicate that there is a flow path to the north around the monitoring wells placed on the east side of the waste storage area.

There are not any wells to monitor this flow path and uranium from the waste storage area could be circumventing the monitoring wells in the Production Area. If the readings in the wells at Location 013 are the result of this circumvention, then there could be a considerable amount of uranium moving to the east.

Recommended Action

Install Wells 2423 and 3423 downgradient of the sump in the fire training area. The wells should be sampled for extended HSL, full radiological, and general groundwater parameters. Additional characterization of the glacial overburden in the fire training area will be proposed in a forthcoming RI/FS Work Plan addendum.

Wells 2678 and 3678 should be installed along the construction access road approximately 300 feet north of the north buffer zone fence. This location is where the distance between the FEMP site and the bedrock valley wall on the north is at a minimum. This will be the best place to determine if uranium is migrating along the northern side of the Production Area. Because of the presence of contamination in Well 3024, both the 2000- and 3000-series wells should be installed. Samples from these wells should be analyzed for full radiological and general groundwater parameters.

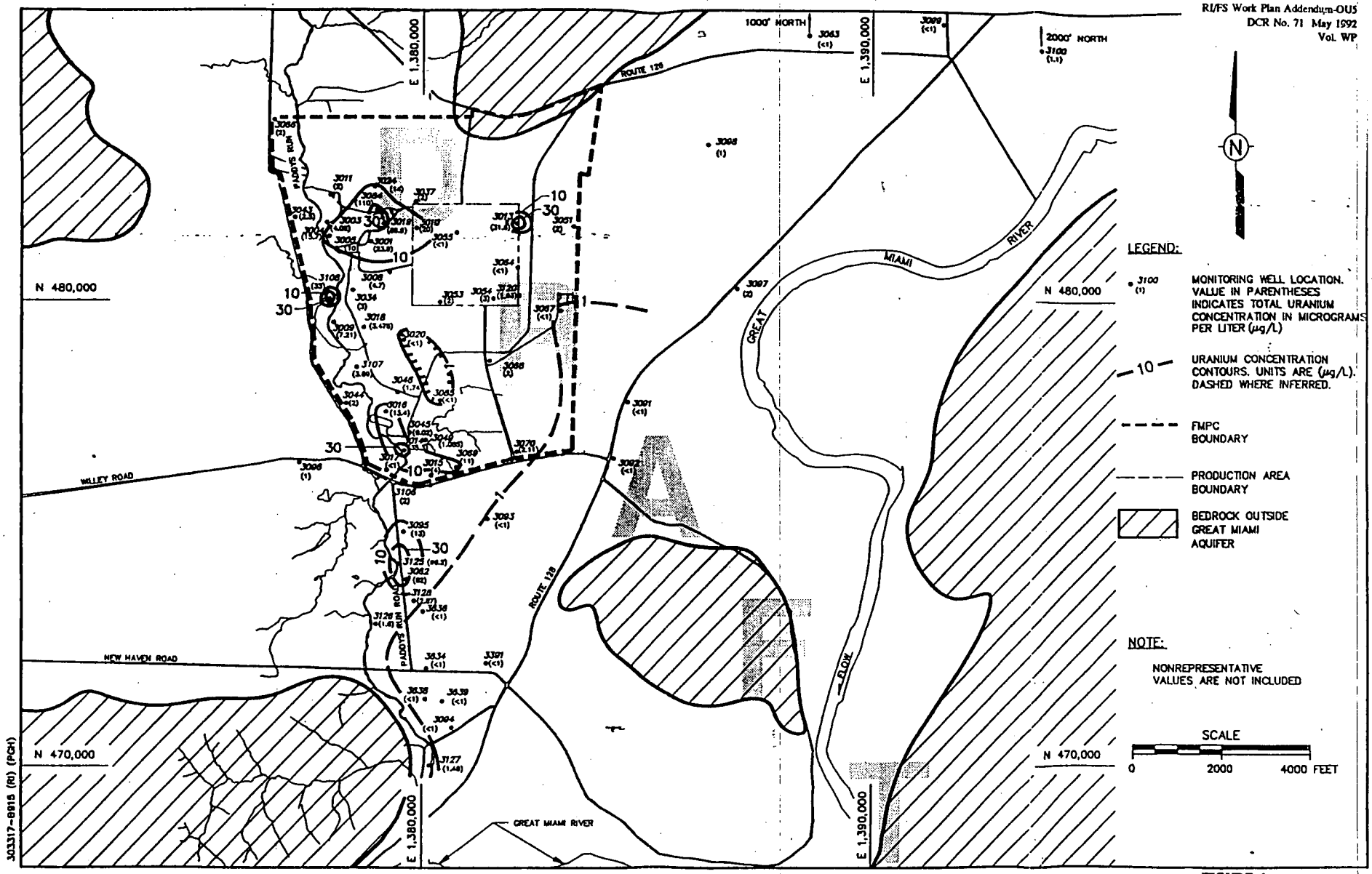

FIGURE 6
MAXIMUM URANIUM CONCENTRATION IN GROUNDWATER, 3000 SERIES WELLS SECOND QUARTER 1988 THROUGH SECOND QUARTER 1990

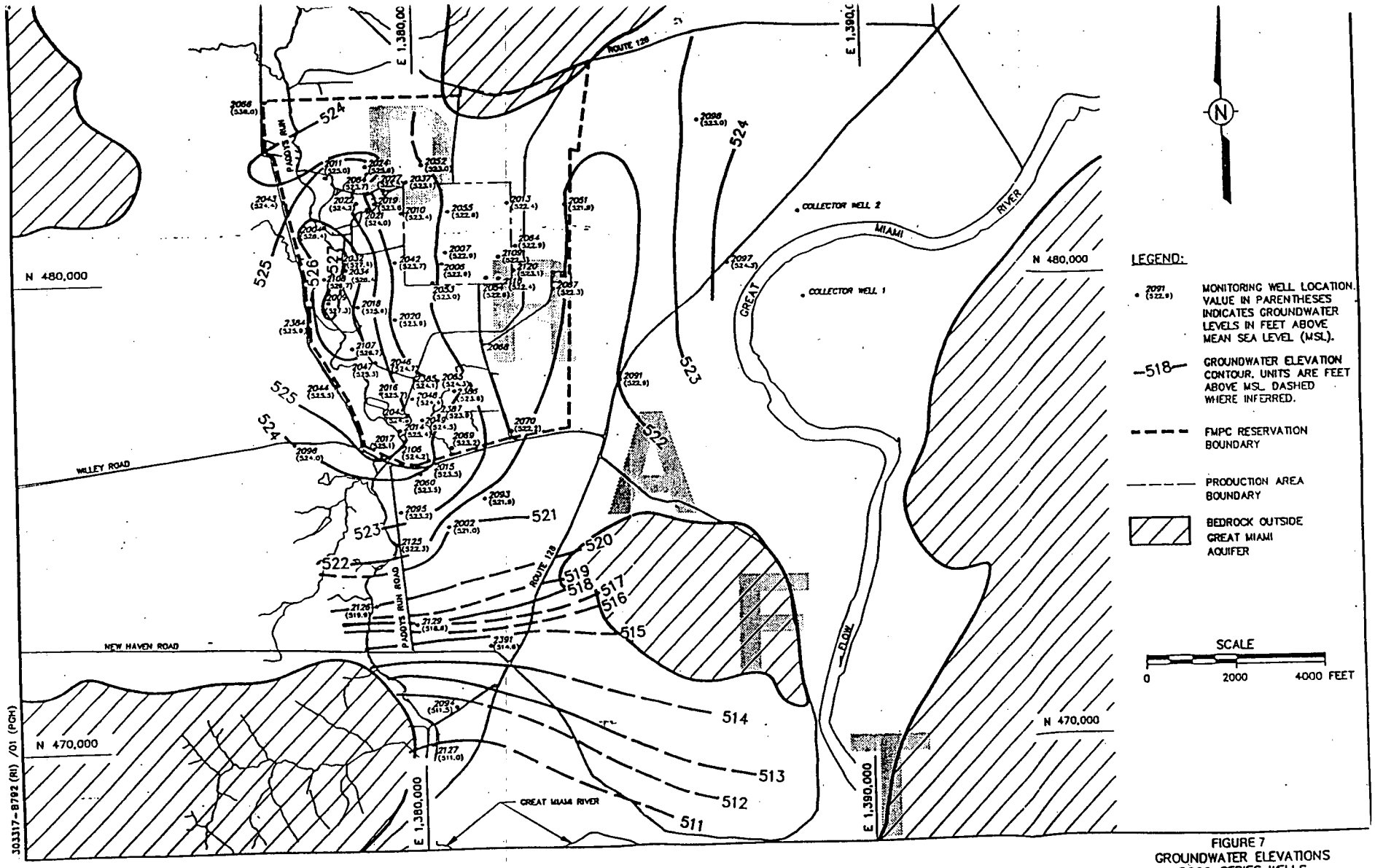

FIGURE 7
GROUNDWATER ELEVATIONS
2000 SERIES WELLS
MAY 1990

BACKGROUND WELLS

Because of the gradient reversal shown in Figure 7, and the fact that uranium is found at Locations 024 and 052, which were meant to be background wells, there is a need for an additional background well pair.

Recommended Action

Install Wells 2679 and 3679 at a location just inside the north fence, due north of Location 024, as shown in Figure 1. This location is approximately half way between existing background wells at Location 066 and the bedrock valley wall on the eastern side of the Shandon tributary.