

## 11.0 Sanitary Lagoons

### 11.1 East Sanitary Lagoon & West Sanitary Lagoon

These unlined ponds were rectangular in shape and approximately 208 ft. x 170 ft. in surface area. The bottom areas of these ponds were approximately 18,210 square feet and the approximate capacity of each pond was 500,000 gallons at a normal water depth of 5 feet. The East and West Sanitary Lagoons initially received all liquid waste from the Uranium plant from 1966 to 1970. In 1970, all liquid waste from the Uranium plant was diverted to other uranium evaporation ponds located on-site. From 1970 until 1985, the MOFF Plant septic tank, the Uranium Plant septic tank, the Uranium Plant laundry, the MOFF Plant lab, the Uranium Plant lab, the Uranium Plant dock drain, and numerous floor drains in the Uranium Plant discharged into the East and West Sanitary Lagoons. In 1985, both the East and West Sanitary Lagoons were isolated. In January, 1986, the remaining water in the East and West Sanitary Lagoons was pumped to the New Lined Sanitary Lagoon. Initial soil removal and packaging of contaminated soil from the East Sanitary Lagoon was performed from January 30, 1986 through October 30, 1986. Initial soil removal and packaging of contaminated soil from the West Sanitary Lagoon was performed from August 20, 1986 to March 16, 1987. Cimarron personnel packaged 2,826 55-gallon drums of waste from the East Sanitary Lagoon, 3,013 55-gallon drums of waste from the West Sanitary Lagoon, and 1,562 drums associated with pipeline trenches. Therefore, approximately 55,000 cubic feet of waste were shipped off site to a commercial LLRW disposal facility. Final clean-up and survey work was performed on both lagoons from September 4, 1990 to September 11, 1990.

#### A. Characterization:

After remediation was performed on both sanitary lagoons, the initial round of soil sampling results indicated additional areas requiring remediation. This initial soil sampling was conducted on March 10, 1987 for the West Sanitary Lagoon and on September 5, 1986 for the East Sanitary Lagoon. These soil samples were taken at a depth of 0 to 1 ft.

Final contaminated soil removal was completed in September, 1990 for both the East and West Sanitary Lagoons. Following this remediation effort, soil core sampling 0 to 4 ft. in depth within the sanitary lagoons was

completed in September, 1990. A 5m x 5m grid system was utilized for this sampling effort. Soil analytical data is shown on Drawings No. 90POSLSS-0 through 90POSLSS-4. This sampling program involved the use of composite samples taken from depths of 0 to 6 in., 6 in. to 1 ft., 1 to 2 ft., 2 to 3 ft., and 3 to 4 ft. All results show total uranium concentrations less than the Option #1 guideline value of 30 pCi/g. A Micro-R survey was also conducted in 1990 on the same 5m x 5m grid and the results are shown on Drawing No. 90POSLUR-1.

Additionally, the area surrounding the East and West Sanitary Lagoons was cored to a depth of 4 ft. and the associated soil samples were analyzed at the Cimarron facility on-site laboratory for total uranium. The corings were collected from a 10m x 10m grid. These sample analysis results are shown on Drawings No. 90PRSLSS-0 through 90PRSLSS-4. Of the 620 soil samples taken during this sampling effort, only one soil sample concentration exceeded the Option #1 limit. However, this one soil sample concentration falls below the Option #1 guideline after background (6 pCi/g total uranium) is subtracted.

B. Confirmatory Survey:

Confirmatory radiological surveys and soil sampling were conducted on the East and West Sanitary Lagoons by the ORAU staff on November 5 and 6, 1990<sup>11</sup>. The ORAU final report was issued in November, 1991. Based upon this ORAU confirmatory report, the NRC issued Amendment #9 to the Cimarron Uranium License SNM-928 on December 28, 1992. This amendment released the East and West Sanitary Lagoons and authorized the backfilling of these sanitary lagoons. Backfilling was completed in July, 1993.

Upon completion of the lagoon backfilling, the surface of the backfilled areas was randomly sampled for total uranium at a depth of 0 to 6 in.. These sample results are shown on Drawing No. 93FISLSS-0. A Micro-R survey and a gamma survey also were performed between August 12 and September 12, 1993 for this area utilizing a 10m x 10m grid. The Micro-R survey results are shown on Drawings No. 93FISLUR-0 and 93FISLUR-1. The gamma survey results are shown on Drawing 93FISL3D-0.



The sampling and survey efforts completed to date meet the current requirements for a final release survey.

C. Environmental Data:

Groundwater in this area is monitored via wells #1332 and #1333. Gross alpha concentrations in both wells were less than the detection limit of 10 pCi/L. Gross beta was below the detection limit of 20 pCi/L in both wells during the monitored period. Total uranium concentrations were less than 0.005 mg/L at both wells. All isotopic concentrations for uranium, thorium, and radium were at levels characteristic of background.

11.2 New Sanitary Lagoon

The New Sanitary Lagoon (hypalon-lined) was installed by January, 1986. The New Sanitary Lagoon is located directly above the closed Plutonium Evaporation Pond and a portion of the closed Plutonium Emergency Pond. The location of the lagoon is shown on Drawing No. 93FISLUR-0. This lagoon was installed to replace the East and West Sanitary Lagoons that were being remediated and closed out. A french drain was installed under the New Sanitary Lagoon prior to construction to divert groundwater that may collect under this area. All liquids from the East and West Sanitary Lagoons were pumped to the New Sanitary Lagoon prior to the start of remediation on the East and West Sanitary Lagoons. Waste water from the ion exchange system and the Uranium Building drains was also released to the New Sanitary Lagoon. The New Sanitary Lagoon was utilized from early 1986 to October 22, 1992. This lagoon now is isolated and only rainwater is being collected.

A. Characterization Data

The NRC authorized the backfilling and closure of the retention ponds located below the New Sanitary Lagoon by letter dated July 10, 1978. Authorization was based upon NRC confirmatory sample analysis results. These retention ponds also had been sampled by Cimarron personnel prior to confirmatory sampling conducted by the NRC in 1978. The closure of the retention ponds, previously located below the New Sanitary Lagoon, is discussed in Section 12.0.

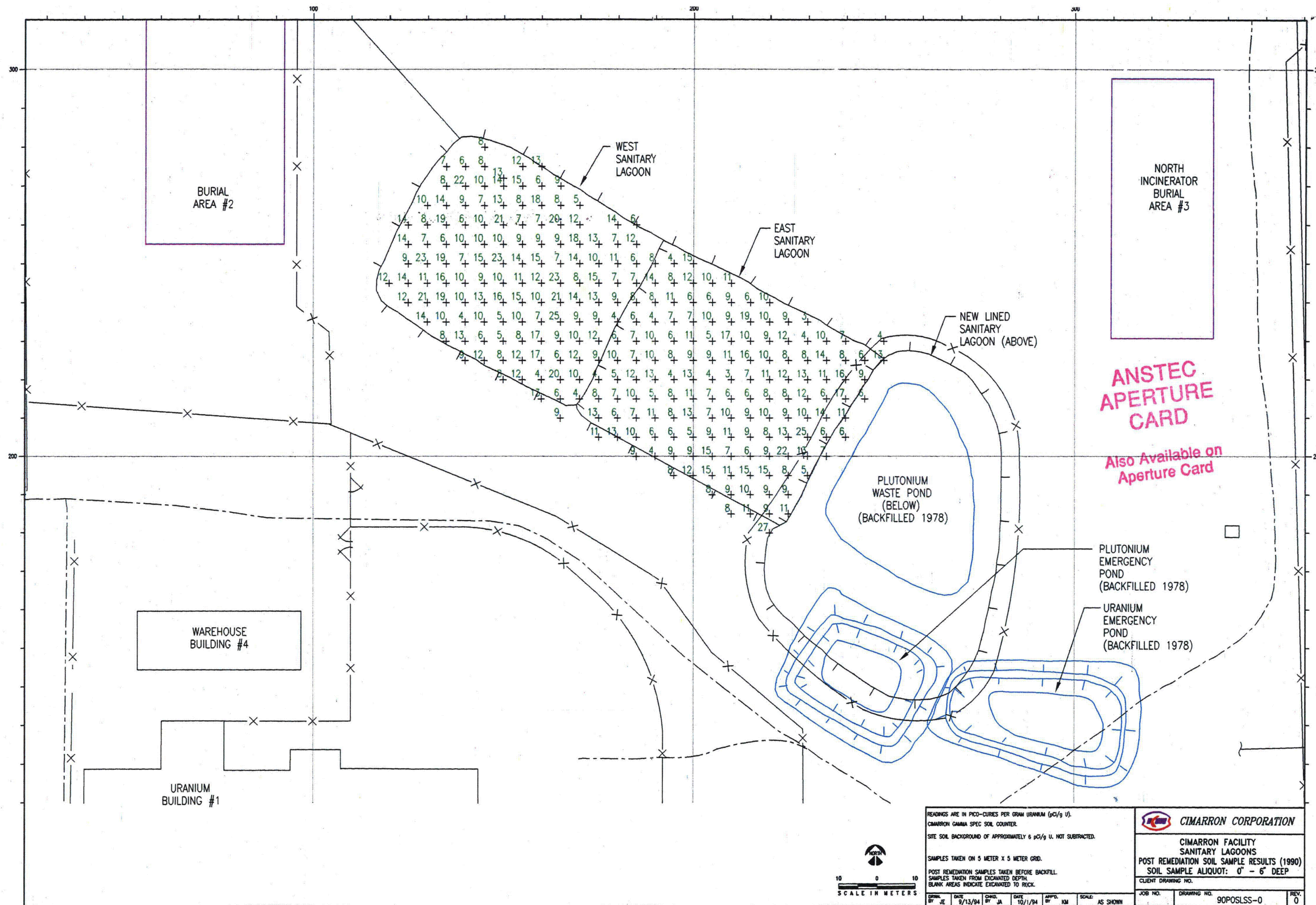
Sludge sample concentrations from the New Sanitary Lagoon range between 22 pCi/g and 26 pCi/g total uranium. The New Sanitary Lagoon will be characterized further prior to closure of this area.

#### B. Environmental Data

Well #1334 is located north of the sanitary lagoons. Gross alpha concentrations ranged from less than 10 pCi/L to 43 pCi/L during the 1989 to 1993 monitoring period. Gross beta concentrations all were less than 20 pCi/L from 1989 through 1993. Total uranium concentrations ranged from less than 0.005 mg/L (7 pCi/L) in June, 1993 to 0.25 mg/L (360 pCi/L) in June, 1991. Isotopic uranium concentrations reported in June 1991 were much lower (U-234: 14.3 pCi/L, U-235: 0.02 pCi/L, U-236: 0.02 pCi/L, and U-238: 17.8 pCi/L), indicating a possible error in reporting or measurement for the total uranium results. The total and isotopic uranium results for 1992 and 1993 are below the Table 2, Column 2 concentrations listed in 10 CFR 20, Appendix B.

Samples are collected weekly from the drain pipe located beneath the sanitary lagoon (sample location #1214) and analyzed for gross alpha. Gross alpha concentrations ranged from less than  $1.2 \text{ E-}07 \text{ } \mu\text{Ci/mL}$  to  $9.6 \text{ E-}07 \text{ } \mu\text{Ci/mL}$  during 1993, and from  $1.3 \text{ E-}09 \text{ } \mu\text{Ci/mL}$  to  $1.2 \text{ E-}07 \text{ } \mu\text{Ci/mL}$  through May 4, 1994. The New Sanitary Lagoon has been isolated since October 22, 1992.

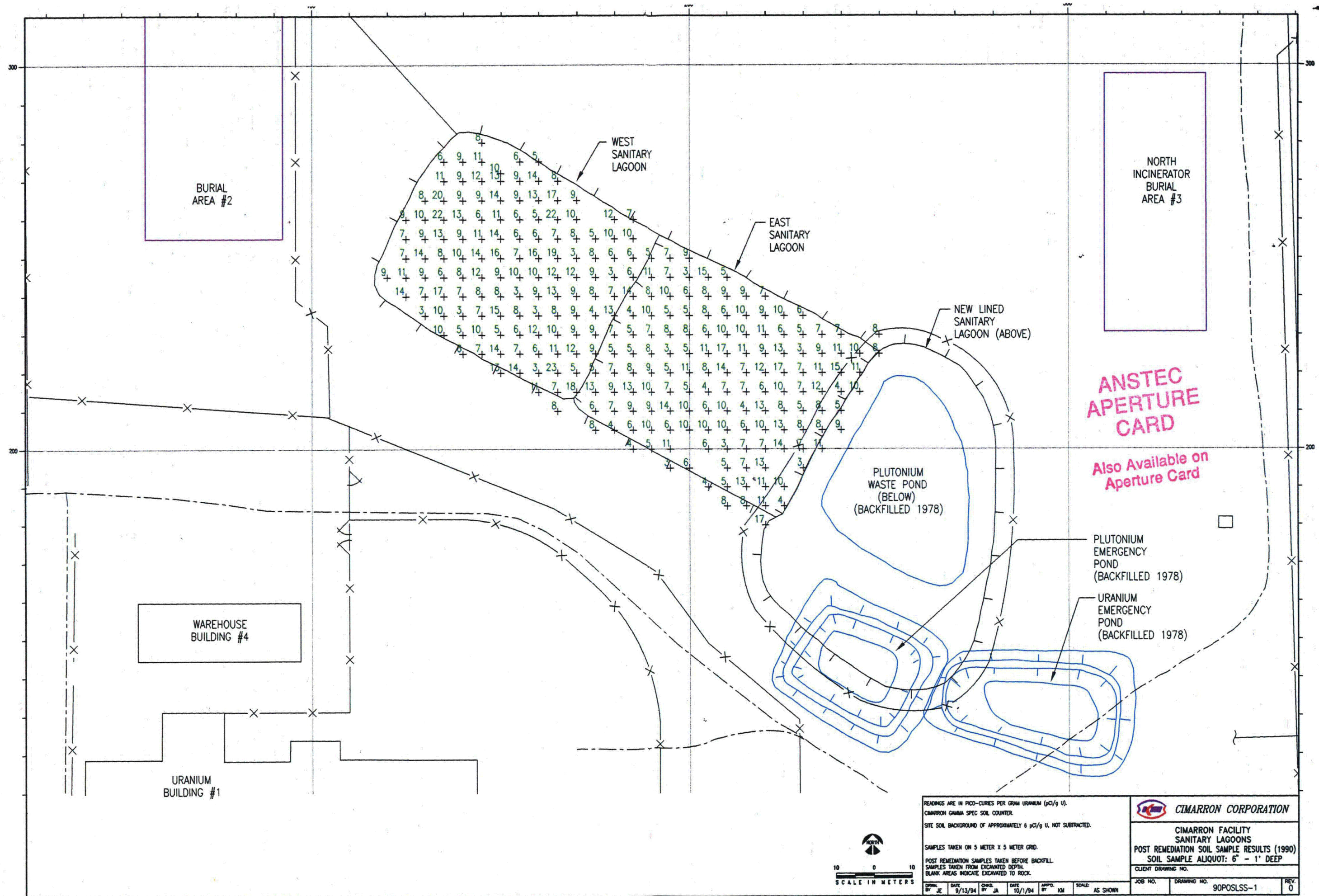
Weekly samples are collected also from the spring located east of the new sanitary lagoon. Gross alpha concentrations ranged from less than  $1.2 \text{ E-}07 \text{ } \mu\text{Ci/mL}$  to  $1.3 \text{ E-}06 \text{ } \mu\text{Ci/mL}$  in 1993. Sample results through May 4, 1994, ranged from  $6.0 \text{ E-}09 \text{ } \mu\text{Ci/mL}$  to  $6.36 \text{ E-}08 \text{ } \mu\text{Ci/mL}$ . Recent sample results are below the Table 2, Column 2 concentrations listed in 10 CFR 20, Appendix B.



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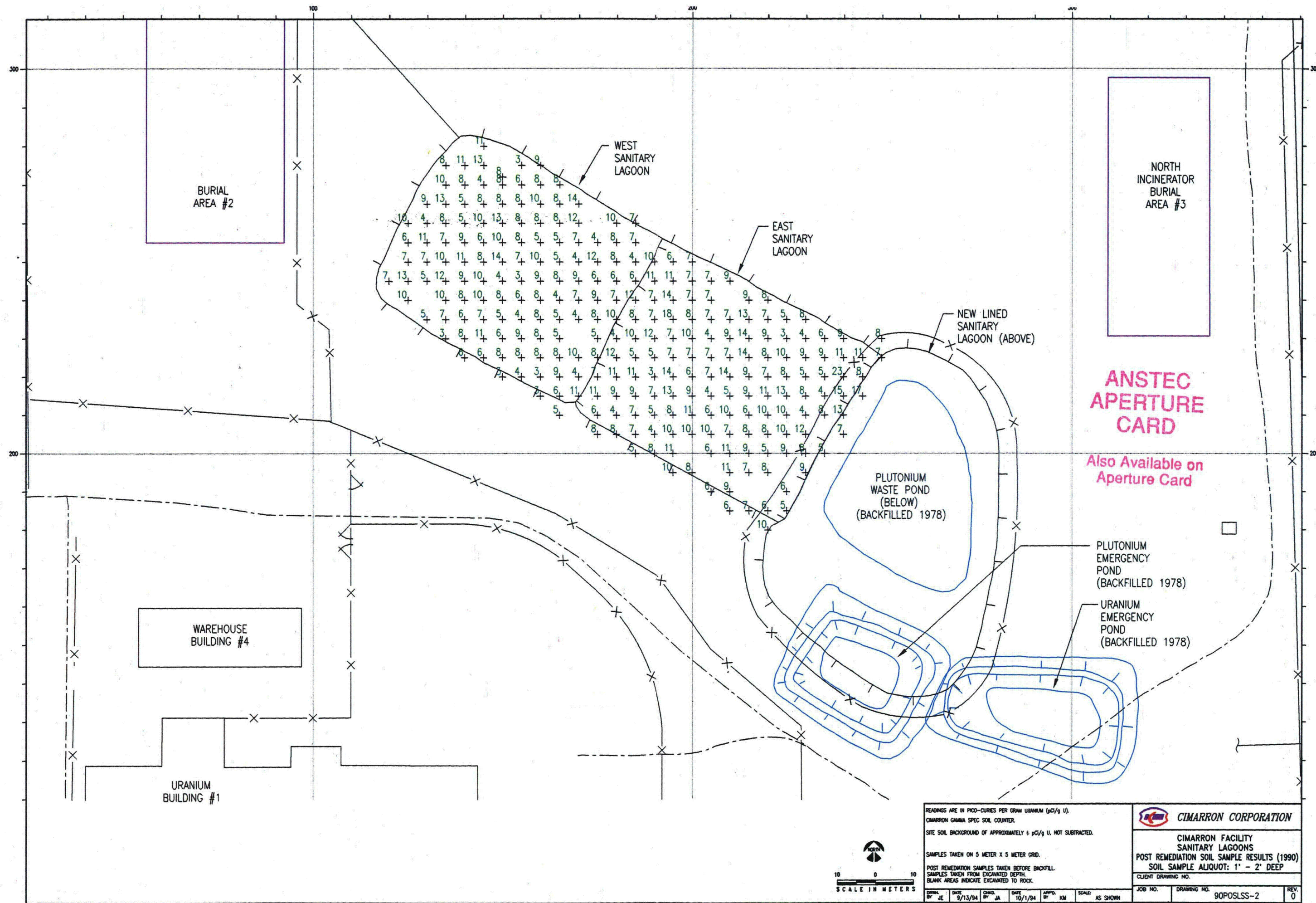


READINGS ARE IN PICO-CURIES PER GRAM URANIUM (pCi/g U).  
CIMARRON GAMMA SPEC SOIL COUNTER.  
SITE SOIL BACKGROUND OF APPROXIMATELY 6 pCi/g U, NOT SUBTRACTED.  
SAMPLES TAKEN ON 5 METER X 5 METER GRID.  
POST REMEDIATION SAMPLES TAKEN BEFORE BACKFILL.  
SAMPLES TAKEN FROM EXCAVATED DEPTH.  
BLANK AREAS INDICATE EXCAVATED TO ROCK.

**CIMARRON CORPORATION**  
CIMARRON FACILITY  
SANITARY LAGOONS  
POST REMEDIATION SOIL SAMPLE RESULTS (1990)  
SOIL SAMPLE ALIQUOT: 6" - 1' DEEP  
CLIENT DRAWING NO.  
JOB NO. DRAWING NO. 90POSLS-1 REV. 0

DATE 9/13/94  
BY JE  
CHD. BY JA  
DATE 10/1/94  
APPR. BY KM  
SCALE: AS SHOWN

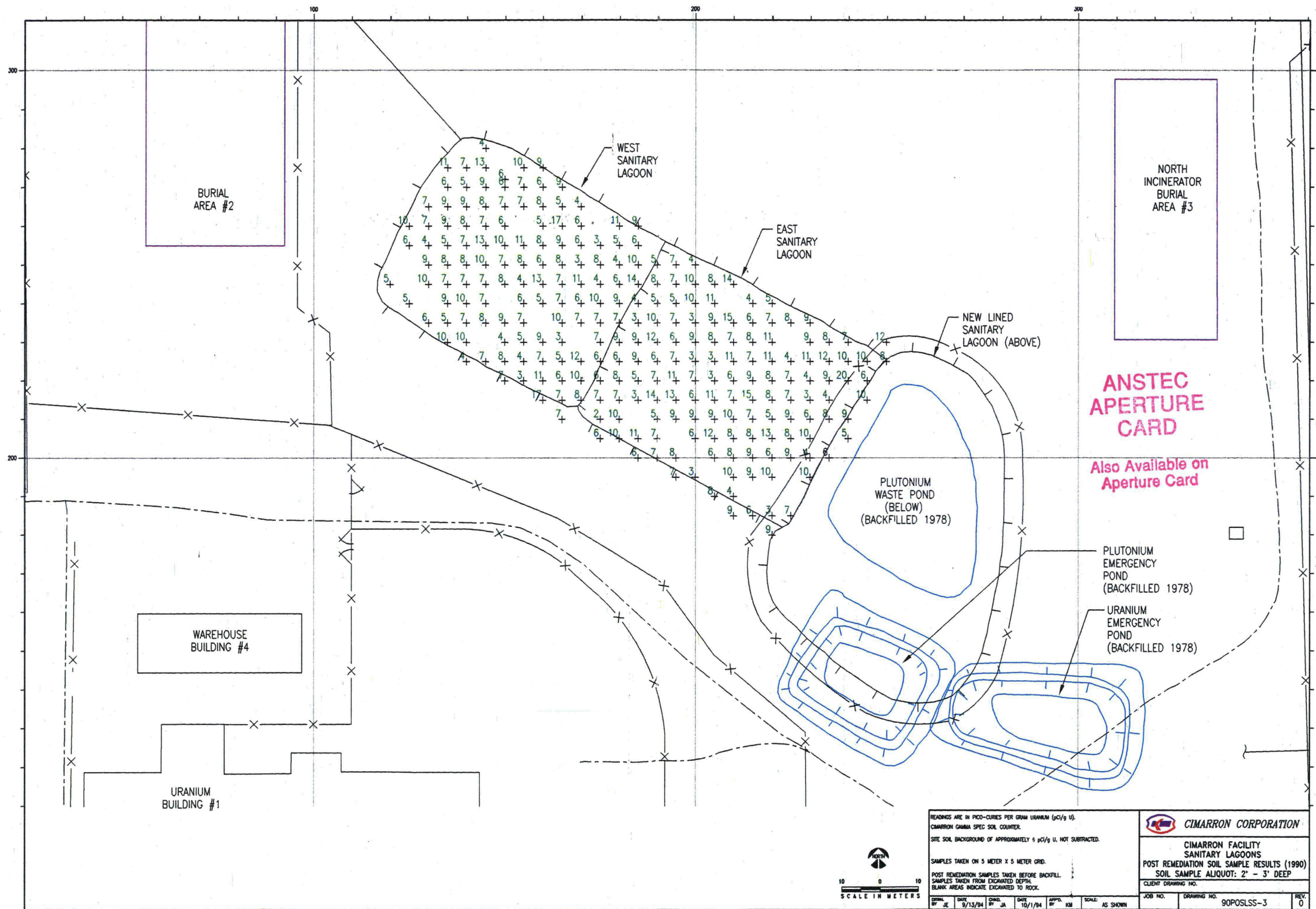




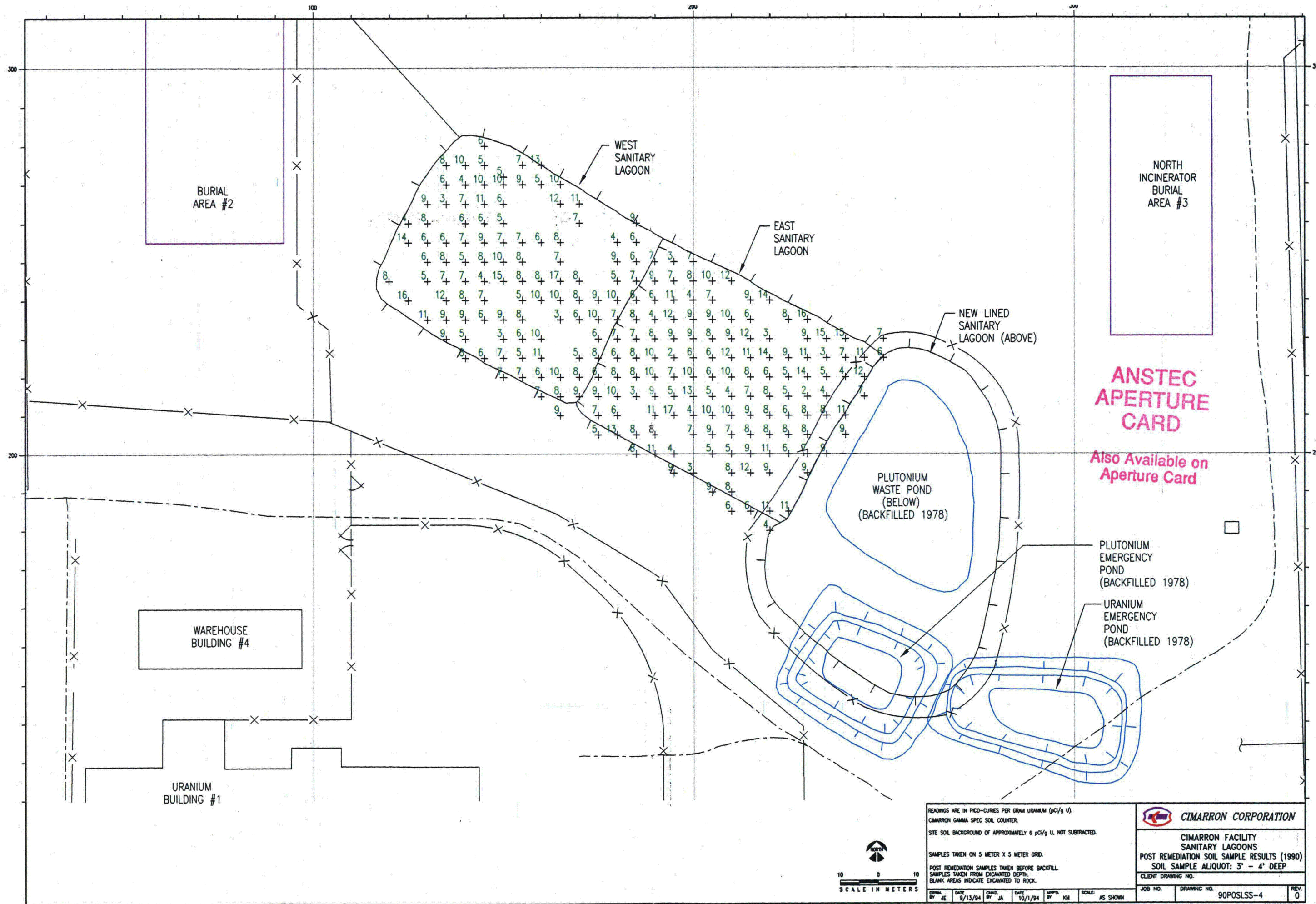
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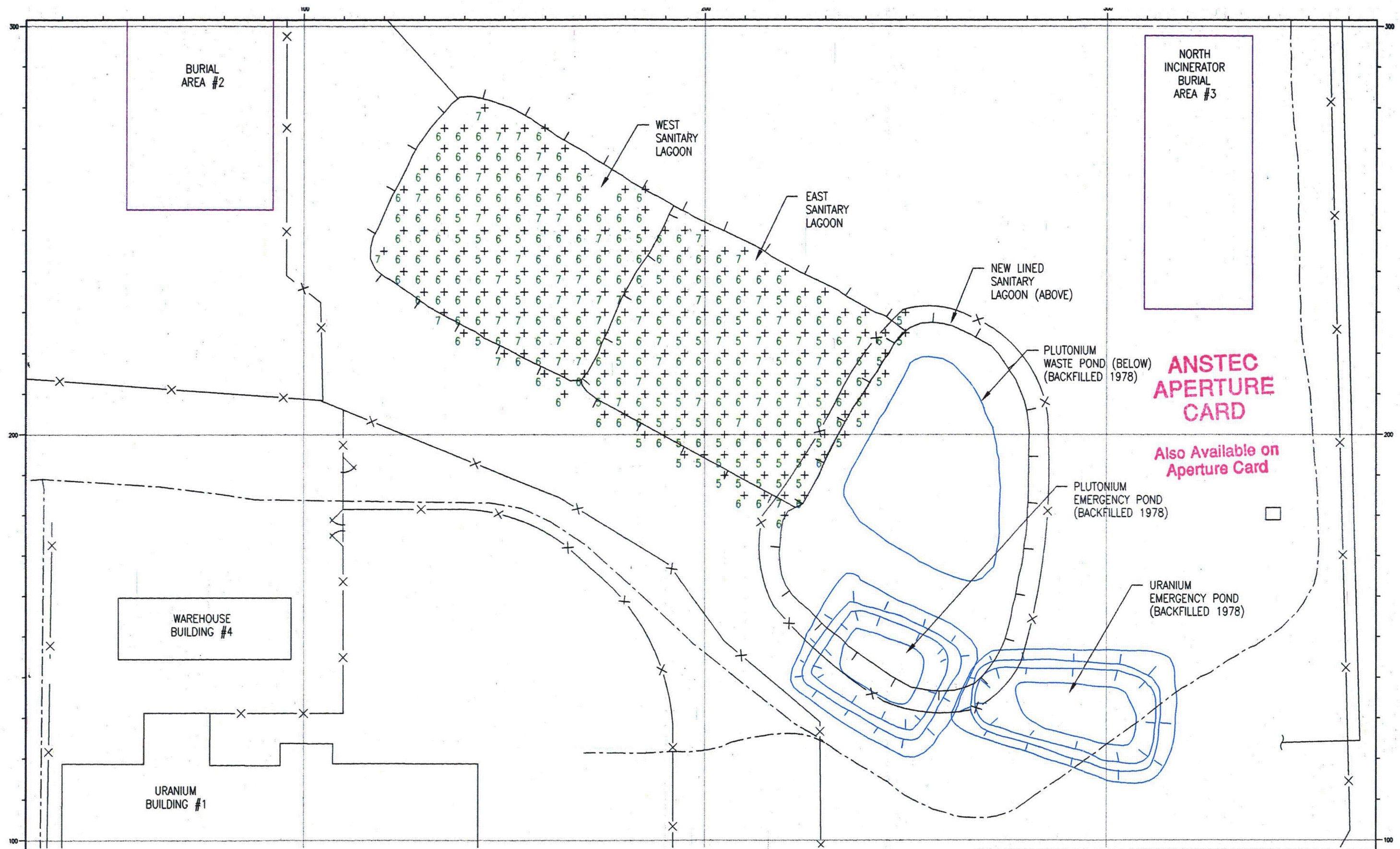




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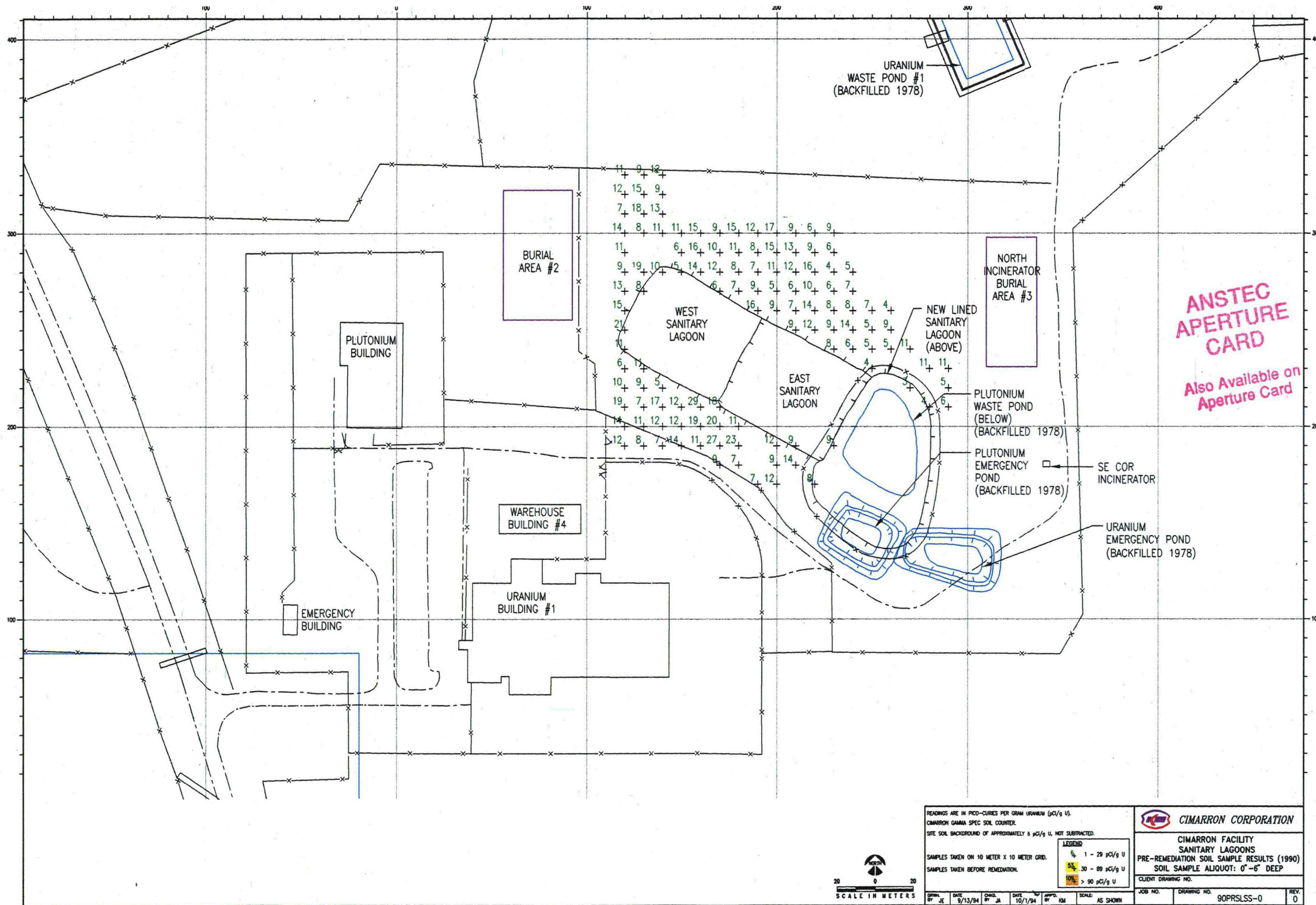


READINGS ARE IN MICRO-R/Hr. ( $\mu R/Hr.$ ) INSTRUMENT: LUDLUM MICRO-R METER MODEL NO: 125 SERIAL NO: 9081 ESTABLISHED SITE BACKGROUND OF 7 $\mu R/Hr.$ , NOT SUBTRACTED. SAMPLES TAKEN ON A 5 METER X 5 METER GRID. READINGS WERE TAKEN AFTER REMEDIATION, BUT BEFORE BACKFILL.				<b>CIMARRON CORPORATION</b> <b>CIMARRON FACILITY</b> <b>SANITARY LAGOONS</b> <b>POST REMEDIATION MICRO-R SURVEY (1990)</b> <b>AT ONE METER ABOVE SURFACE</b> CLIENT DRAWING NO.	
DRAWN BY: JE DATE: 9/13/94 CHD. BY: JA DATE: 10/1/94 APPD. BY: KM SCALE: AS SHOWN	JOB NO. DRAWING NO. 90POSUR-1 REV. 0				

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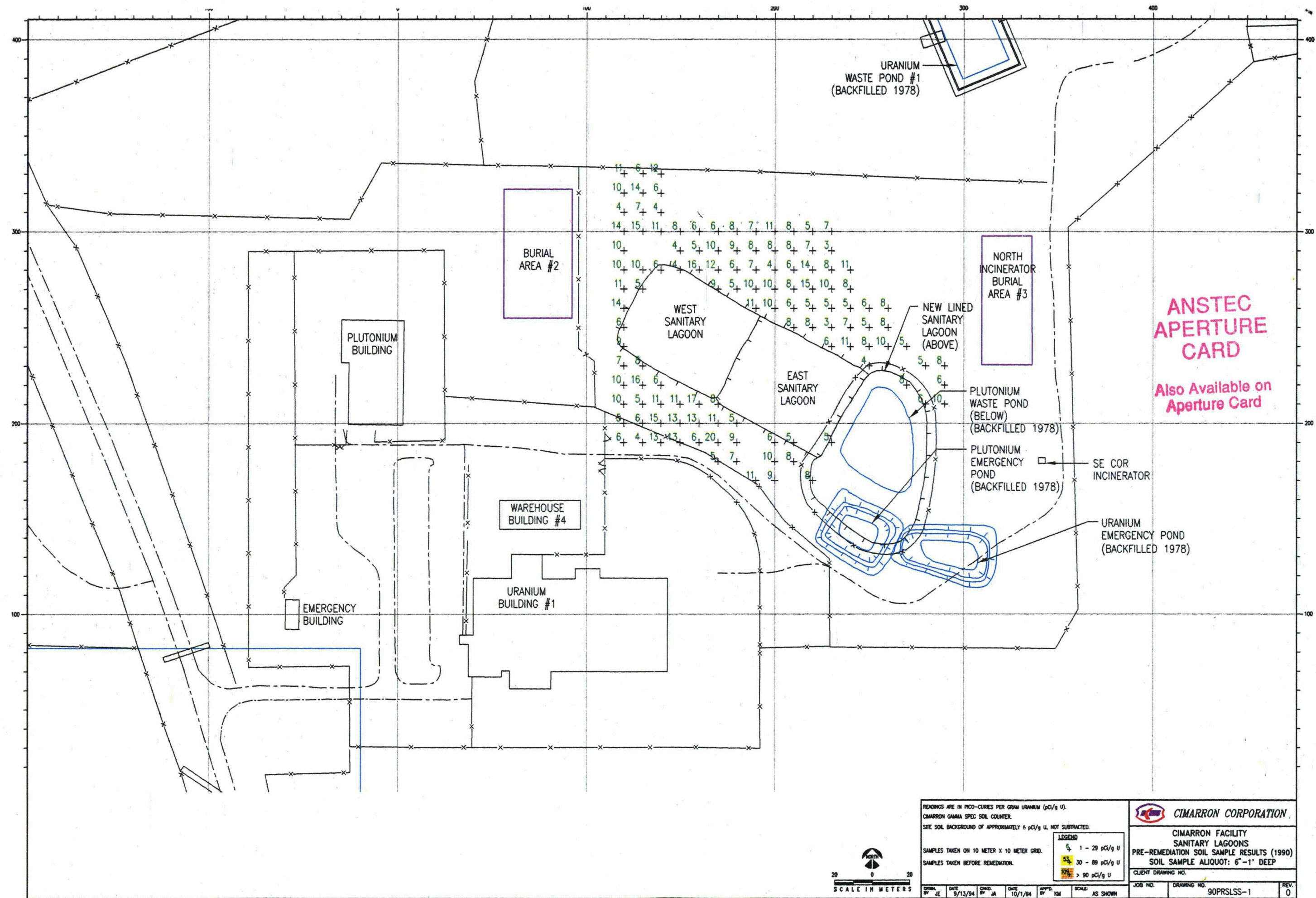




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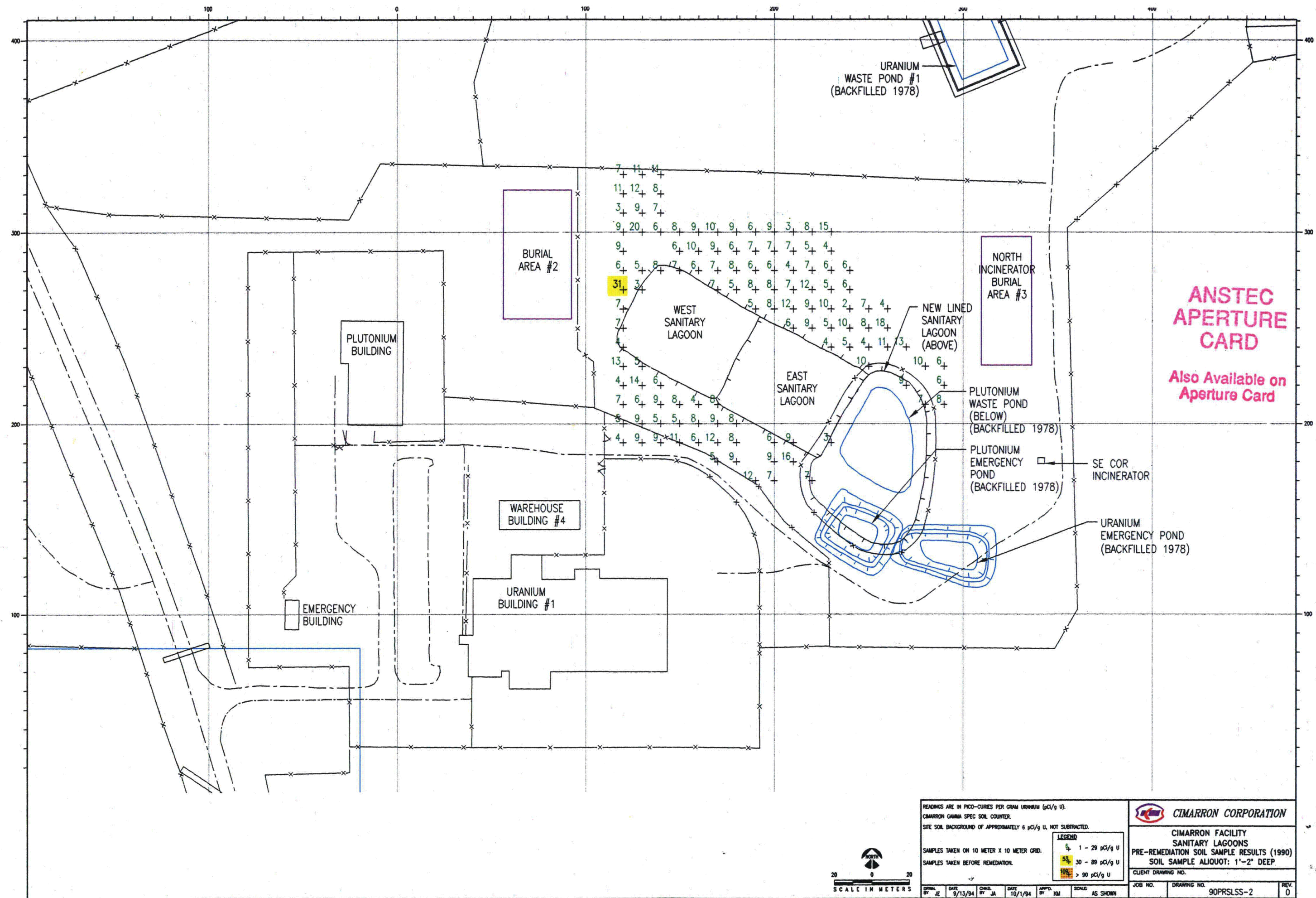




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CARD**

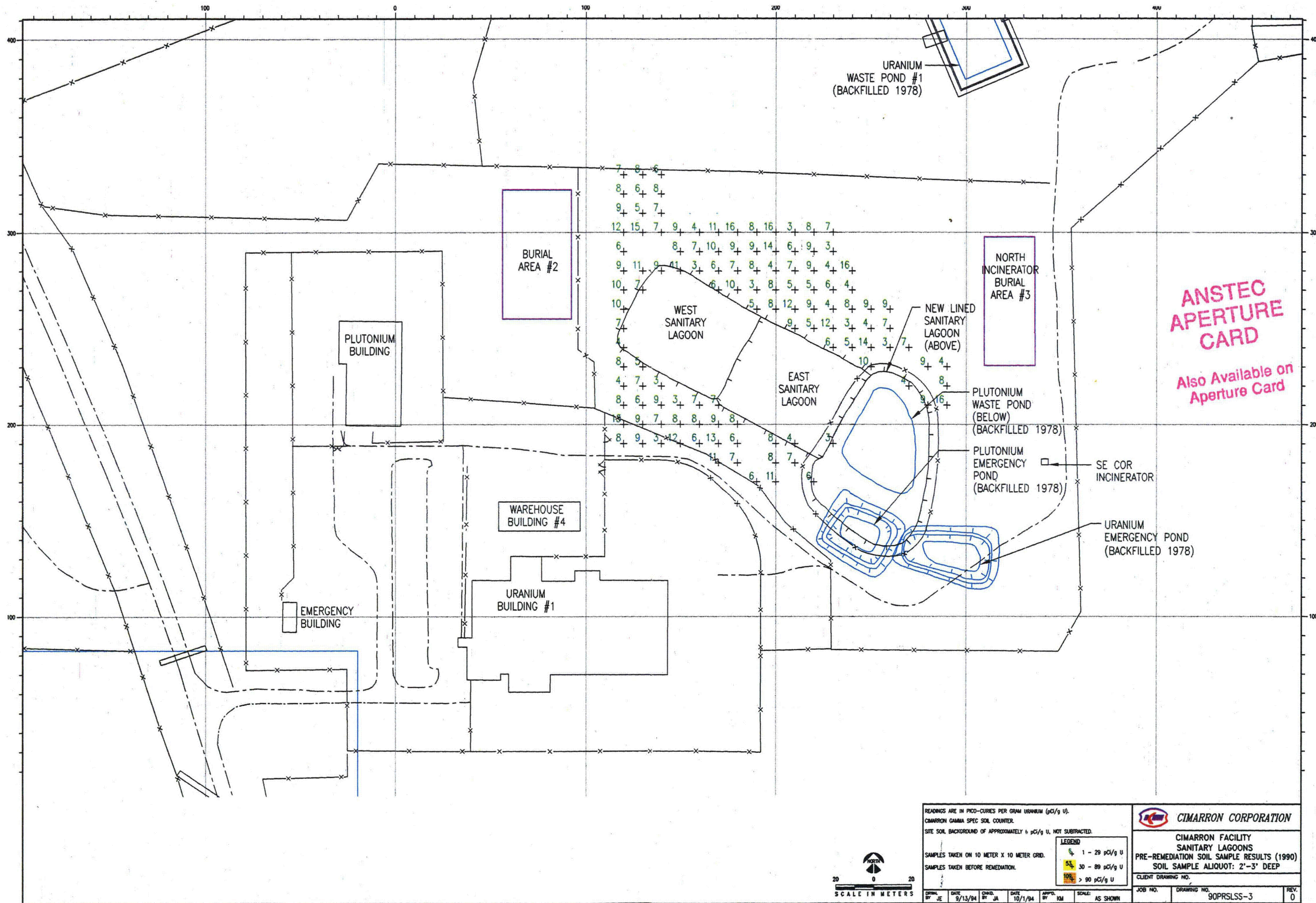
Also Available on  
Aperture Card

READINGS ARE IN PICO-CURIES PER GRAM URANIUM (pCi/g U). CIMARRON GAMMA SPEC SOIL COUNTER. SITE SOIL BACKGROUND OF APPROXIMATELY 6 pCi/g U, NOT SUBTRACTED. SAMPLES TAKEN ON 10 METER X 10 METER GRID. SAMPLES TAKEN BEFORE REMEDIATION.				<b>LEGEND</b> 1 - 29 pCi/g U 30 - 89 pCi/g U > 90 pCi/g U		<b>CIMARRON CORPORATION</b> CIMARRON FACILITY SANITARY LAGOONS PRE-REMEDIATION SOIL SAMPLE RESULTS (1990) SOIL SAMPLE ALIQUOT: 1'-2" DEEP CLIENT DRAWING NO.	
JOB NO. 90PRSLSS-2	DRAWING NO. 90PRSLSS-2	REV. 0	SCALE: AS SHOWN				

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READINGS ARE IN PICO-CURIES PER GRAM URANIUM (pCi/g U).  
CIMARRON GAMMA SPEC SOIL COUNTER.  
SITE SOIL BACKGROUND OF APPROXIMATELY 6 pCi/g U, NOT SUBTRACTED.

SAMPLES TAKEN ON 10 METER X 10 METER GRID.  
SAMPLES TAKEN BEFORE REMEDIATION.

LEGEND

- 1 - 29 pCi/g U
- 30 - 89 pCi/g U
- > 90 pCi/g U

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CIMARRON FACILITY  
SANITARY LAGOONS  
PRE-REMEDIATION SOIL SAMPLE RESULTS (1990)  
SOIL SAMPLE ALIQUOT: 2"-3" DEEP

CLIENT DRAWING NO.

JOB NO. DRAWING NO. 90PRSLSS-3 REV. 0

DATE 9/13/94 DATE 10/1/94

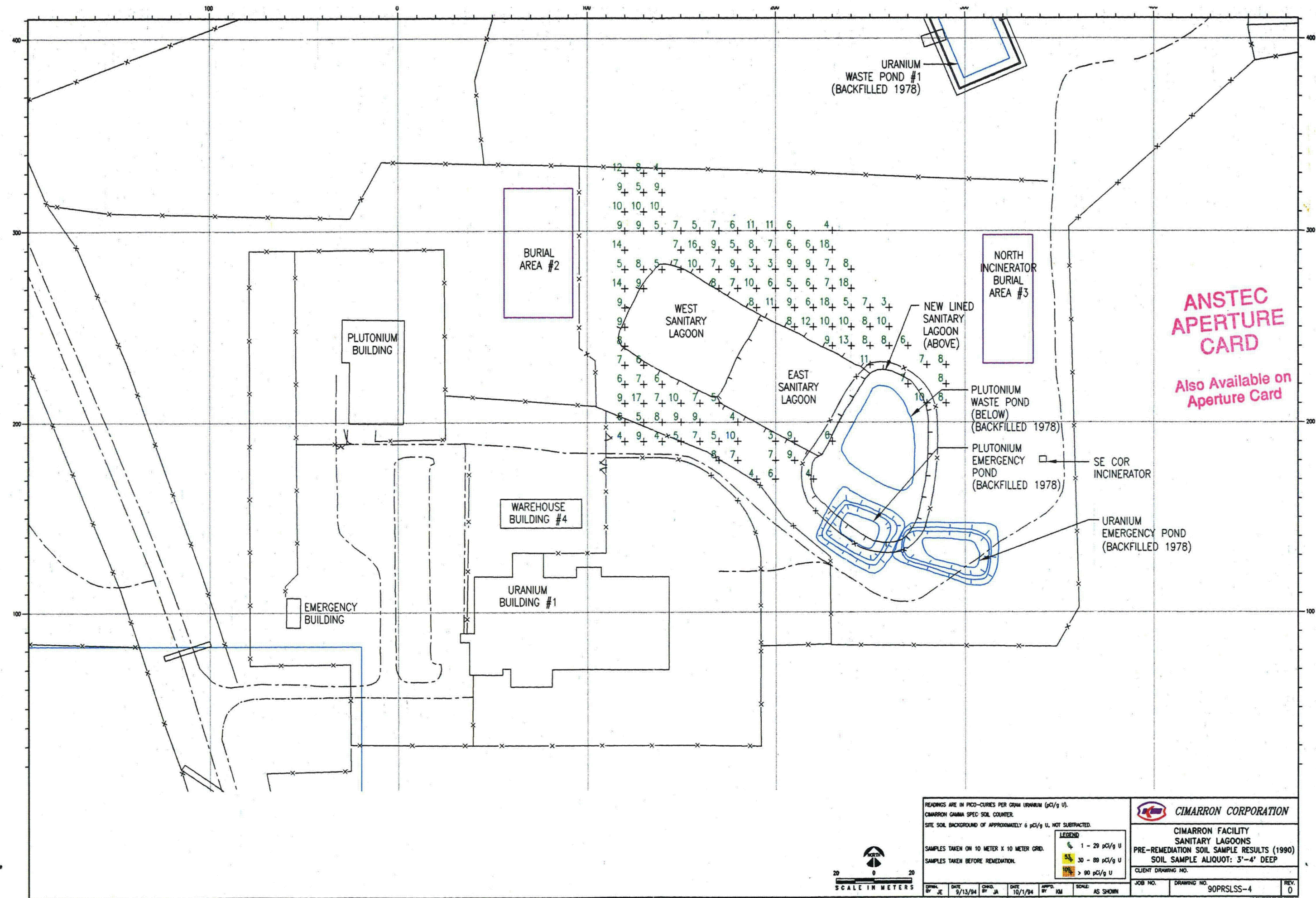
SCALE: AS SHOWN



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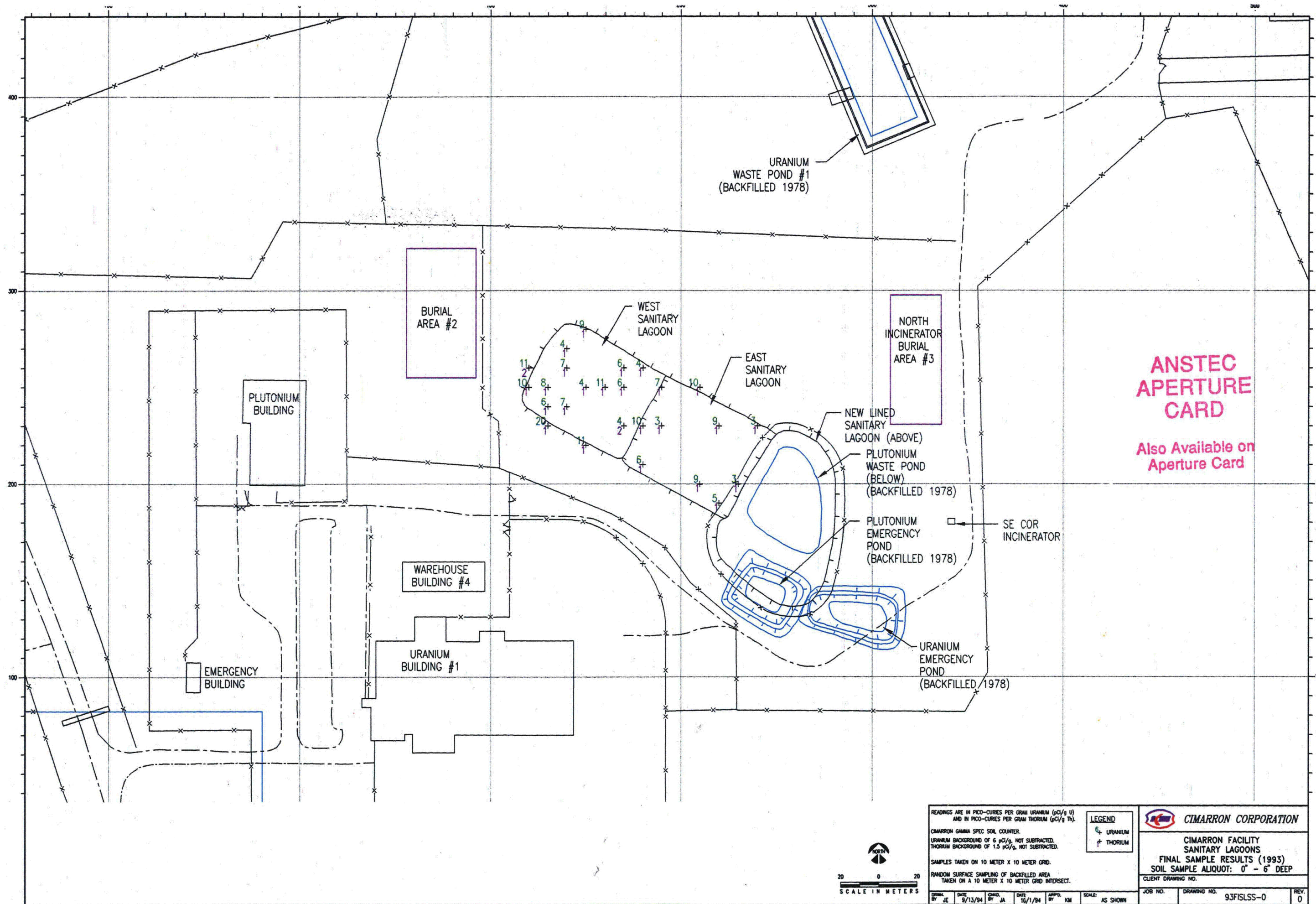


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APERTURE  
CARD**  
Also Available on  
Aperture Card

READINGS ARE IN PICO-CURIES PER GRAM URANIUM (pCi/g U). CIMARRON GAMMA SPEC SOIL COUNTER. SITE SOIL BACKGROUND OF APPROXIMATELY 6 pCi/g U, NOT SUBTRACTED.		<b>CIMARRON CORPORATION</b> CIMARRON FACILITY SANITARY LAGOONS PRE-REMEDIATION SOIL SAMPLE RESULTS (1990) SOIL SAMPLE ALIQUOT: 3'-4' DEEP	
SAMPLES TAKEN ON 10 METER X 10 METER GRID. SAMPLES TAKEN BEFORE REMEDIATION.		CLIENT DRAWING NO.	
DRN. BY: JE DATE: 9/13/94 CRD. BY: JA DATE: 10/1/94 APP'D. BY: KM SCALE: AS SHOWN	JOB NO.	DRAWING NO. 90PRSLSS-4	REV. 0

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Also Available on  
Aperture Card

READINGS ARE IN PICO-CURIES PER GRAM URANIUM (pCi/g U)  
AND IN PICO-CURIES PER GRAM THORIUM (pCi/g Th).

CIMARRON GAMMA SPEC SOIL COUNTER.  
URANIUM BACKGROUND OF 6 pCi/g. NOT SUBTRACTED.  
THORIUM BACKGROUND OF 1.5 pCi/g. NOT SUBTRACTED.

SAMPLES TAKEN ON 10 METER X 10 METER GRID.  
RANDOM SURFACE SAMPLING OF BACKFILLED AREA  
TAKEN ON A 10 METER X 10 METER GRID INTERSECT.

**LEGEND**  
U+ URANIUM  
Th+ THORIUM

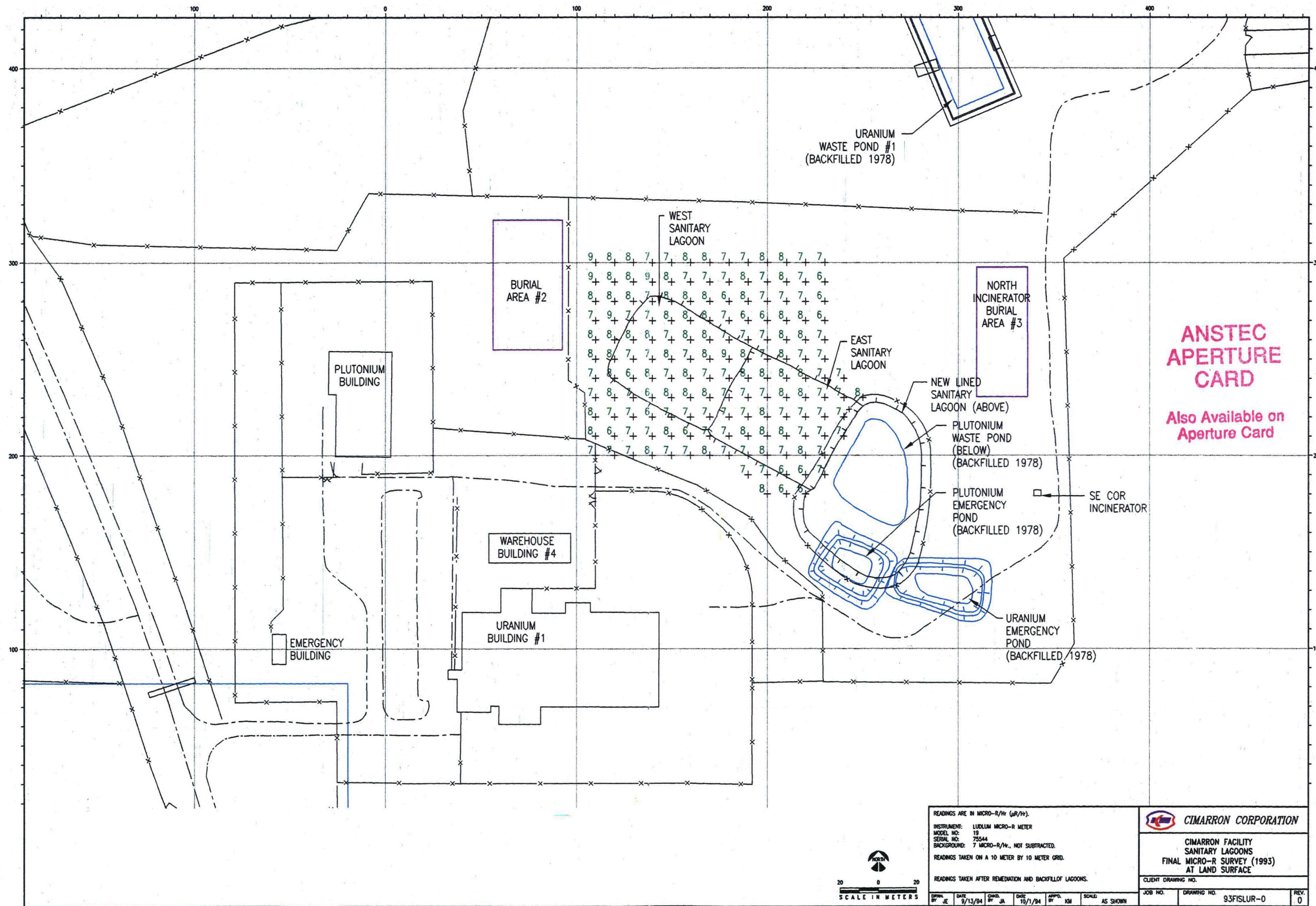
**CIMARRON CORPORATION**  
  
CIMARRON FACILITY  
SANITARY LAGOONS  
FINAL SAMPLE RESULTS (1993)  
SOIL SAMPLE ALIQUOT: 0" - 6" DEEP  
CLIENT DRAWING NO.

JOB NO.	DRAWING NO.	REV.
	93FISLSS-0	0

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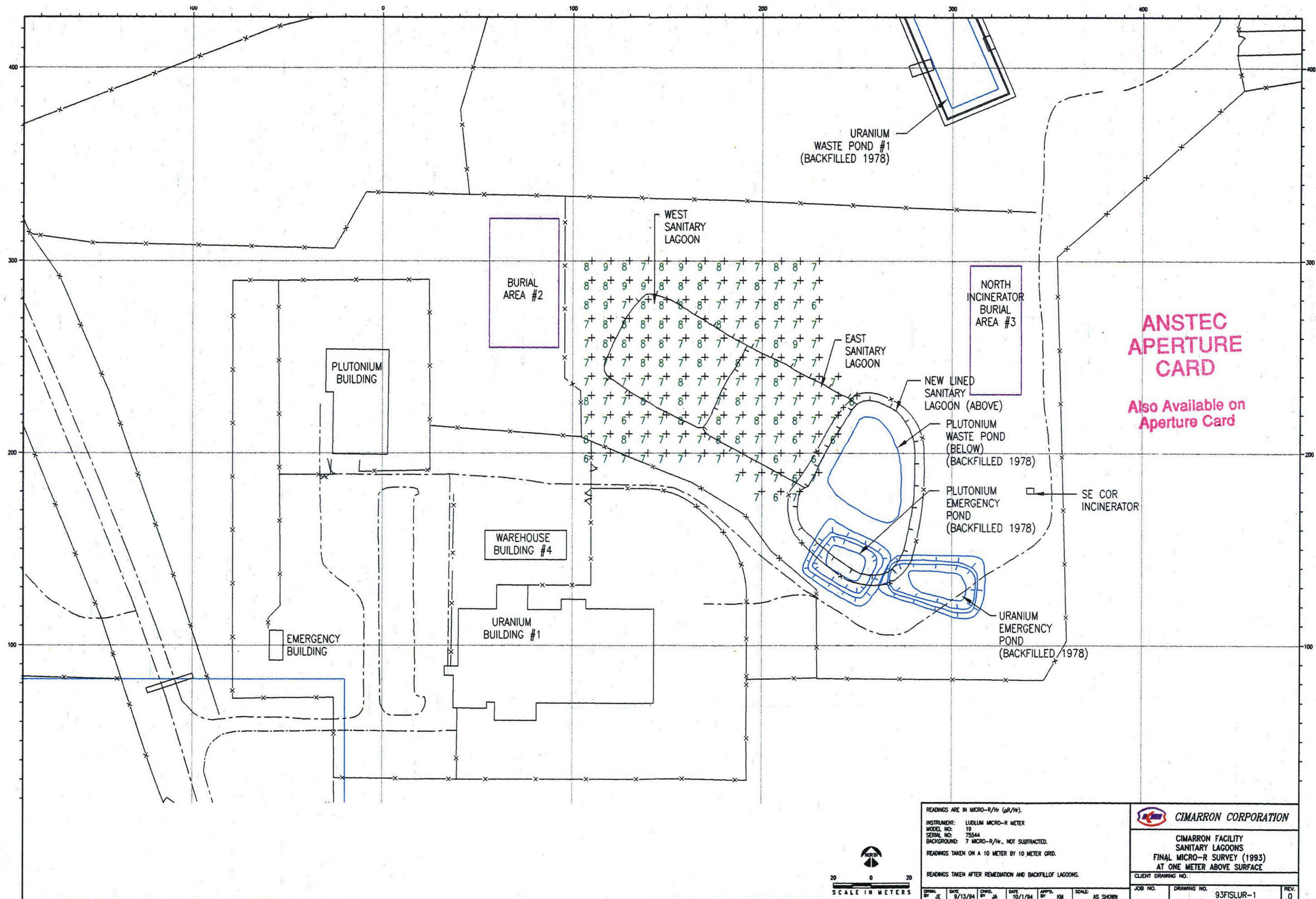




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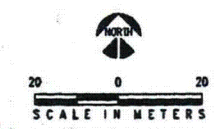
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**ANSTEC  
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Also Available on  
Aperture Card

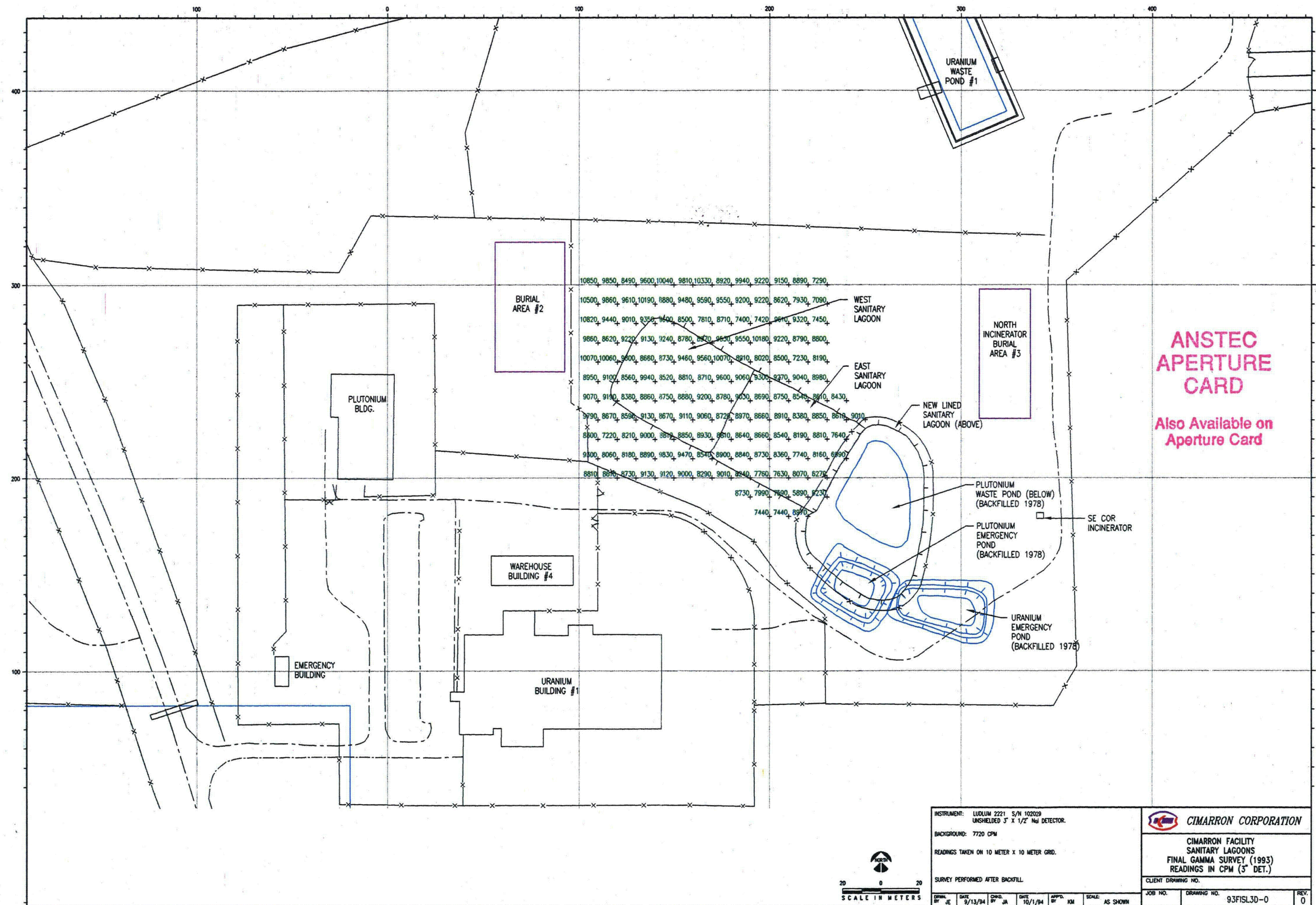


READINGS ARE IN MICRO-R/HR ( $\mu R/HR$ ). INSTRUMENT: LUDLUM MICRO-R METER MODEL NO: 19 SERIAL NO: 75544 BACKGROUND: 7 MICRO-R/HR, NOT SUBTRACTED. READINGS TAKEN ON A 10 METER BY 10 METER GRID. READINGS TAKEN AFTER REMEDIATION AND BACKFILL OF LAGOONS.		<b>CIMARRON CORPORATION</b>  CIMARRON FACILITY SANITARY LAGOONS FINAL MICRO-R SURVEY (1993) AT ONE METER ABOVE SURFACE CLIENT DRAWING NO.	
JOB NO. 93FISLUR-1	DRAWING NO. 93FISLUR-1	REV. 0	SCALE: AS SHOWN

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INSTRUMENT: LUDLUM 2221 S/N 102029  
UNSHIELDED 5" X 1 1/2" NaI DETECTOR.

BACKGROUND: 7720 CPM

READINGS TAKEN ON 10 METER X 10 METER GRID.

SURVEY PERFORMED AFTER BACKFILL.

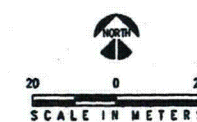
DATE: 9/13/94 BY: JA  
DATE: 10/1/94 BY: KM  
SCALE: AS SHOWN

**CIMARRON CORPORATION**

CIMARRON FACILITY  
SANITARY LAGOONS  
FINAL GAMMA SURVEY (1993)  
READINGS IN CPM (3" DET.)

CLIENT DRAWING NO.

JOB NO. DRAWING NO. 93FISL3D-0 REV. 0



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## 12.0 Five Former Waste Water Ponds

The five former waste water ponds discussed in this section include the Uranium Waste Ponds #1 and #2, the Plutonium Evaporation and Emergency Ponds, and the Uranium Emergency Pond. The closure of the five Waste Ponds at the Cimarron facility started in March, 1976 with the construction and installation of a dike across the south half of Uranium Waste Pond #1. This dike consisted of a four-foot-tall plywood barrier wrapped with an EPDM liner which was weighted and staked to the Waste Pond #1 sides and bottom. This enabled Waste Pond #1 to be consolidated into a much smaller area. Excess water was decanted to Waste Pond #2. In March, 1976, Cimarron personnel fabricated and installed a filter system for decanting water from the Plutonium Evaporation Pond to Uranium Waste Pond #2. The water was pumped from the surface through the filtration system.

In April, 1976, water from the Plutonium Emergency Pond and the Uranium Emergency Pond was pumped to Uranium Waste Pond #1 with no visible sludge remaining in these two ponds. After being pumped dry and characterized, the Uranium Emergency Pond was left undisturbed (no additional remediation was performed) until written approval was received from the NRC to backfill all five ponds. The Plutonium Emergency Pond was left undisturbed until November 5, 1976 when it was used to treat water with radionuclide concentrations greater than 0.1 MPC that remained in the other ponds. This was done in order to keep the concentration of radionuclides in the water being pumped to Waste Pond #2 below 0.1 MPC. All water was pumped to Uranium Waste Pond #2 from the Plutonium Emergency Pond by December 10, 1976. All the waste precipitate residues were removed from the Plutonium Emergency Pond and the liquid was pumped to the Plutonium Evaporation Pond on December 10, 1976. Uranium Waste Pond #1 water was decanted to Uranium Waste Pond #2 beginning on April 13, 1976 and continuing through April 22, 1976. The Plutonium Evaporation Pond was decanted through a filtration system to Uranium Waste Pond #2 beginning on April 23, 1976 and continuing through June 21, 1976.

Sludge solidification at Uranium Waste Pond #1 started on July 30, 1976. This was accomplished by using a pump to fill 55-gallon drums with contaminated sludges which in turn were placed on conveyors adjacent to the mixing operation. After filling the barrels approximately 5/6 full with contaminated sludge, a mixer was inserted and cement was added gradually to produce a solidified waste form. Waste solidification operations were completed by October 27, 1976 for Uranium Waste Pond #1. A total of 865 drums of solidified waste containing 3,002 grams

of U-235 were shipped from Uranium Waste Pond #1 to a commercial LLRW disposal facility.

The decanted water remaining in the Plutonium Evaporation Pond was processed through a filtration system until approximately 70,000 gallons of water remained. The 70,000 gallons of water was not processed because the radionuclide concentration was greater than 0.1 MPC. The activity in this water was approximately  $6E-5$  uCi/ml alpha, with the radioactive particles in colloidal suspension. On November 5, 1976, treatment of the 70,000 gallons of water in the Plutonium Evaporation Pond was initiated with the water being decanted to the Plutonium Emergency Pond on a batch basis. The water from the Plutonium Emergency Pond then was decanted to Uranium Waste Pond #2. This batch process was repeated until all the excess water from the Plutonium Evaporation Pond was removed. The treatment was accomplished by adding ferric sulfate and NaOH to precipitate a  $Fe(OH)_3$  floc. The  $Fe(OH)_3$  heel was returned to the Plutonium Evaporation Pond from the Plutonium Emergency Pond on December 10, 1976. The sludge from the Plutonium Evaporation Pond and the Plutonium Emergency Pond was solidified with concrete. Waste solidification commenced on December 10, 1976 and was completed by March 1, 1977. A total of 491 drums of solidified waste containing less than 1 gram of Plutonium (total for all 491 drums) were shipped off site for disposal at a commercial LLRW disposal facility.

After completion of the water treatment project and subsequent sludge solidification in the Waste Ponds, Cimarron staff, the Oklahoma State Department of Health in October, 1977, and the NRC in November, 1977, sampled the five former waste water ponds and the resulting sample analyses were compared.<sup>12</sup> On March 2, 1978, Cimarron received written permission from the Oklahoma State Department of Health to cover the five former waste water ponds. On July 10, 1978<sup>13</sup>, Cimarron received written permission from the NRC to backfill and cover the five former waste water ponds. These five ponds were backfilled and covered between August 3, 1978 and November 1, 1978. A December 14, 1978 NRC inspection report states that burial of the "five liquid effluent retention ponds was completed during the inspection". Initial seeding and fencing were performed between November 2, 1978 and March 20, 1979. Sprigging and fertilizing of these five former waste water ponds were performed from July 18, 1979 to October 30, 1979.

## 12.1 Uranium Emergency Pond, Plutonium Evaporation Pond, and Plutonium Emergency Pond

### A. Uranium Emergency Pond (UEM Pond)

This unlined evaporation pond was irregular in shape. Axis measurements along the center line to the top of the dike were approximately 150 ft. x 180 ft.. The bottom area was approximately 5,000 ft<sup>2</sup> and the approximate capacity was 180,000 gal. at a maximum depth of 4.5 ft.

### B. Plutonium Evaporation Pond (PEV Pond)

This hypalon-lined evaporation pond was irregular in shape. Axis measurements along the center line to the top of the dike were approximately 120 ft. x 180 ft. The bottom area was approximately 10,000 ft<sup>2</sup> and the approximate capacity was 700,000 gal. at a maximum depth of 7 ft. The Plutonium Evaporation Pond liner was surveyed for alpha contamination and then rolled up and left in place prior to backfilling. The liner was later removed in 1986 when the New Sanitary Lagoon was constructed.

### C. Plutonium Emergency Pond (PEM Pond)

This hypalon-lined evaporation pond was irregular in shape. Axis measurements along the centerline to the top of the dike were approximately 100 ft. x 80 ft. The bottom area was approximately 4,500 ft<sup>2</sup> and the approximate capacity was 250,000 gal. at a maximum depth of 7 ft. The Plutonium Emergency Pond liner was surveyed for alpha contamination prior to being rolled up and left in place prior to backfilling.

### D. Characterization Data:

These three ponds were sampled in 1977 by Cimarron personnel, Oklahoma State Department of Health, and the NRC prior to being backfilled. The sample locations and analytical results are included in Attachment 12.0.

Pre-remediation Micro-R and gamma surveys were conducted over the Plutonium Emergency Pond and the Uranium Emergency Pond areas. These data are contained



on Drawings No. 90PRUYUR-0, 90PRUYUR-1, and 90 PRUY3D-0, which are included as attachments to Section 9.0.

The UEM Pond and PEM Pond areas were partially cored down to four feet in 1990. The soil was composited in intervals of 0 to 6 in., 6 in. to 1 ft., 1 to 2 ft., 2 to 3 ft., and 3 to 4 ft.. The soil sample analysis results have been placed on Drawings No. 90PRPUSS-0 through 90PRPUSS-4. Only portions of the ponds could be cored due to the fact that part of the two ponds are located beneath the new lined sanitary lagoon. The majority of the soil sample results for this area were below the 30 pCi/g guideline value for total uranium (Option #1). As shown on the referenced drawings, several samples near the restricted area fence exceeded the 30 pCi/g guideline value for total uranium.

## 12.2 Uranium Waste Pond #1:

The closure of this pond was discussed in greater detail in Section 12.0. This asphalt pitch, felt and pea-gravel-lined evaporation pond was rectangular in shape. Axis measurements along the center line to the top of the dike were approximately 300 ft. x 110 ft.. The bottom area was approximately 23,000 ft<sup>2</sup> and the approximate capacity was 1,152,000 gal. at a maximum depth of 8 ft. Uranium Waste Pond #1 was closed by crushing the asphalt liner into the pond. The underlying clay dike material and clean soil was used to fill in the depression (a depth of approximately 4 ft.). This pond was backfilled in 1978 after being sampled by the NRC.

### A. Characterization Data:

As discussed in Section 12.0, this Pond was sampled by Cimarron staff, Oklahoma State Department of Health, and the NRC prior to being backfilled. However, in January 1993, the NRC sent a letter to Kerr-McGee Corporation stating the following:

"...the five former wastewater ponds that were closed in 1978 must be addressed in detail. A thorough characterization of these ponds must be included, and the Decommissioning Plan must describe how you plan to address any contamination in excess of levels acceptable for release for unrestricted use."

As a result of this letter from the NRC, Cimarron staff initiated an extensive characterization program for this area in an attempt to address NRC concerns. In March, 1993, a 10m x 10m grid was established for Waste Pond #1 by Cimarron personnel, and soil corings were taken to a depth of 6 ft.. Composite soil samples at one-foot intervals were obtained during this effort and analyzed for total uranium. These sample analysis results are shown on Drawings No. 93IVWPSS-1 through 93IVWPSS-6. The soil samples were analyzed at the Cimarron laboratory. Two grids showed soil concentrations exceeding the 30 pCi/g total uranium guideline value for Option #1 material at a depth of 6 ft.. The samples had uranium concentrations of 81 pCi/g and 167 pCi/g. A backhoe was utilized to collect additional soil samples at depths of 6 to 9 ft. in the same locations where the two soil samples exceeded the Option #1 limit. These sample analysis results are shown on Drawings No. 93IVWPSS-7 through-93IVWPSS-9. The highest concentration for this sampling phase with the backhoe was 133 pCi/g total uranium for contaminated soil collected at 8 to 9 feet in depth.

After reviewing the data from this first round of sampling (0 to 6 ft. and 6 to 9 ft.), Cimarron staff initiated a random sampling effort in the Waste Pond #1 area down to 12 ft. utilizing a drill rig. The results of this second round of sampling are shown on Drawings No. 93IVWPSS-R1 through 93IVWPSS-R12. A total of 138 samples were taken. As shown on the drawings, there were no soil samples with uranium concentrations above 30 pCi/g below 10 ft. There were several soil samples with uranium concentrations exceeding 100 pCi/g (maximum of 197 pCi/g total uranium) above 10 ft.

The very southern tip of Waste Pond #1 was not sampled due to large pieces of equipment being stored in this area at the time of sample collection. The southern tip of Waste Pond #1 is over the original diked area and it is unlikely that elevated concentrations of uranium would be found in this area.

A Micro-R survey of this area was conducted in 1993 and the results are listed on Drawings No. 93IVWPUR-0 and 93IVWPUR-1. The survey readings were in the range of 5

to 10 uR/hr. A gamma survey also was conducted in 1993 and the results are shown on Drawing No. 93IVWP3D-0.

## B. Environmental Data

Monitoring wells #1311, #1312, and #1313 serve to monitor the area surrounding Uranium Waste Pond # 1. Well #1311 is southeast of the pond area and is probably not influenced by the pond, since any effluent from the pond should flow toward the Cimarron River to the north. Well #1312 is west of the pond, while well #1313 is north of the pond. These wells appear to be influenced by the pond, based upon the results of the environmental monitoring program. Figures 12.1 through 12.3 have been generated to show trends occurring in wells. "Less than" data are presented on graphs at the uppermost bound.

Concentrations of gross alpha activity in wells #1311, #1312, and #1313 ranged from less than detectable ( $< 10$  pCi/L) to 2200 pCi/L (well #1312, June 21, 1985) during the monitoring period from 1985 through 1993. Sample results are presented in Figure 12.1. Gross alpha concentrations in well #1311 remained low throughout the 1985-1993 monitoring period, reaching a maximum of 32 pCi/L in 1990 and 1992. Concentrations in wells #1312 and #1313 decreased to near background levels during 1986 through 1988 and then increased to a maximum of 1510 pCi/L in well #1313 on June 12, 1992. Sample concentrations for wells #1312 and #1313 decreased in 1993 to 116 pCi/L and 647 pCi/L, respectively. Assuming that all alpha activity comes from uranium isotopes, the 10 CFR 20 Appendix B Table 2, Column 2 value for uranium (300 pCi/L) was exceeded in 1993 at well #1313. As the direction of the trend is downward for wells #1312 and #1313, it is likely that gross alpha concentrations will continue to decline.

Gross beta concentrations in wells #1311, #1312, and #1313 varied from less than 20 pCi/L to 11,800 pCi/L (well #1312, April 24, 1986). Data are plotted in Figure 12.2. Concentrations in well #1311 remained low, peaking at 49 pCi/L in 1992. As with gross alpha, activity in wells #1312 and #1313 trended lower through 1988, then increased.

Figure 12.1

KERR MCGEE--CIMARRON  
GROSS ALPHA-WELLS 1311, 1312, 1313

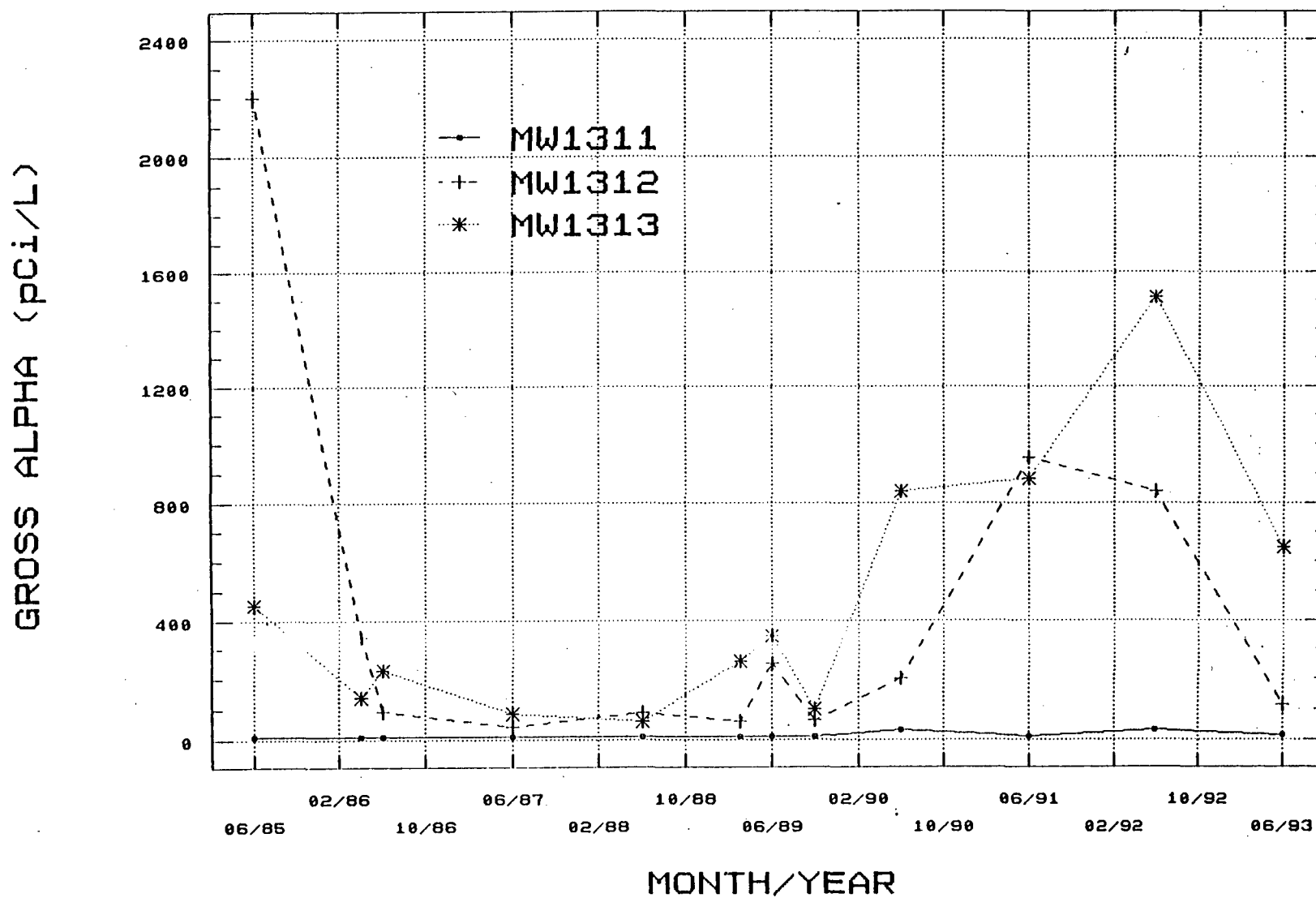




Figure 12.2

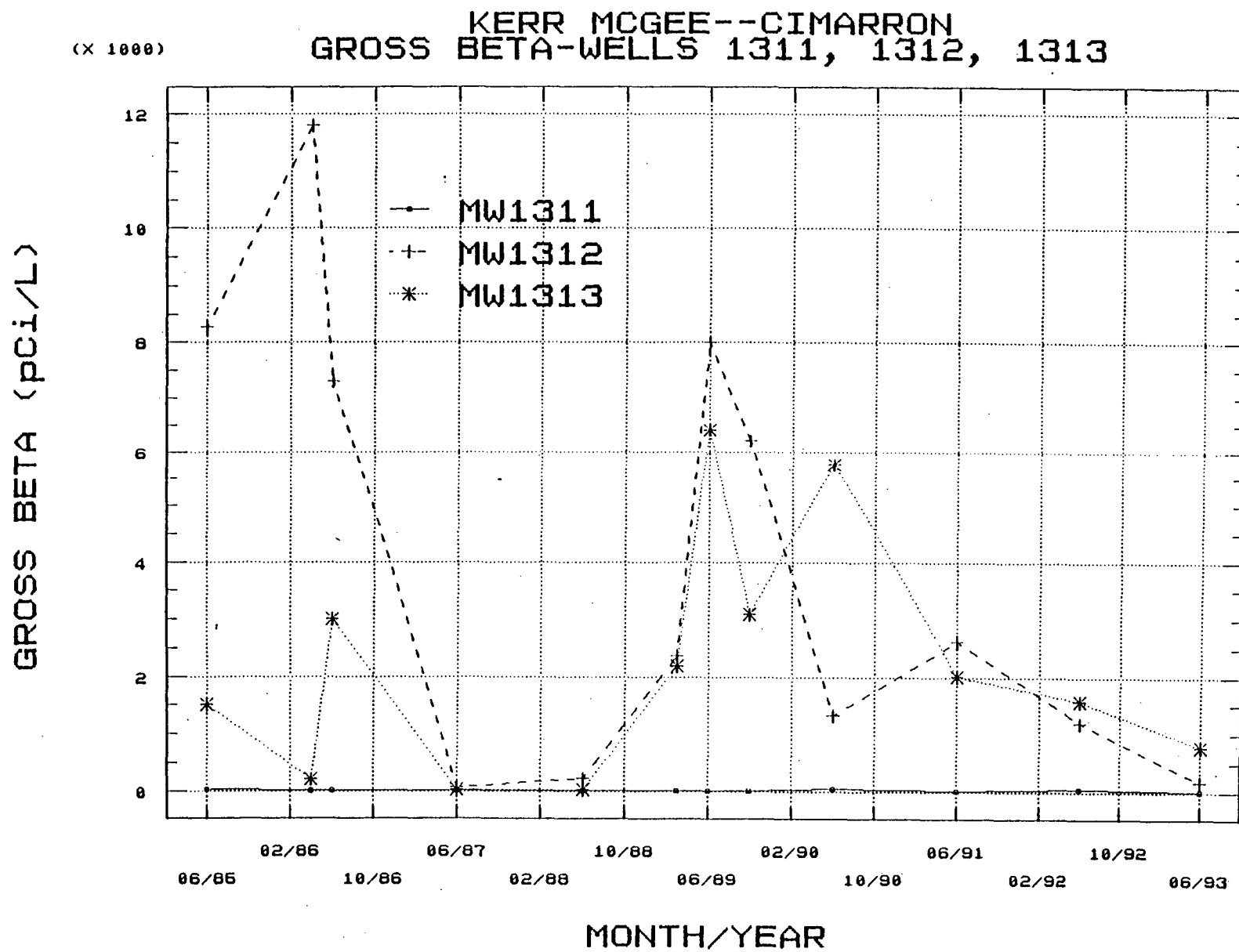
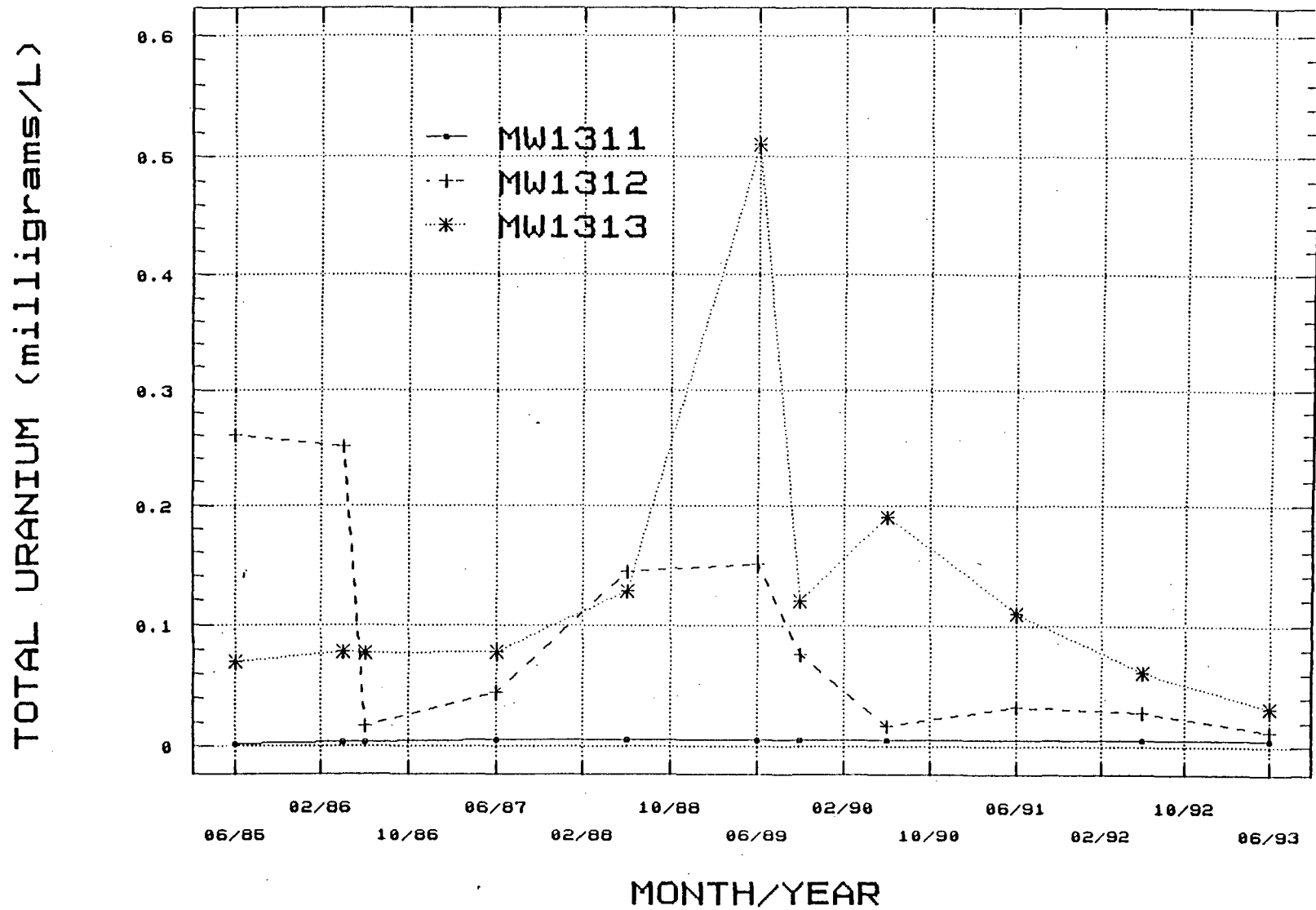


Figure 12.3

KERR MCGEE--CIMARRON  
TOTAL URANIUM--WELLS 1311, 1312, 1313

However, a peak in activity occurred in 1989 (8,000 pCi/L) at well #1312, followed by a downward trend through 1993. Concentrations in 1993 were trending lower in well #1312 (176 pCi/L) and well #1313 (791 pCi/L).

Total uranium concentrations in wells #1311, #1312, and #1313 followed essentially the same trend as the gross beta concentration. Figure 12.3 shows total uranium concentrations over time. Total uranium concentrations ranged from less than 0.002 milligrams per liter (mg/L) at well #1311 to 0.51 mg/L at well #1313 in 1989. Since 1989, concentrations have decreased to 0.012 mg/L in well #1312 and 0.032 mg/L in well #1313. Assuming a uranium enrichment of 2.7 weight percent, the specific activity is calculated as  $1.5 \times 10^{-6}$  Ci/g, using the equation from footnote 3 to Appendix B, 10 CFR 20. Using this conversion factor, the 1993 total uranium concentrations are estimated at 17 pCi/L and 46 pCi/L for wells #1312 and #1313, respectively. These values are well below the Table 2, Column 2 limit for mixtures of uranium isotopes.

Various isotopic analyses were performed on groundwater samples. Isotopic analyses show general agreement with total uranium results. Isotopic radium and thorium were characteristic of normal background levels.

### 12.3 Uranium Waste Pond #2:

The closure of Waste Pond #2 has been discussed in greater detail in Section 12.0. This pond had a compacted clay bottom liner with EPDM poly rubber sidewalls anchored at the bottom and top of the dike. The pond was rectangular in shape and axis measurements along the center line to the top of the dike were approximately 405 ft. x 270 ft. The bottom area was approximately 90,000 ft<sup>2</sup> and its capacity was 3,025,000 gal. at a maximum height of 4 ft. This pond was closed without the removal of sludge due to the fact that sludge was never generated in this pond.

#### A. Characterization Data:

As with Uranium Waste Pond #1, Cimarron personnel initiated an extensive characterization of this area by coring the original pond and the immediate area around the pond. The area was cored on a 10m x 10m grid in early 1993. Soil

samples were collected at one-foot intervals from 0 to 6 ft. in depth. Each one-foot soil interval was composited and analyzed at the Cimarron laboratory for total uranium. The sample analysis results are shown on Drawings No. 93IVWPSS-1 through 93IVWPSS-6. Soil sample concentrations ranged from less than 20 pCi/g to 243 pCi/g total uranium. At the 5 to 6 ft. depth interval, three samples exceeded the Option #1 guidelines.

After reviewing the data from the first round of sampling, Cimarron staff initiated additional sampling in the three areas where the samples exceeded the Option #1 limits. A drill rig was utilized to core to twelve feet in these three grid locations. The sample analysis results for this second round of sampling are shown on Drawings No. 93IVWPSS-R1 through 93IVWPSS-R12. Elevated concentrations of total uranium in the soil samples were not present below a depth of 9 ft. (One sample at the 8- to 9-foot depth was 39 pCi/g total uranium including background).

A Micro-R survey of this area was performed in 1993 and has been placed on Drawings No. 93IVWPUR-0 and 93IVWPUR-1. A gamma survey was also performed in 1993 for this area and the results are shown on Drawing No. 93IVWP3D-0.

B. Environmental Data:

Wells #1320 and #1321 are located near the southwest corner of the Waste Pond # 2 area. Gross alpha concentrations were low, ranging from less than 10 pCi/L to 22 pCi/L (well #1321, June, 1991). Gross beta concentrations were also low, ranging from less than 20 pCi/L to 26 pCi/L (well #1320, 1985). Total uranium was less than 0.005 mg/L from 1989 through 1993 in well #1320. Total uranium concentrations in well #1321 ranged from less than 0.005 mg/L to 0.021 mg/L (30 pCi/L). As these wells are located on the up gradient side of the waste pond unit, it is difficult to determine any groundwater impacts associated with the burial area.

Well #1336 was located north of Uranium Waste Pond #2. This well was sampled from 1989 through 1991 until the sample pump became stuck in the well casing. A new well has been installed recently (well #1336A) in the vicinity of

the original well and is being sampled in accordance with the environmental monitoring procedures.

Gross alpha concentrations in well #1336 ranged from 28 pCi/L in October, 1989, to 1,010 pCi/L in June, 1991. Gross beta concentrations peaked at 11,000 pCi/L in June, 1989, and trended downward to 2,082 pCi/L in June, 1991. Total uranium concentrations ranged from 0.015 mg/L (220 pCi/L) in June, 1989, and trended upward to 0.62 mg/L (900 pCi/L) in June, 1991. Samples collected in 1990 and 1991 exceeded the Table 2, Column 2 concentration limits of Appendix B to 10 CFR 20.

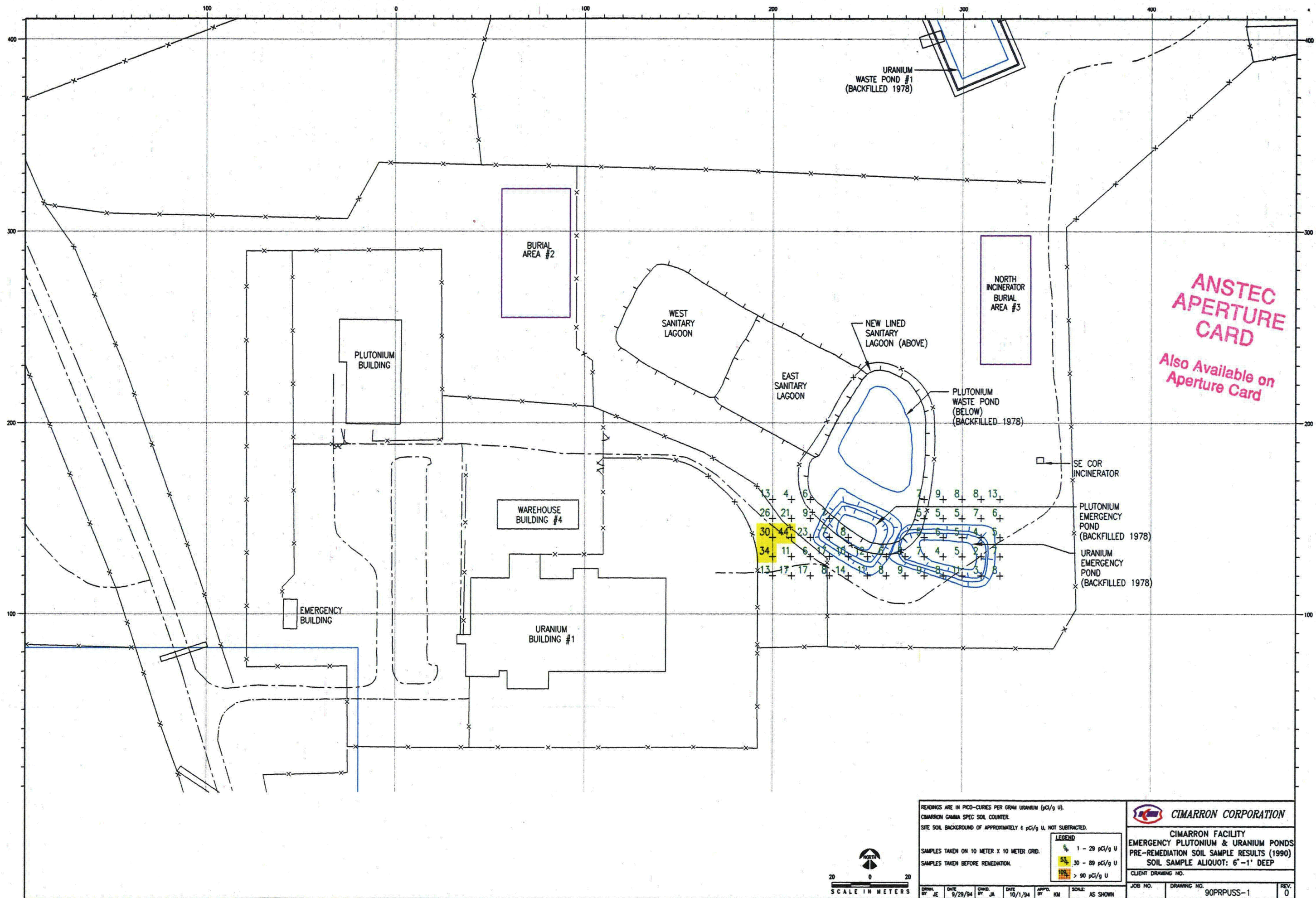
A surface water sample is collected annually from a stream north of Uranium Waste Pond #2 at sample location #1208. All samples collected during the 1977 through 1993 monitoring period ranged from less than 10 pCi/L to 296 pCi/L gross alpha concentration in June, 1993. Gross beta concentrations at sample location #1208 ranged from less than detectable to 600 pCi/L in 1986. The gross beta concentration in 1993 was 30 pCi/L. Total uranium ranged from less than 0.002 mg/L to 0.2 mg/L (290 pCi/L, based on 2.7 weight percent enriched U-235) in 1993. The 1993 surface water total uranium results are supported by isotopic analysis for U-235 (9.2 pCi/L), U-234 (217 pCi/L), and U-238 (77.1 pCi/L). Kerr-McGee will continue to monitor surface water at sample location #1208 during remedial activities.

#### 12.4 Industrial Waste Burial Area North of Uranium Waste Pond #1

There are two solid waste trenches located at the north end of Waste Pond #1 which were closed in 1985. The nonradioactive solid wastes (trash, glass, cans, paper, etc.) that were placed in these trenches came from the operation of equipment utilized in the Kerr-McGee Coal Liquification R&D Project.



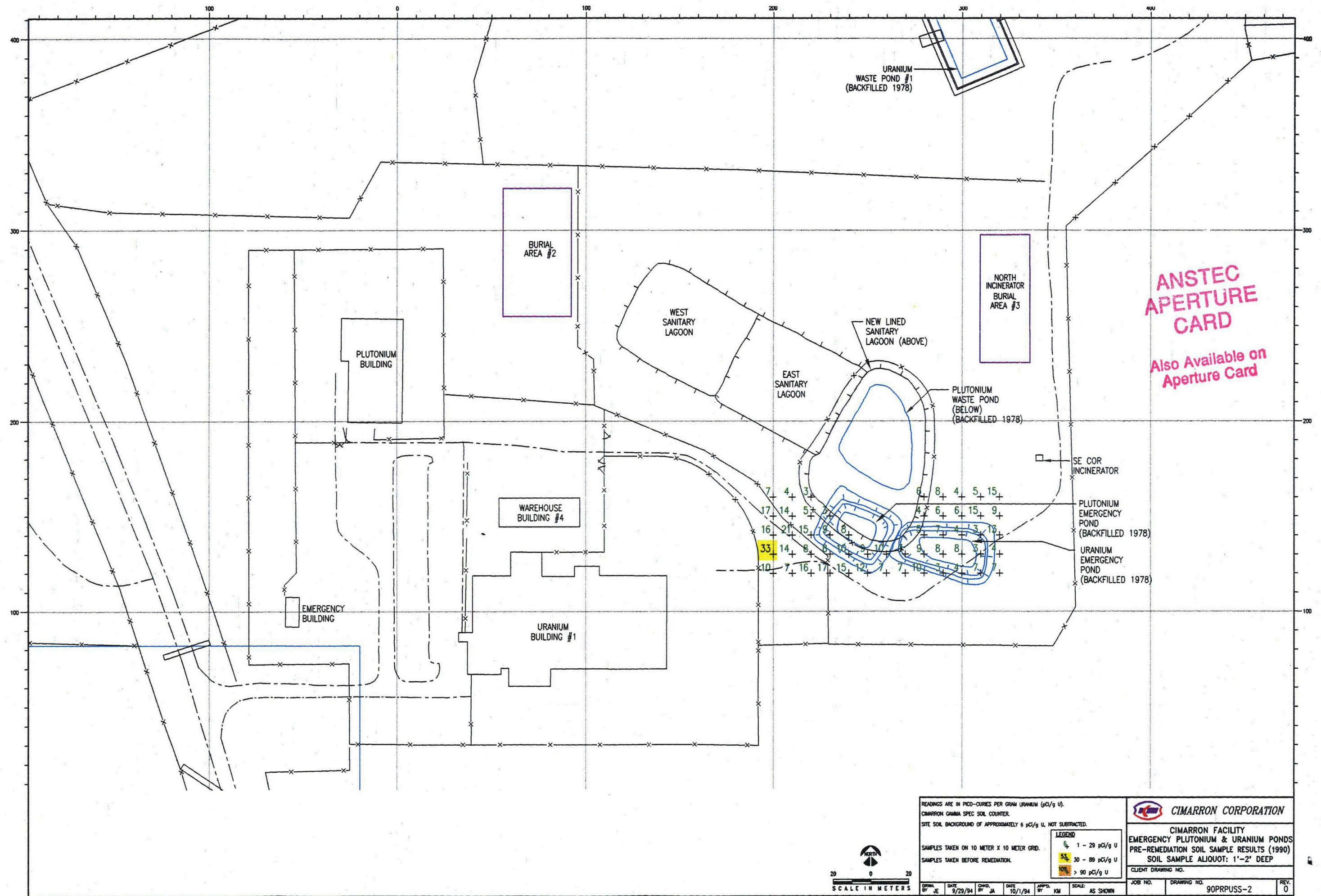




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READINGS ARE IN PICO-CURIES PER GRAM URANIUM (pCi/g U).  
CIMARRON GAMMA SPEC SOIL COUNTER.  
SITE SOIL BACKGROUND OF APPROXIMATELY 6 pCi/g U, NOT SUBTRACTED.

SAMPLES TAKEN ON 10 METER X 10 METER GRID.  
SAMPLES TAKEN BEFORE REMEDIATION.

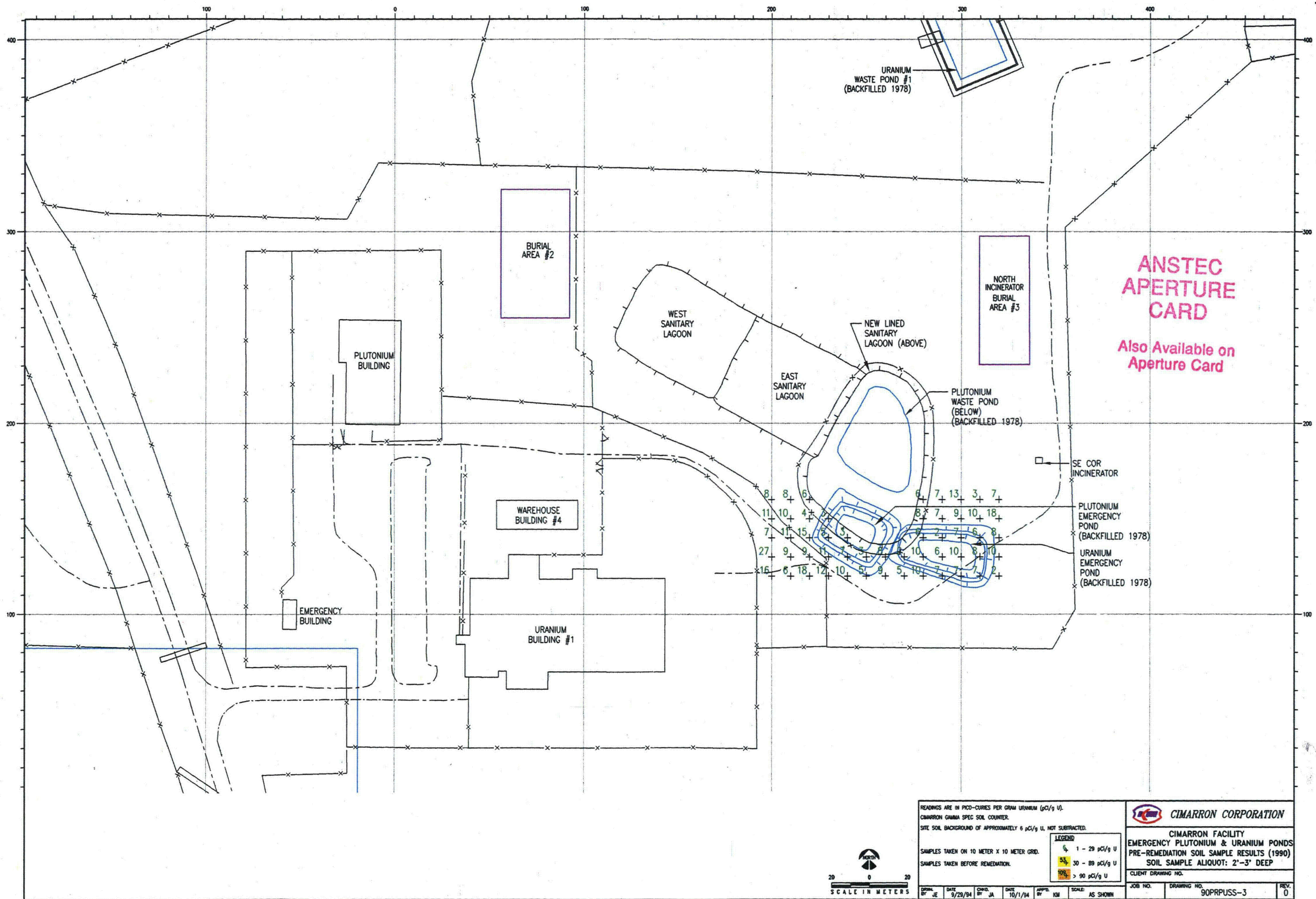
LEGEND  
1 - 29 pCi/g U  
30 - 89 pCi/g U  
> 90 pCi/g U

CIMARRON CORPORATION  
CIMARRON FACILITY  
EMERGENCY PLUTONIUM & URANIUM PONDS  
PRE-REMEDIATION SOIL SAMPLE RESULTS (1990)  
SOIL SAMPLE ALIQUOT: 1'-2' DEEP  
CLIENT DRAWING NO.

JOB NO. DRAWING NO. 90PRPUSS-2 REV. 0

DATE 9/29/94 CHD. BY JA DATE 10/1/94 APPD. BY KIM SCALE: AS SHOWN

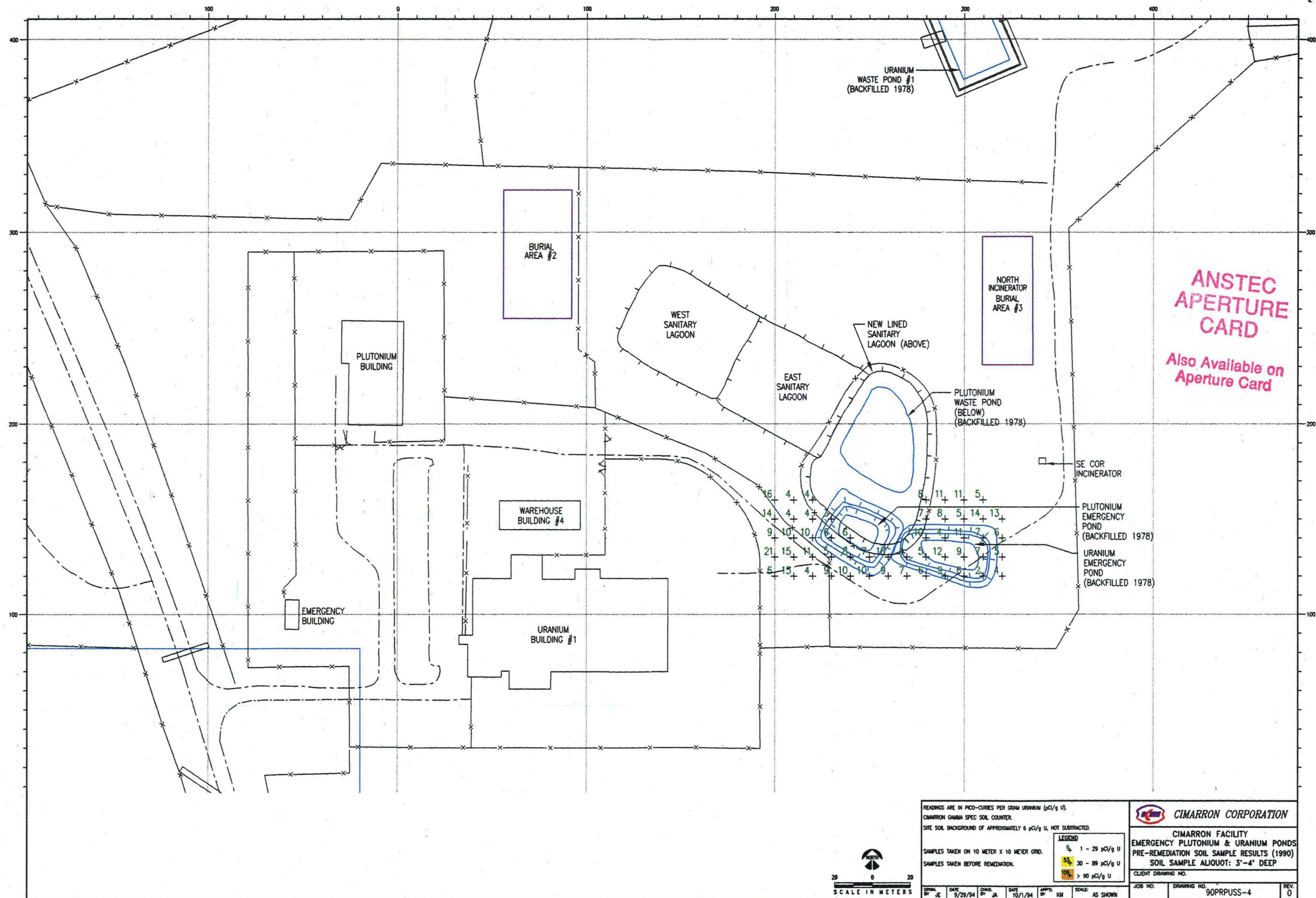




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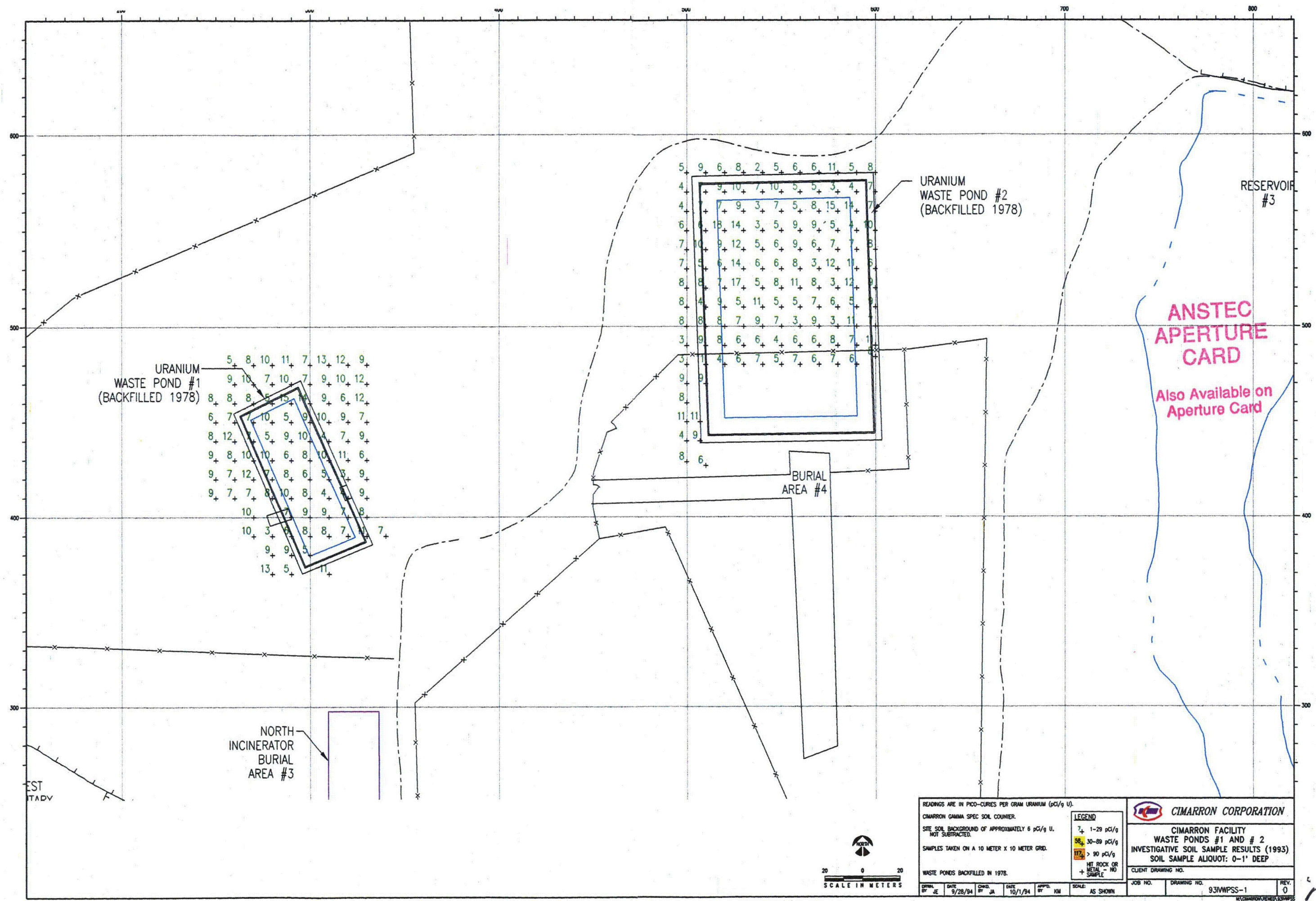
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URANIUM  
WASTE POND #1  
(BACKFILLED 1978)

URANIUM  
WASTE POND #2  
(BACKFILLED 1978)

RESERVOIR  
#3

ANSTEC  
APERTURE  
CARD

Also Available on  
Aperture Card

BURIAL  
AREA #4

NORTH  
INCINERATOR  
BURIAL  
AREA #3

READINGS ARE IN PICO-CURIES PER GRAM URANIUM (pCi/g U).

CIMARRON GAMMA SPEC SOIL COUNTER.

SITE SOIL BACKGROUND OF APPROXIMATELY 6 pCi/g U.  
NOT SUBTRACTED.

SAMPLES TAKEN ON A 10 METER X 10 METER GRID.

WASTE PONDS BACKFILLED IN 1978.

LEGEND

- 7+ 1-29 pCi/g
- 58+ 30-89 pCi/g
- MTZ > 90 pCi/g
- MTZ HIT ROCK OR METAL - NO SAMPLE

CIMARRON CORPORATION

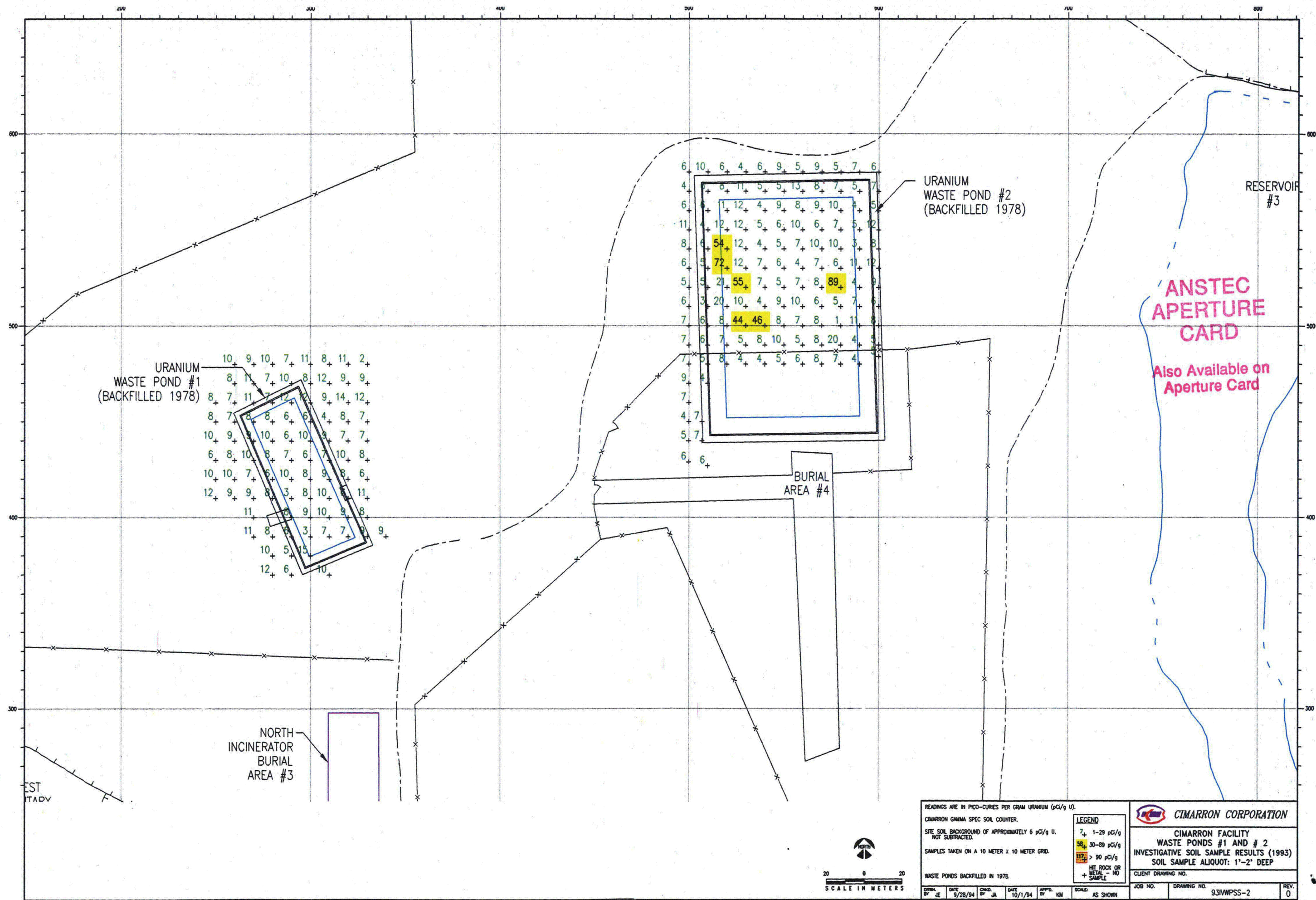
CIMARRON FACILITY  
WASTE PONDS #1 AND #2  
INVESTIGATIVE SOIL SAMPLE RESULTS (1993)  
SOIL SAMPLE ALIQUOT: 0-1' DEEP

CLIENT DRAWING NO.

JOB NO. DRAWING NO. 93JWPPSS-1 REV. 0

DATE 9/28/94 CDR. BY JA DATE 10/1/94 APPR. BY KM SCALE: AS SHOWN

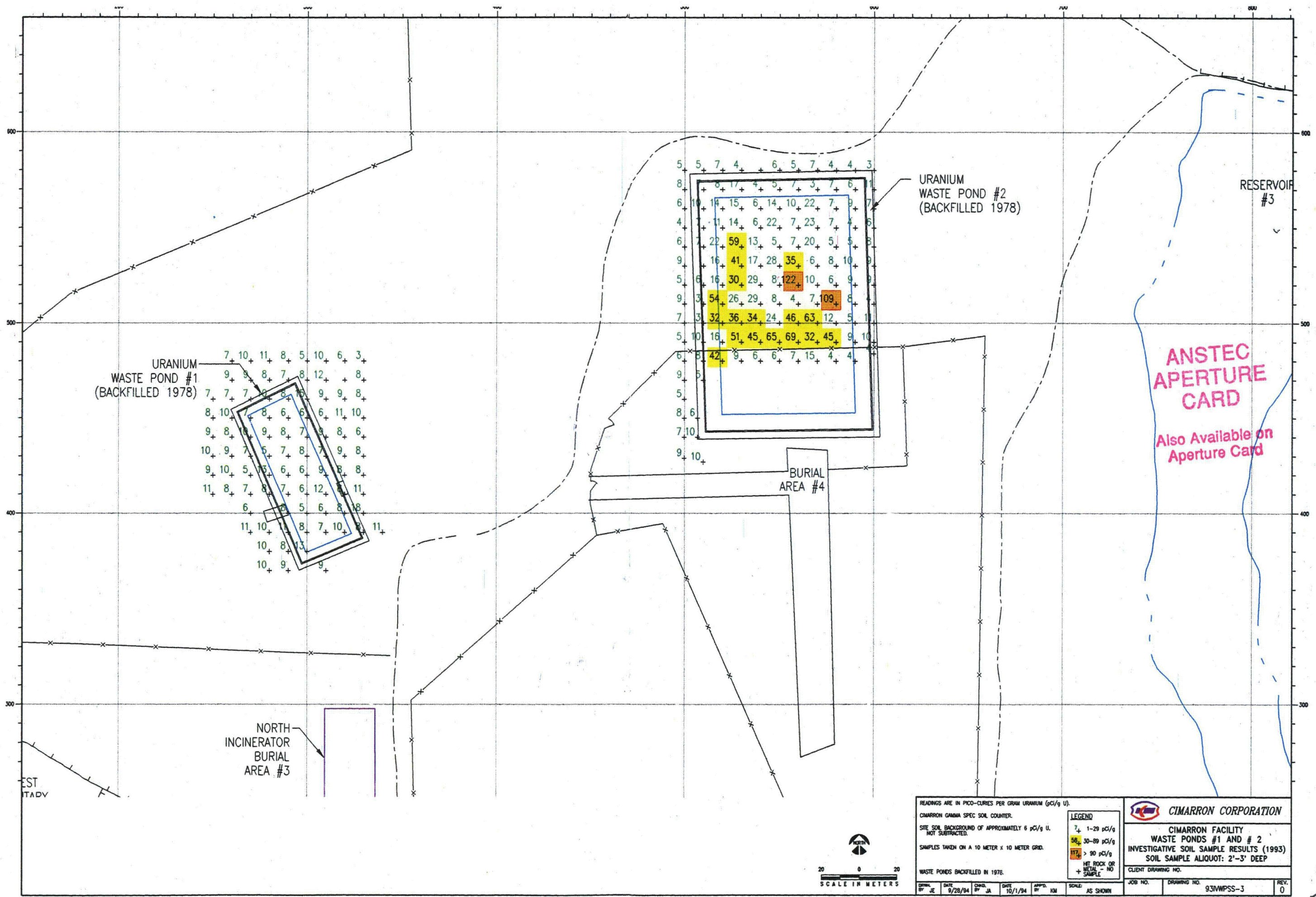




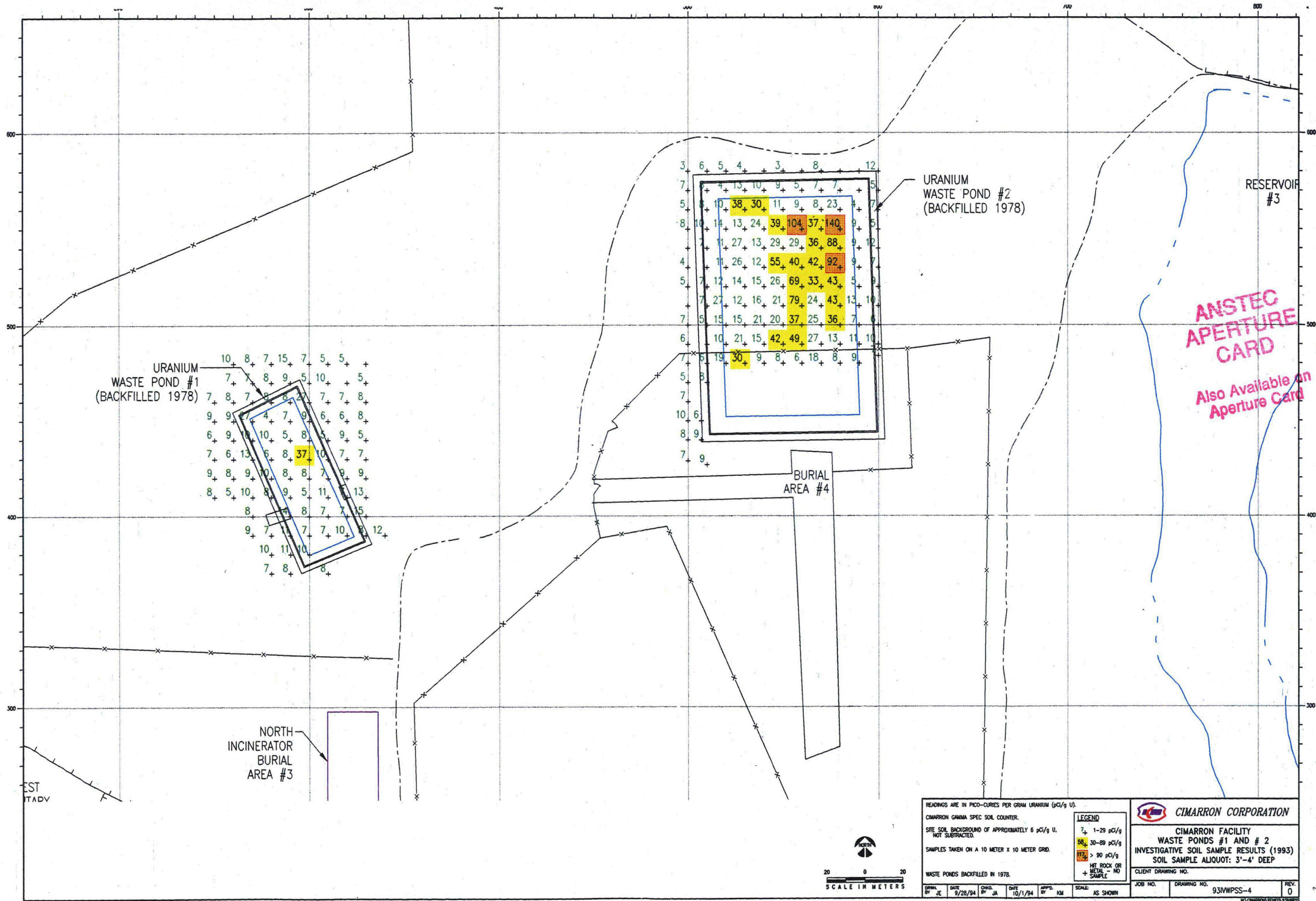
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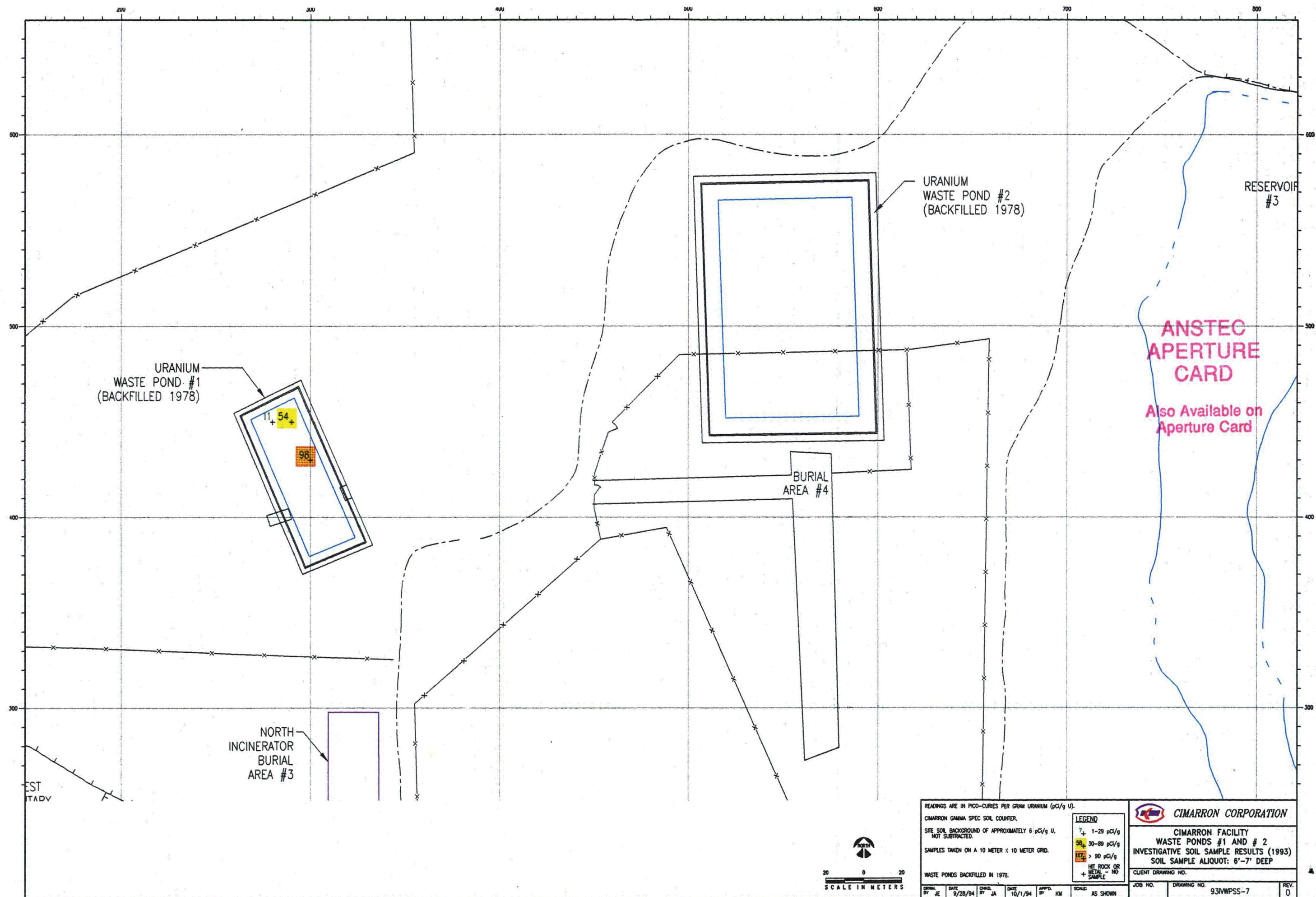








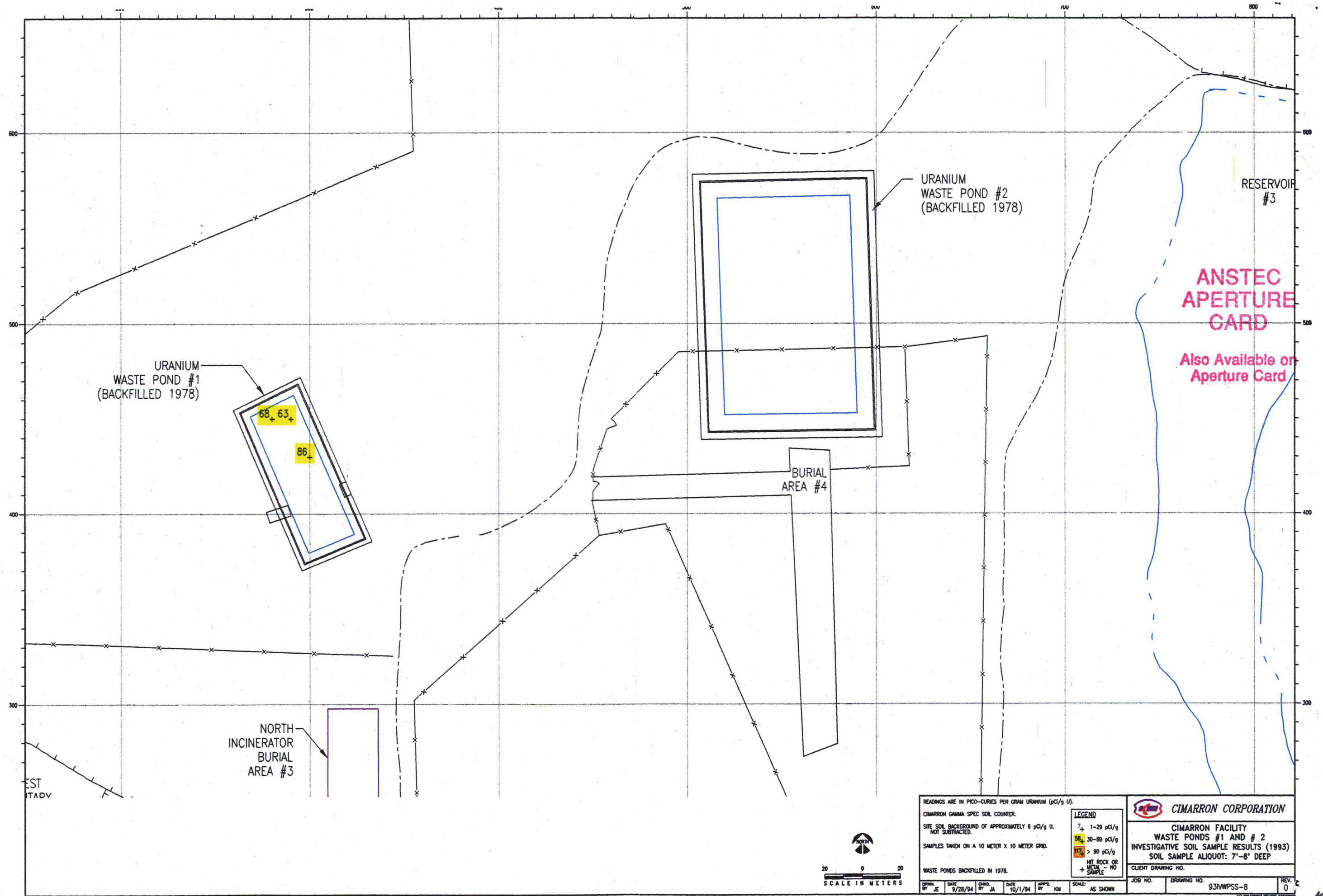




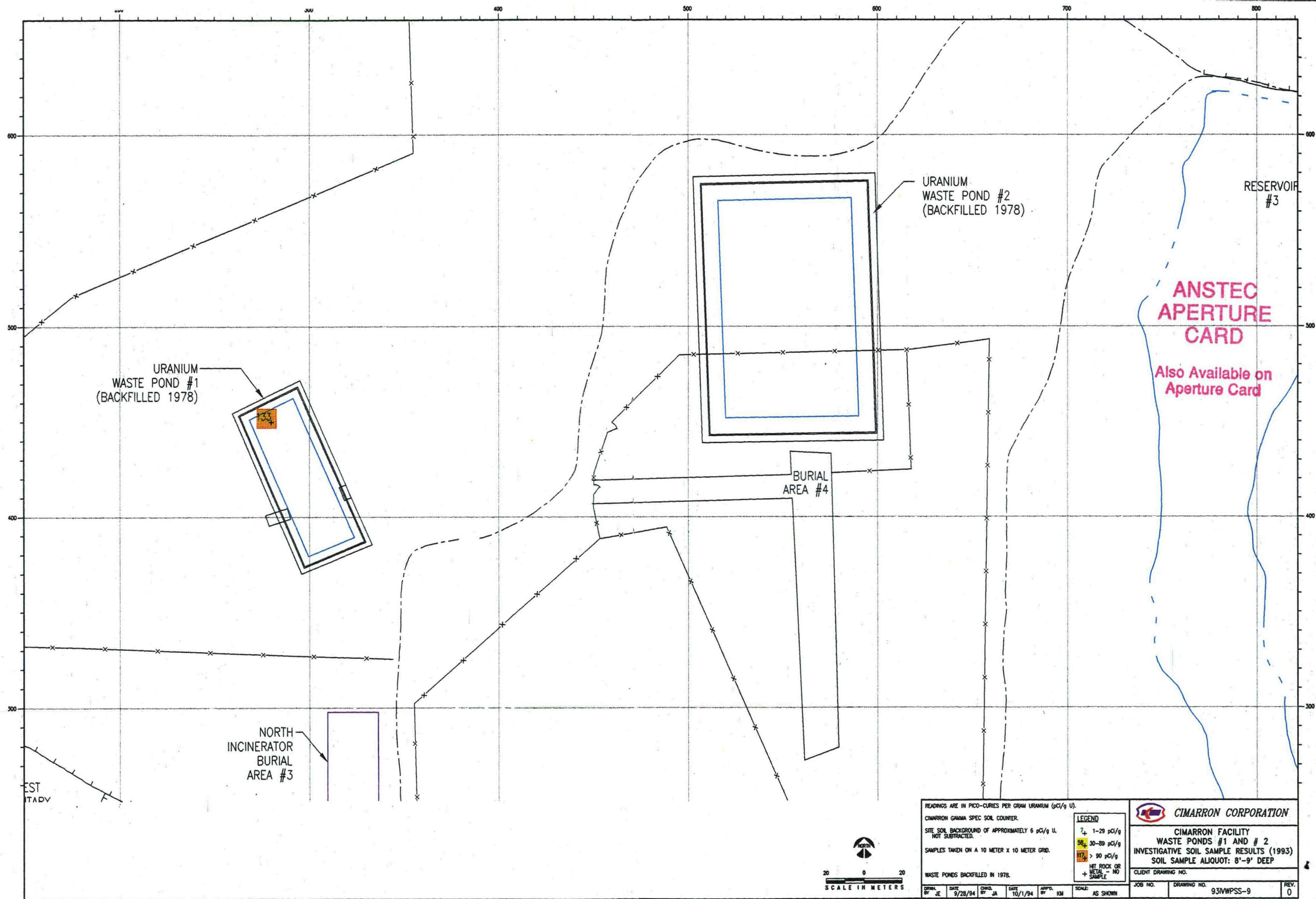
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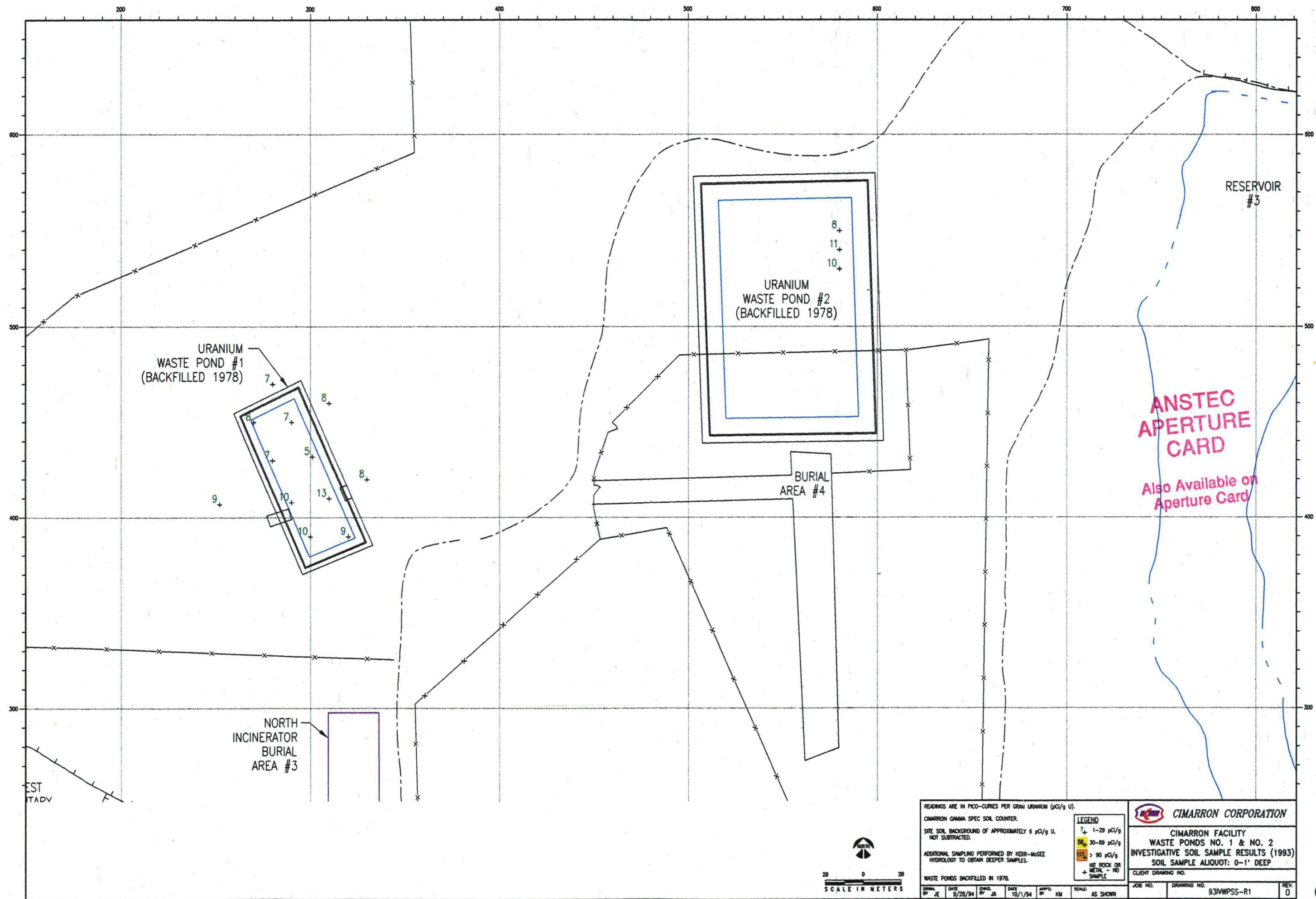




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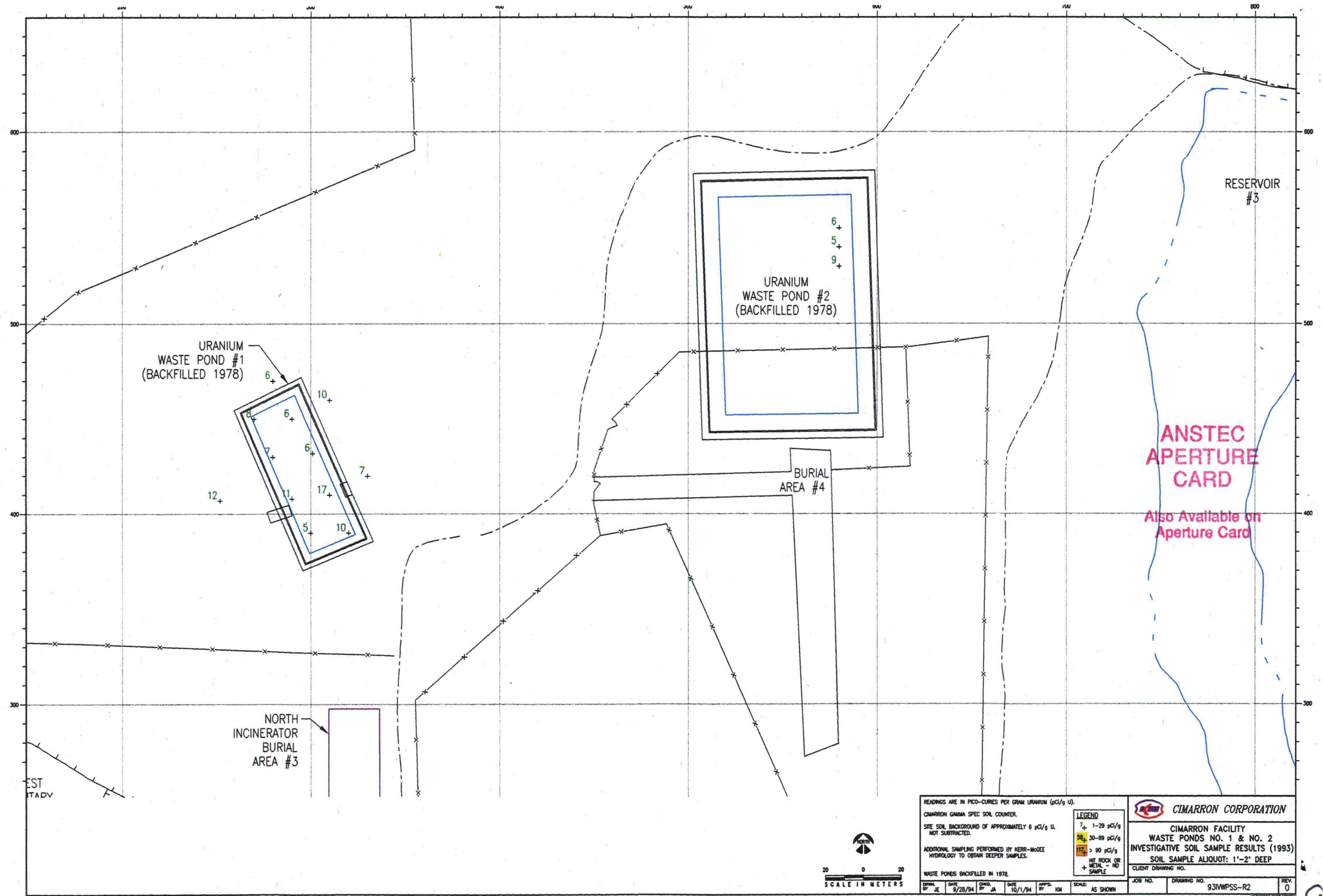




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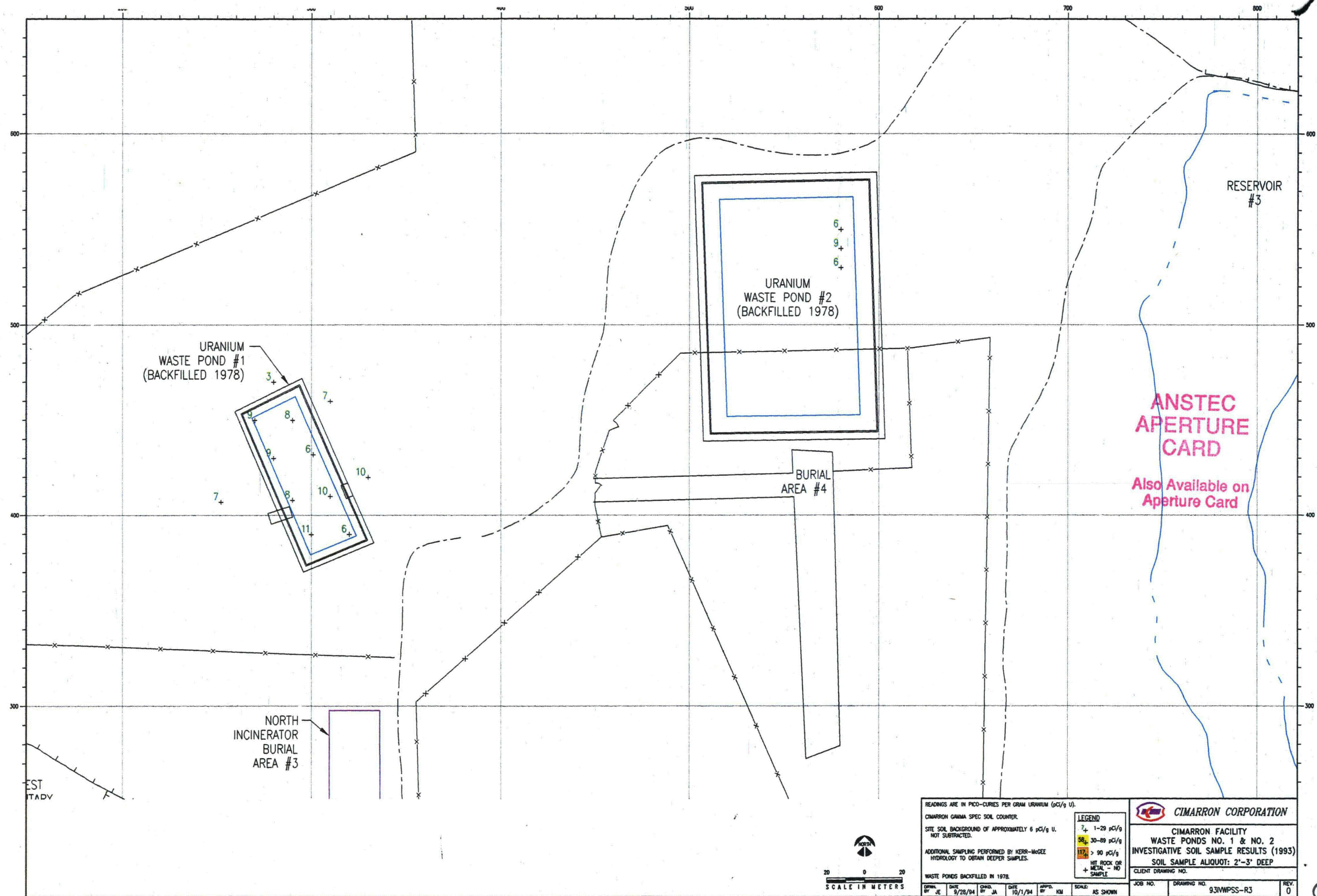




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CIMARRON GAMMA SPEC SOIL COUNTER.			
SITE SOIL BACKGROUND OF APPROXIMATELY 6 pCi/g U. NOT SUBTRACTED.			
ADDITIONAL SAMPLING PERFORMED BY KERR-McGEE HYDROLOGY TO OBTAIN DEEPER SAMPLES.			
WASTE PONDS BACKFILLED IN 1978.			
DATE	BY	DATE	BY
9/28/84	JE	10/1/84	KM
JOB NO.		DRAWING NO.	
93JWPPSS-R2		REV. 0	

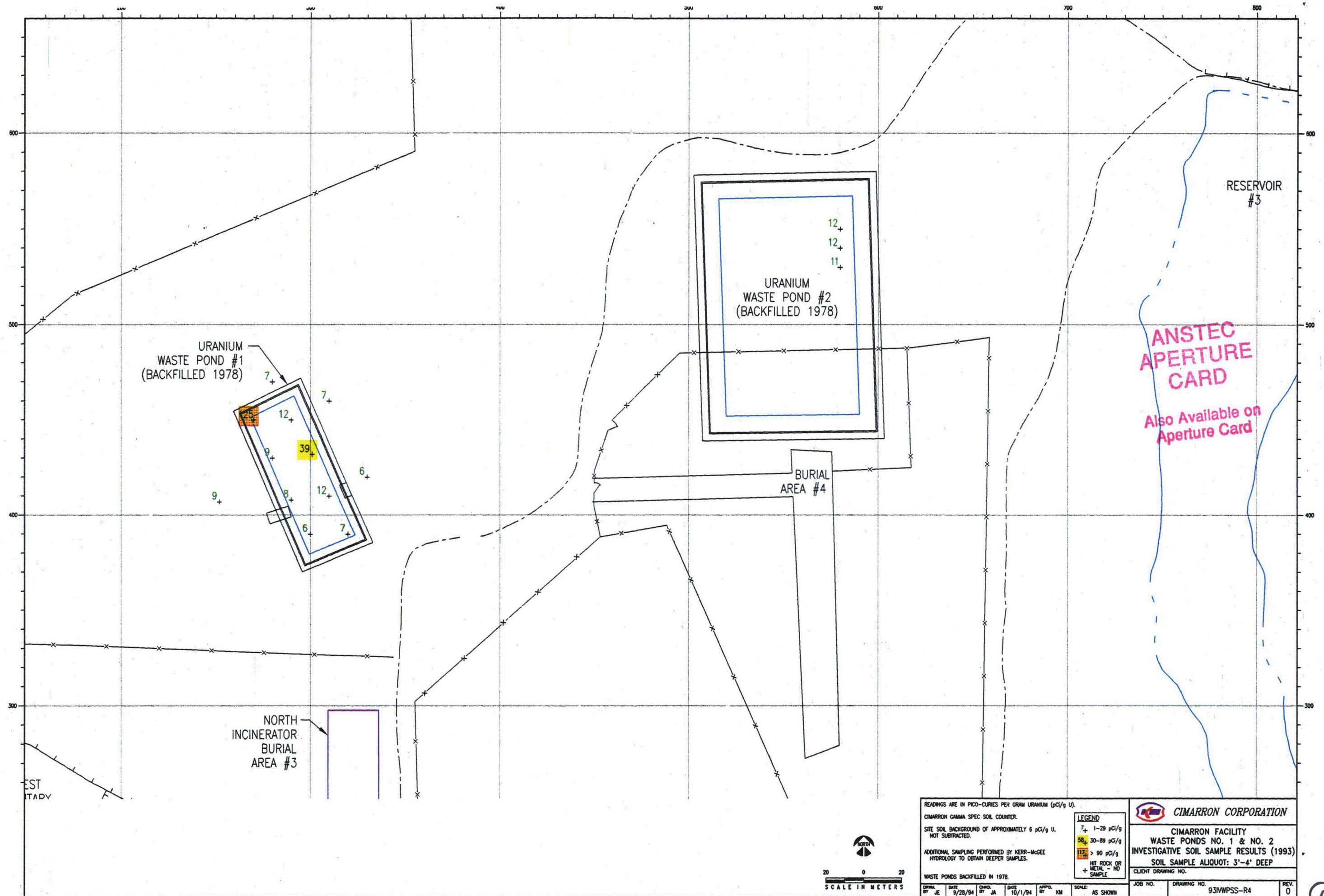
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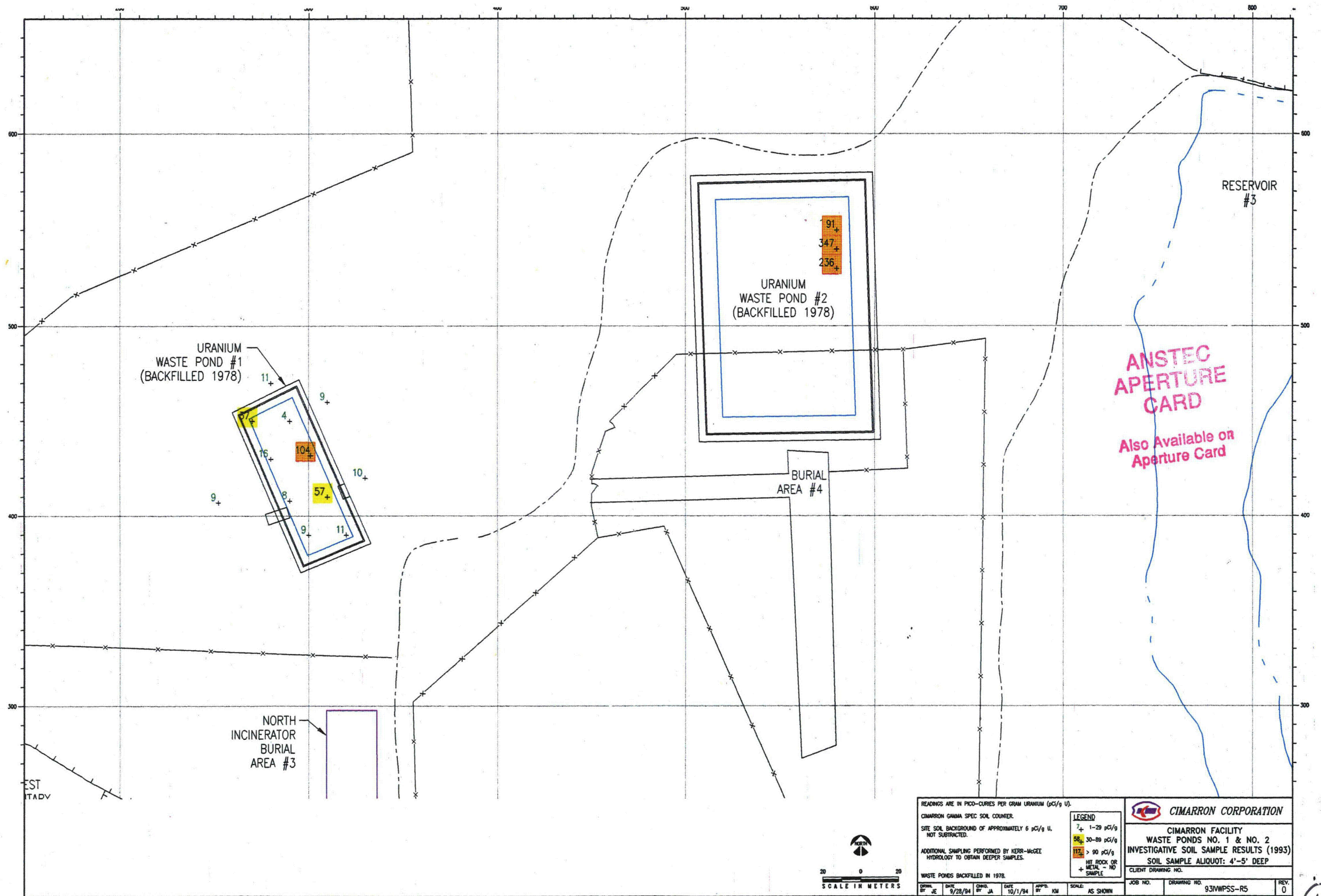




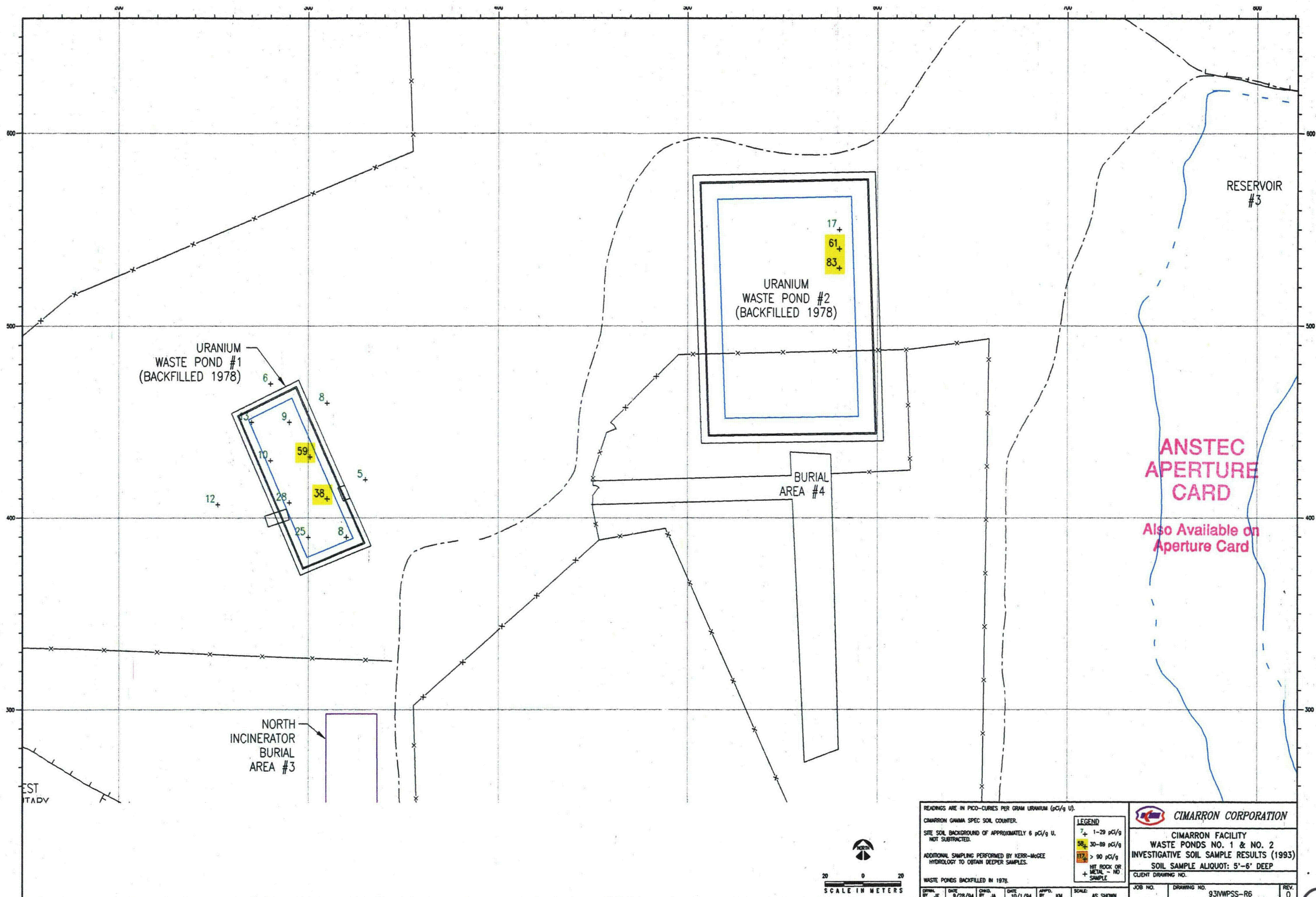
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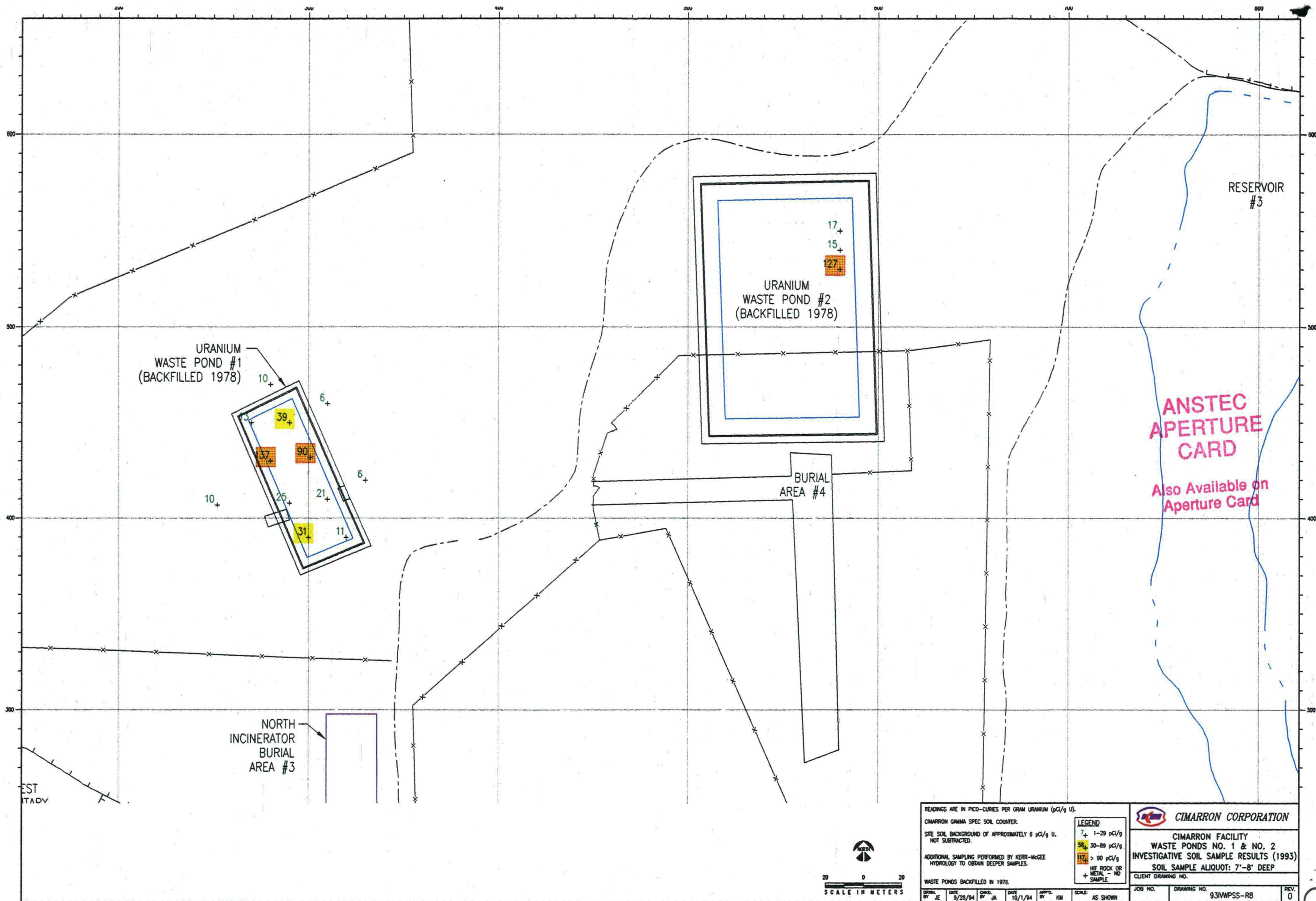


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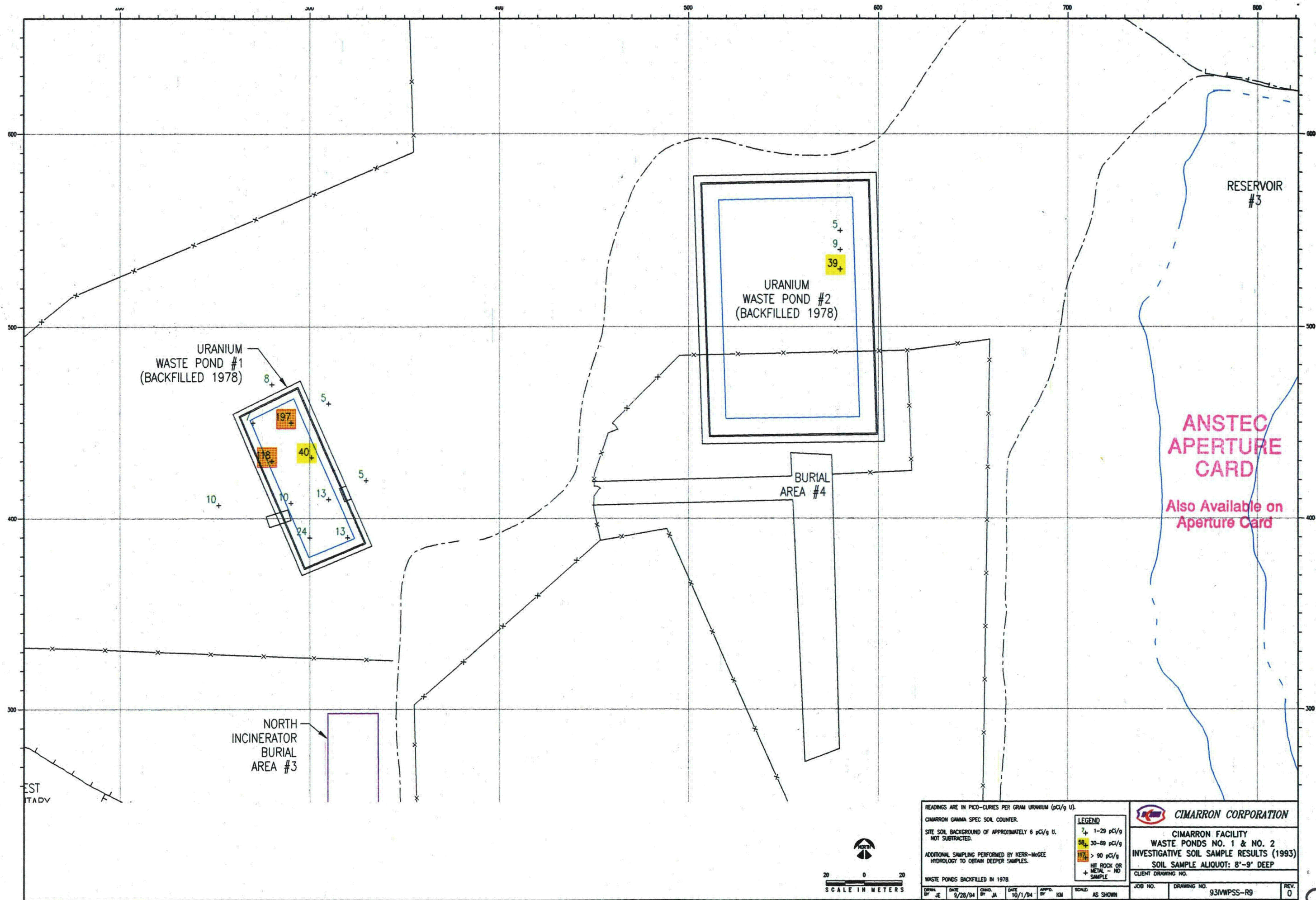




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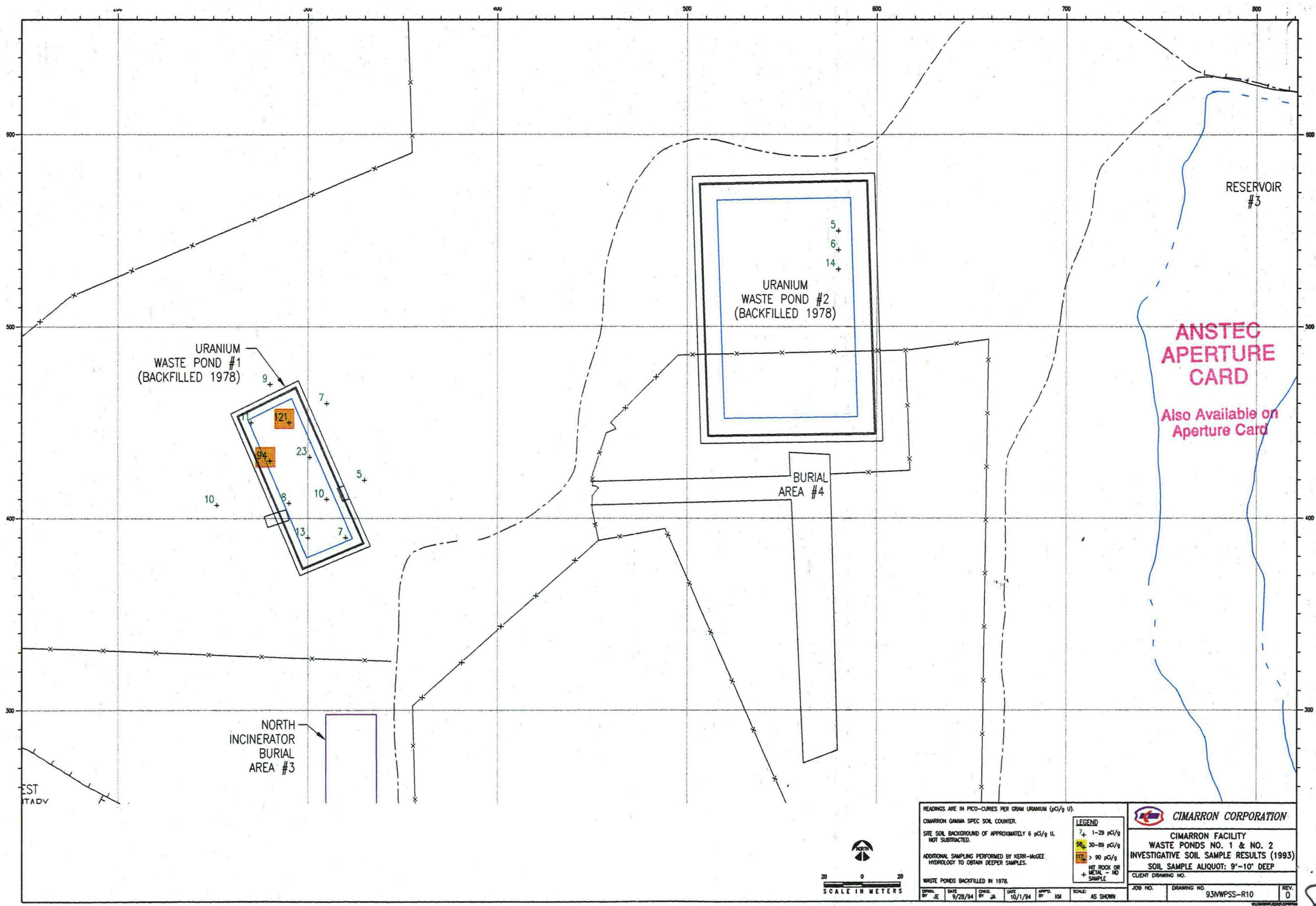




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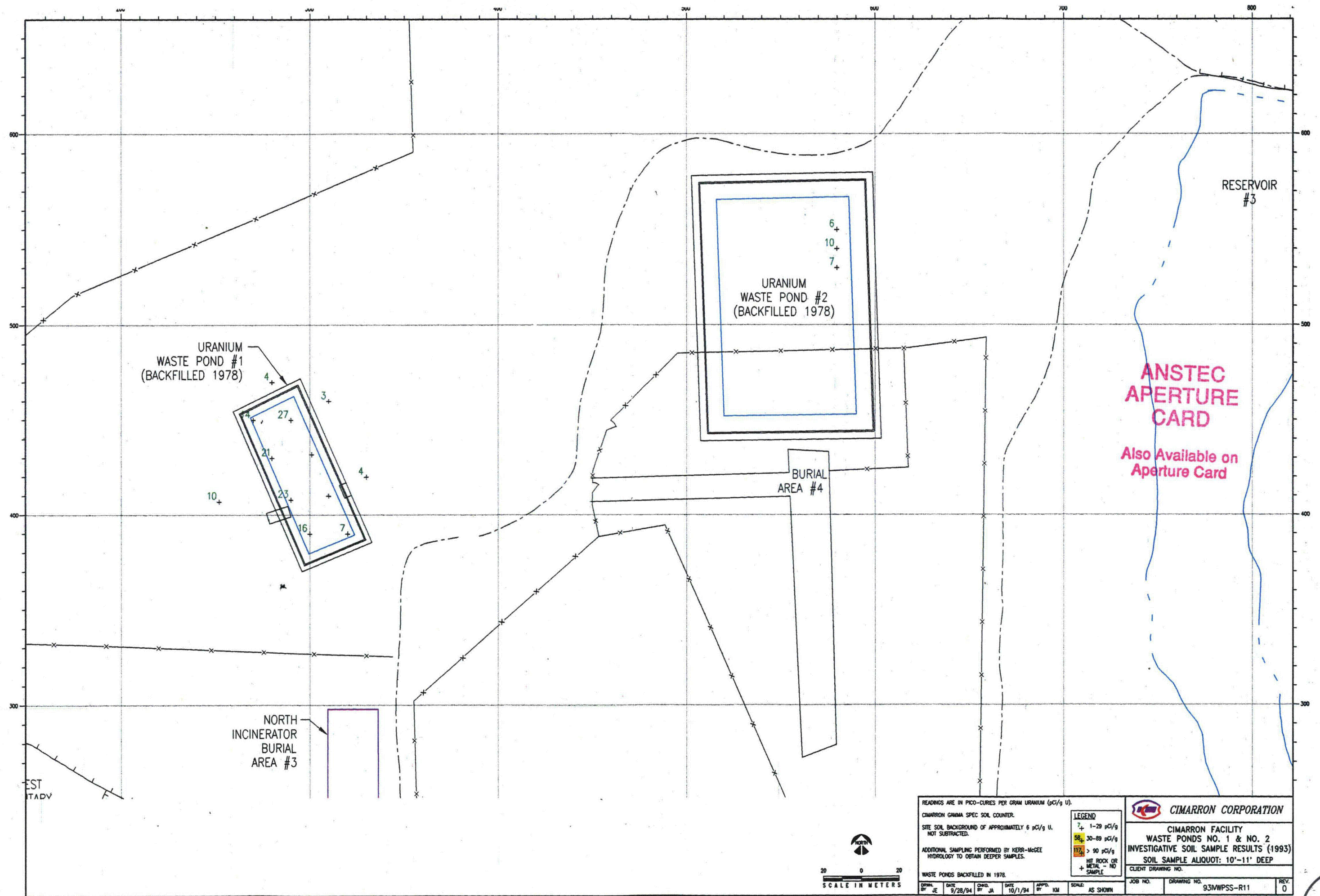
**ANSTEC  
APERTURE  
CARD**  
Also Available on  
Aperture Card

READINGS ARE IN PICO-CURIES PER GRAM URANIUM (pCi/g U).				<b>CIMARRON CORPORATION</b>			
CIMARRON GAMMA SPEC SOIL COUNTER.				<b>CIMARRON FACILITY</b>			
SITE SOIL BACKGROUND OF APPROXIMATELY 6 pCi/g U. NOT SUBTRACTED.				<b>WASTE PONDS NO. 1 &amp; NO. 2</b>			
ADDITIONAL SAMPLING PERFORMED BY KERR-McGEE HYDROLOGY TO OBTAIN DEEPER SAMPLES.				<b>INVESTIGATIVE SOIL SAMPLE RESULTS (1993)</b>			
WASTE PONDS BACKFILLED IN 1978.				<b>SOIL SAMPLE ALIQUOT: 9"-10" DEEP</b>			
LEGEND				CLIENT DRAWING NO.			
7+ 1-29 pCi/g				JOB NO.			
30-89 pCi/g				DRAWING NO.			
90+ pCi/g				93/WPSS-R10			
HIT ROCK OR METAL - NO SAMPLE				REV.			
DATE 9/28/94				0			
DATE 10/1/94				SCALE: AS SHOWN			
DATE 10/1/94				DATE 10/1/94			

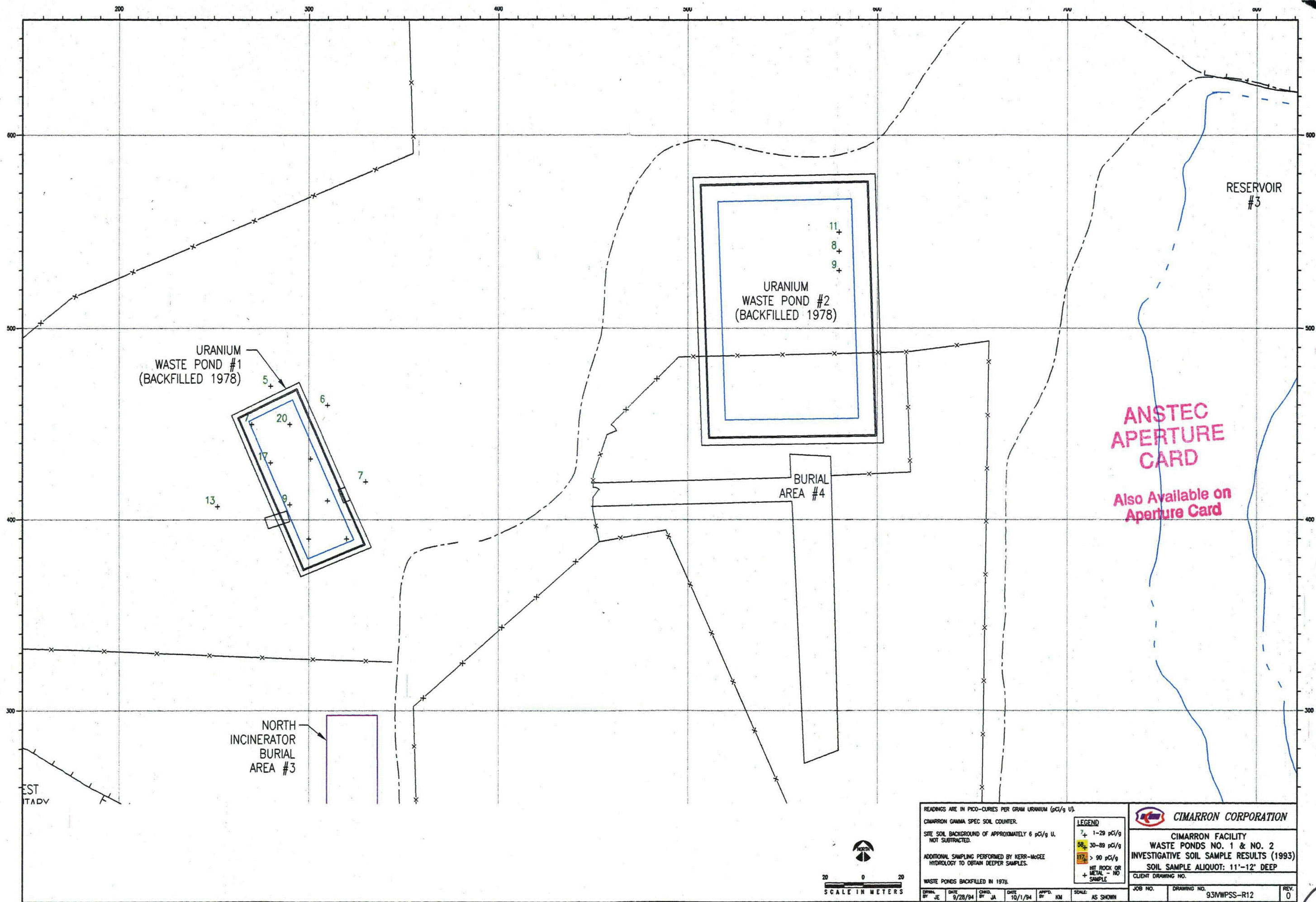
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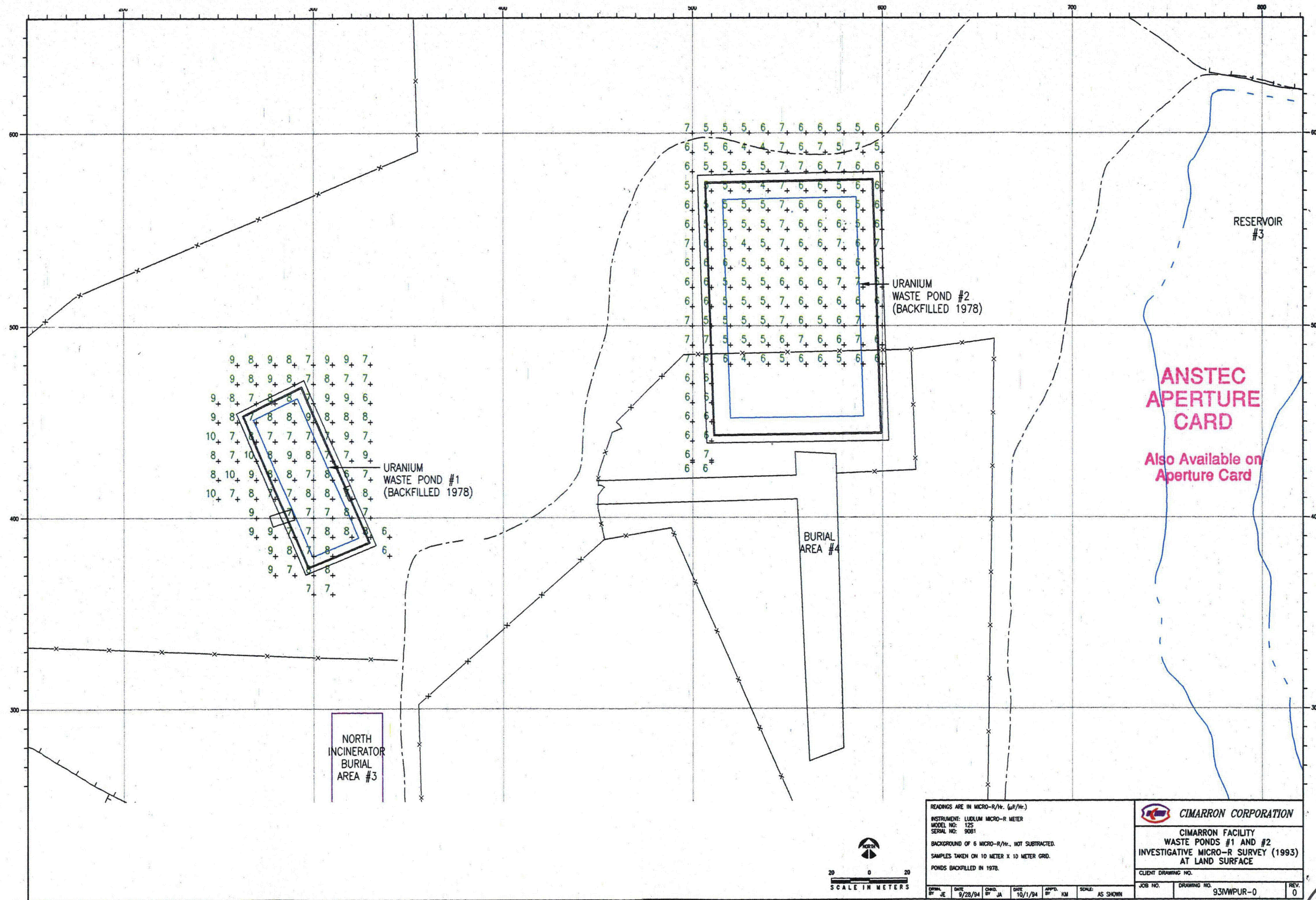






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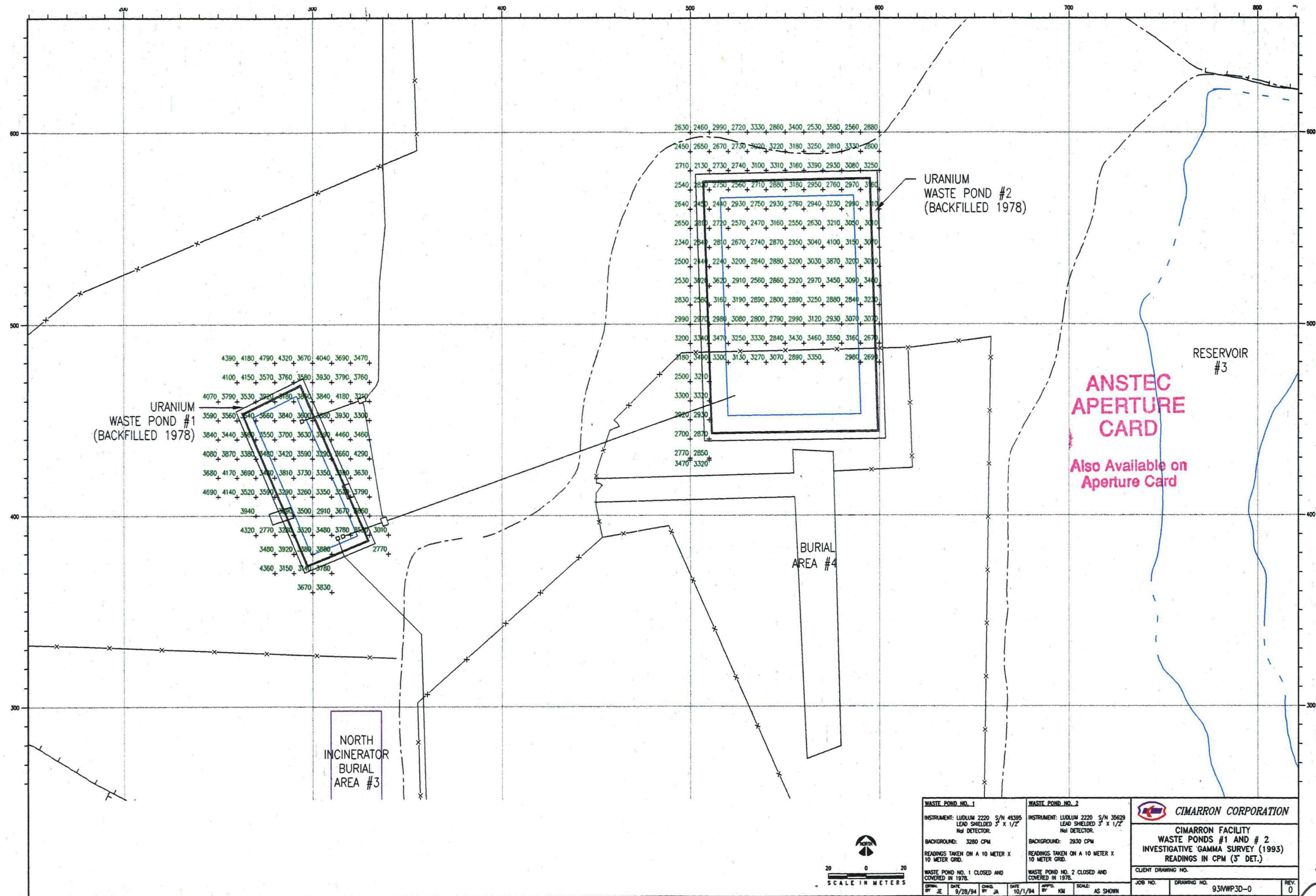












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