NOTICE

All drawings located at the end of the document.

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Post-Closure Care Permit Application

For U S.D.O.E.-Rocky Flats Plant Hazardous & Radıoactıve Mıxed Wastes

CO7890010526

5 October 1988

Volume XIV

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By
Date 4/1/92

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Resource Conservation and Recovery Act

Post-Closure Care Permit Application

For U.S.D O.E.-Rocky Flats Plant Hazardous & Radioactive Mixed Wastes

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5 October 1988

Volume XIV

Prepared by:

ROCKWELL INTERNATIONAL

North American Aerospace Operations

In Association with:

WESTON
MANAGERS DESIGNERS/CONSULTANTS

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REVIEWED FOR CLASSIFICATION/UCNI
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Date 4/1/92

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RCRA POST-CLOSURE CARE PERMIT
CONTENTS OF VOLUMES

SECTION	VOLUME
POST-CLOSURE CARE PERMIT	I
Sections A through K	II
	III
	IV
CLOSURE PLANS	
APPENDIX I-2	
Solar Evaporation Ponds	V
	VI
	VII
	VIII
APPENDIX I-3	
Present Landfill	IX
	X
	XI
APPENDIX I-4	
West Spray Field	XII
	XIII
APPENDIX I-5	
Original Process Waste Lines	XIV
	XV
	XVI
APPENDIX I-6	
Container Storage Facilities	XVII
APPENDIX I-7	
Building 443 No. 4 Fuel Oil Tank	XVIII
APPENDIX I-8	
Hazardous Waste Storage Area, SWMU No. 203	XIX
APPENDIX I-9	
Original Uranium Chip Roaster	XX
APPENDIX I-10	
Building 444 Acid Dumpsters	XXI
APPENDIX I-11	
Bench Scale Treatment Unit, No. 32	XXII
APPENDIX I-12	
Acid Dumpsters and Solvent Dumpsters	XXIII

ORIGINAL PROCESS WASTE LINES

CLOSURE PLAN

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS PLANT
GOLDEN, COLORADO

OCTOBER 3, 1988

ROCKWELL INTERNATIONAL
NORTH AMERICAN AEROSPACE OPERATIONS
ROCKY FLATS PLANT

CLOSURE PLAN

ORIGINAL PROCESS WASTE LINES

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS PLANT
GOLDEN, COLORADO
OCTOBER 3, 1988

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CLOSURE PLAN
ORIGINAL PROCESS WASTE LINES

TABLE OF CONTENTS

1.0	INTRODUCTION	1-1
1.1	Description of the Rocky Flats Plant	1-1
	1.1.1 Location and Operator	1-1
	1.1.2 Mission	1-3
	1.1.3 Brief History	1-4
1.2	Description of the Original Process Waste Lines	1-6
	1.2.1 Introduction	1-6
	1.2.2 Past Use	1-7
	1.2.3 Process Waste Lines	1-8
	1.2.3.1 Introduction	1-8
	1.2.3.2 Construction Details	1-10
	1.2.3.3 Transfer of Process Waste	1-12
	1.2.3.4 Releases	1-12
	1.2.3.5 Disposition of the Lines	1-15
	1.2.4 Process Waste Tanks	1-17
	1.2.4.1 Introduction	1-17
	1.2.4.2 Construction Details	1-19
	1.2.4.3 Storage of Process Waste	1-19
	1.2.4.4 Releases	1-21
	1.2.4.5 Disposition of the Tanks	1-22
1.3	Maximum Waste Inventory	1-25
1.4	Description of Auxiliary Equipment	1-27
1.5	Final Closure Plan Summary	1-28
	1.5.1 Closure Objectives	1-28
	1.5.2 Closure Plan	1-28
	1.5.3 Closure Schedule	1-32
	1.5.4 Justification for Extension of Schedule	1-34
	1.5.5 Protection of Human Health and the Environment	1-36
1.6	Administration of Closure	1-40
1.7	Closure Cost Estimates and Financial Assurance	1-40

2.0 REMOVAL, TREATMENT AND DISPOSAL OF WASTE FROM TANKS AND LINES 2-1

2.1 Introduction 2-1

2.2 Maximum Amount of Remaining Waste 2-1
2.2.1 Tanks 2-1
2.2.2 Lines 2-2

2.3 Pretreatment 2-3

2.4 Removing, Treating or Disposing Inventory 2-3
2.4.1 Introduction 2-3
2.4.2 Waste Characterization 2-3
2.4.3 Methodology for Selection of a Waste Management Procedure 2-6

2.5 Schedule for Residual Waste Removal, Treatment and Disposal 2-7
2.5.1 Tanks 2-7
2.5.2 Lines 2-7

3.0 CLOSURE PERFORMANCE CRITERIA FOR LINES, TANKS, SOIL AND GROUND WATER 3-1

3.1 Introduction 3-1

3.2 Lines 3-2
3.2.1 Background 3-2
3.2.2 Quantity of Pipes 3-3
3.2.3 Past Decontamination 3-4
3.2.4 Closure Alternatives 3-5
3.2.5 Closure Performance Standard 3-7
3.2.6 Schedule 3-8

3.3 Tanks 3-9
3.3.1 Background 3-9
3.3.2 Quantity of Tanks 3-10
3.3.3 Past Decontamination 3-10
3.3.4 Closure Alternatives 3-12
3.3.5 Closure Performance Standard 3-13
3.3.6 Schedule 3-14

3.4 Soil 3-14
3.4.1 Background 3-14
3.4.2 Volume of Contaminated Soil 3-15
3.4.3 Soil Characterization 3-15
3.4.4 Closure Alternatives 3-19
3.4.5 Closure Performance Standard 3-22
3.4.5.1 Indicator Parameter Selection 3-23
3.4.5.2 Indicator Parameter Concentration Levels 3-28
3.4.6 Schedule 3-32

3.5 Ground Water 3-34
3.5.1 Background 3-34
3.5.2 Volume of Contaminated Ground Water 3-34
3.5.3 Ground-Water Quality 3-34
3.5.4 Closure Alternatives 3-35
3.5.5 Closure Performance Standard 3-36
3.5.6 Schedule 3-36

4.0 CLOSURE ALTERNATIVE OF CAP AND COVER 4-1

4.1 Introduction 4-1

4.2 Demolition 4-2

4.3 Regrading 4-2

4.4 Cap 4-4
4.4.1 Extent of Cap 4-5
4.4.2 Cap Design 4-5
4.4.3 Type of Materials 4-7
4.4.4 Depth of Materials 4-9
4.4.5 Volume of Materials 4-10
4.4.6 Source of Materials 4-10
4.4.7 Cap Stability 4-11
4.4.8 Differential Settlement 4-12
4.4.9 Infiltration Control 4-12
4.4.10 Surface Drainage Control 4-13
4.4.11 Subsurface Drainage Control 4-14
4.4.12 Construction Procedures 4-14

4.5 Cover 4-15

4.6 Quality Assurance/Quality Control Procedures 4-18
4.6.1 Quality Control 4-19
4.6.2 Quality Assurance 4-20

4.7 Health and Safety Plan 4-21

4.8 Maintenance of Final Cover 4-23

5.0 CLOSURE ALTERNATIVE OF REMOVAL AND DISPOSAL OF LINES, TANKS, SOIL AND GROUND WATER 5-1

5.1 Introduction 5-1

5.2 Removal, Packaging and Disposal 5-2

5.3 Site Restoration 5-4

5.4 Air Monitoring 5-6

5.5 Access Control 5-7

5.6 Dust Control 5-8

5.7 Health and Safety Plan 5-8

6.0 DECONTAMINATION OF TANKS, LINES AND EQUIPMENT 6-1

6.1 Introduction 6-1

6.2 Decontamination Procedures 6-1
6.2.1 Tanks 6-1
6.2.2 Lines 6-2
6.2.3 Auxiliary Equipment 6-2
6.2.4 Construction Equipment 6-3

6.3 Evaluating Radioactive Contamination 6-5
6.3.1 Surveying for Alpha 6-5
6.3.2 Surveying for Beta-Gamma 6-6

6.4 Decontamination Facility 6-8

7.0 GROUND-WATER MONITORING 7-1

7.1 Introduction 7-1

7.2 Ground-Water Monitoring 7-1

8.0 CLOSURE CERTIFICATION 8-1

8.1 Certification Requirements 8-1

8.2 Activities Requiring Inspections by a Registered Professional Engineer 8-1

8.3 Anticipated Schedule of Inspections by a Registered Professional Engineer 8-2

9.0 SITE SECURITY 9-1

REFERENCES

LIST OF FIGURES

FIGURE 1-1 - VICINITY MAP 1-2

FIGURE 1-2 - SCHEMATICS OF TANKS 1-20

FIGURE 1-3 - SCHEDULE OF ORIGINAL PROCESS WASTE LINES CLOSURE ACTIVITIES 1-33

FIGURE 3-1 - SOIL CLOSURE ACTIVITIES FLOW DIAGRAM 3-20

FIGURE 4-1 - TYPICAL CROSS-SECTIONS FOR CAP AND COVER ALTERNATIVES 4-6

LIST OF PLATES

PLATE I - ORIGINAL PROCESS WASTE LINES LOCATION MAP

PLATE II - CLOSURE PLAN ACTIVITY DIAGRAM

LIST OF TABLES

TABLE 1-1 - SUMMARY OF ORIGINAL PROCESS WASTE LINES 1-11

TABLE 1-2 - SUMMARY OF ORIGINAL PROCESS WASTE TANKS 1-18

TABLE 3-1 - RESULTS OF SOIL ANALYSES FOR NITRATES AND PLUTONIUM 3-17

TABLE 3-2 - HAZARDOUS SUBSTANCE LIST (HSL) - VOLATILE ORGANICS 3-25

TABLE 3-3 - HAZARDOUS SUBSTANCE LIST (HSL) - METALS 3-26

TABLE 3-4 - INDICATOR PARAMETERS AND CONTAMINANT PERFORMANCE LEVELS 3-33

LIST OF APPENDICES

APPENDIX 1 - ORIGINAL PROCESS WASTE LINES
SITE UTILITY LOCATION MAPS

APPENDIX 2 - ORIGINAL PROCESS WASTE LINES DATA SUMMARY
SHEETS

Appendix 2.1 - Pipes
Appendix 2.2 - Tanks

APPENDIX 3 - REFERENCE DOCUMENTS

APPENDIX 4 - ORIGINAL PROCESS WASTE LINES
GEOLOGIC CHARACTERIZATION REPORT

APPENDIX 5 - CEARP PHASE 2: INSTALLATION GENERIC
MONITORING PLAN (IGMP); SAMPLING PLAN

APPENDIX 6 - SITE CHARACTERIZATION PLAN;
ORIGINAL PROCESS WASTE LINES

APPENDIX 7 - CEARP PHASE 2: INSTALLATION GENERIC
MONITORING PLAN (IGMP);
QUALITY ASSURANCE/QUALITY CONTROL PLAN

APPENDIX 8 - CEARP PHASE 2: INSTALLATION GENERIC
MONITORING PLAN (IGMP);
HEALTH AND SAFETY PLAN

1.0 INTRODUCTION

1.1 Description of the Rocky Flats Plant

1.1.1 Location and Operator

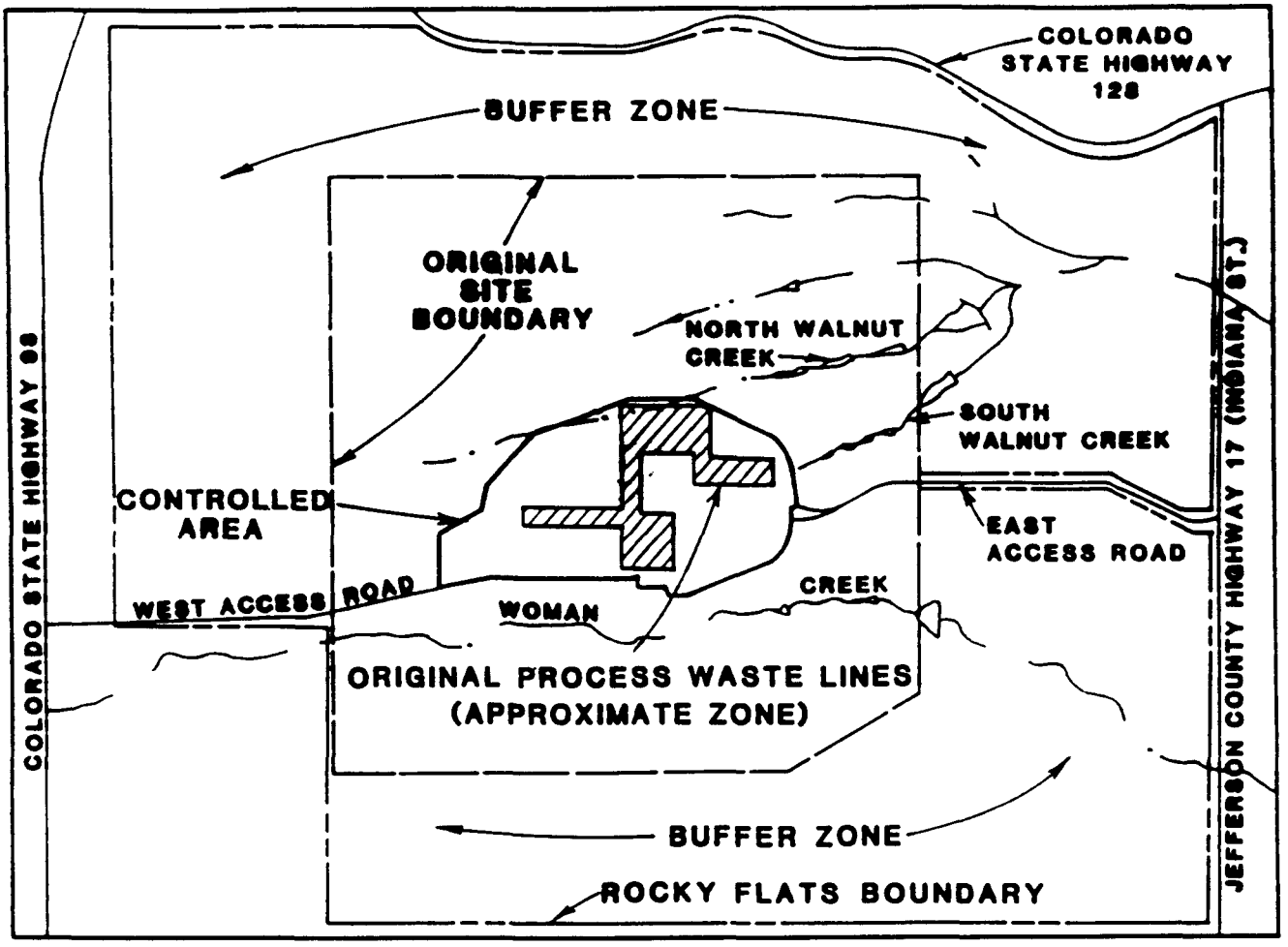
The U.S. Department of Energy's Rocky Flats Plant is located in north-central Colorado, northwest of the City of Denver (Figure 1-1). The Plant is located in Sections 1 through 4 and 9 through 15 of T. 2 S., R. 70 W. The facility's EPA identification number is CO7890010526. The mailing address is:

U.S. Department of Energy
Rocky Flats Plant
P.O. Box 928
Golden, Colorado 80402

The facility contact is:

Albert E. Whiteman, Area Manager
Phone: (303) 966-2025

The facility covers approximately 6,550 acres of federally owned land in northern Jefferson County, Colorado, which is centered at 105° 11' 30" west longitude, 39° 53' 30" north latitude. The facility is approximately 16 miles northwest of Denver and nine to 12 miles from the neighboring



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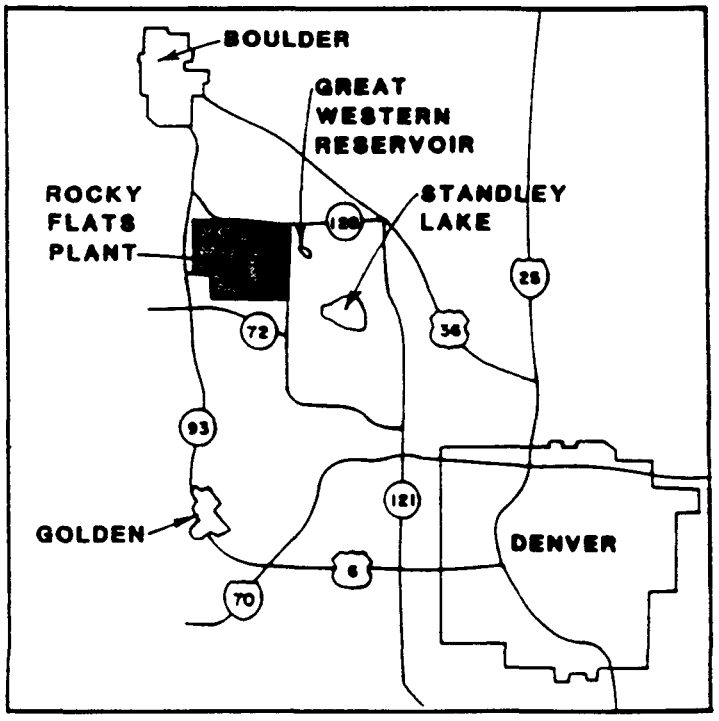
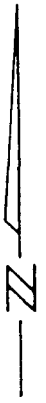


APPROXIMATE SCALE 1"=40,000'



6 064 87	Chen & Associates	VICINITY MAP	Fig 1-1

communities of Boulder, Broomfield, Golden and Arvada. It is bounded on the north by State Highway 128, on the west by a parcel of land east of State Highway 93, on the south by a parcel of land north of State Highway 72 and on the east by Jefferson County Highway 17. Access to the plant is from an east access road exiting from Jefferson County Highway 17 and a west access road exiting from State Highway 93.

The facility is situated at an elevation of approximately 6,000 feet. It is on the eastern edge of a terrace known as Rocky Flats. The terrace is approximately five miles wide and flanks the eastern edge of the foothills of the Rocky Mountains.

1.1.2 Mission

The Rocky Flats Plant is a government-owned and contractor-operated facility. It is part of a nationwide nuclear weapons research, development and production complex administered by the Albuquerque Operations Office of the U.S. Department of Energy (DOE). The prime operating contractor for the Rocky Flats Plant is Aerospace Operations of Rockwell International.

The facility produces metal components for nuclear weapons; therefore, its product is directly related to national defense. The facility fabricates components from plutonium, uranium, beryllium and stainless steel. Other production activities include chemical recovery and purification of recyclable transuranic radionuclides, metal fabrication and assembly and related quality control functions. Other activities include research and development in metallurgy, machining, non-destructive testing, coatings, remote engineering, chemistry and physics. Parts made at the plant are shipped elsewhere for final assembly (U.S. Department of Energy, 1987a).

1.1.3 Brief History

Construction of the Rocky Flats Plant was approved by the U.S. Government in 1951 as an addition to the nation's nuclear weapons production complex. Operations began in 1952 under direction of the Atomic Energy Commission. The original facility covered an area of approximately 2,520 acres (Figure 1-1).

A buffer zone was added in 1974-1975 to enlarge the plant to its present size of approximately 6,550 acres. The buffer

zone had been used for grazing cattle and horses and is enclosed within a cattle fence which is posted with signs indicating restricted access. Two office buildings, a warehouse, firebreaks, holding ponds along three water courses, environmental monitoring instrumentation, a sanitary landfill area, a salvage yard, power lines, inactive gravel pits, clay pits and two target ranges are located in the buffer zone. Additionally, a former wind energy test site now used as an office building and a Ground Wave Emergency Network (GWEN) tower being installed by the U.S. Air Force are located in the buffer zone.

Major facility structures are located in a 400-acre controlled area near the center of the property. Production, research and development facilities at the plant are located in the controlled area which contains approximately 134 structures with a combined floor space of approximately 2.67 million square feet.

1.2 Description of the Original Process Waste Lines

1.2.1 Introduction

The information presented in this closure plan regarding the existence, location, removal, decontamination, reuse, and operating procedures of the original process waste lines (OPWL) has been compiled following extensive research. The research included both interviews with past and present Dow Chemical and Rockwell International employees, and a literature search.

The employees contacted and interviewed as part of the research included building supervisors who are familiar with the operation of the systems within their buildings, health physics personnel familiar with health and safety monitoring at Rocky Flats, and other employees with a general knowledge of the OPWL.

The literature search included reviewing reports, letters and memoranda available in the Rocky Flats Environmental Master File; the May 1986 Rocky Flats Underground Storage Tank report; utility drawings; and the December 1985 Rocky Flats Plant Conceptual Design Report for Environmental

Improvement Projects discussing the original process waste lines. Selected reference documents are included in Appendix 3.

A computer search of catalogued drawings, using key words in the drawing title, was performed. The applicable drawings included site utility drawings and plans and specifications for removal and abandonment of the original process waste lines.

These sources, when combined, have provided the most complete information about the OPWL that is available.

1.2.2 Past Use

The original process waste lines (OPWL) consist of a system of tanks and associated lines. The system was constructed to transport and temporarily store process wastes from point of origin to on-site treatment points. The system was placed into operation in 1952 and additions were made to the system through 1975. The original system was replaced over the period of 1975 to 1983 by the new process waste system. Some of the tanks and lines from the original system have

been incorporated into the new process waste system or the fire water deluge collection system.

The original system is known to have transported or stored various aqueous process wastes containing low-level radioactivity, nitrates, caustics and acids (Maas, 1986). Small quantities of other liquids were also introduced in the system including pickling liquor from foundry operations; medical decontamination fluids; miscellaneous laboratory liquids from Building 123; and laundry effluent from Buildings 730 and 778 (Maas, 1986 and U.S. Department of Energy, 1986a).

1.2.3 Process Waste Lines

1.2.3.1 Introduction

The original process waste lines (OPWL) connect Areas 400, 500, 700, 800 and 900 (Maas, 1986 and Rockwell, 1986a). Fifth-seven designated pipe sections in the OPWL have a total length of approximately 35,000 feet, and 39 designated tank locations comprise a total of 73 tanks.

A topographic map with a scale of one inch equals 200 feet and two-foot contour intervals of the plant area comprising the OPWL, along with approximate locations of the OPWL pipes and tanks, are shown on Plate I. Fifteen large scale (one inch equals 40 feet) utility location maps showing more detailed locations of the OPWL pipes and tanks are presented in Appendix 1.

The OPWL is basically divided into three zones: west; north-south; and east. The west zone begins at Building 123 and follows Cottonwood Avenue east to where it joins the north-south zone at a junction box on Eighth Street west of Building 879. This zone includes Buildings 122, 123, 429, 441, 443, 444 and 447.

The north-south zone extends from Building 887 (south of Building 881) to the north half of the 700 area. This zone includes Buildings 828, 881, 883, 887, 889, 865 and 886 in the 800 area, Buildings 528, 559 and 561, in the 500 area, and Buildings 707, 731, 778, 776, 777, 779, 730, 771, 771C, 728 and 774 in the 700 area.

The east zone begins at the Building 774 complex and extends to the wastewater treatment complex, Building 995, with a

single line extending eastward to Pond B-2 on South Walnut Creek. This zone includes the 207 solar evaporation ponds and Buildings 990 and 995.

1.2.3.2 Construction Details

The lines in the OPWL range in age from nine to 36 years. They vary from one inch to ten inches in diameter and are composed of cast iron, polyethylene, vitrified clay, cement asbestos, saran lined steel, stainless steel, carbon steel, fiberglass, PVC, pyrex glass and teflon (Maas, 1986 and Rockwell, 1986a).

The lines are generally buried three to five feet below the ground surface. The as-built drawings do not contain sufficient detail to determine the exact depth of pipe. The lines are identified on Plate I with a pipe reference number. The pipe reference numbers are summarized in Table 1-1, along with the building area, pipe diameter, length, the pipe material and the dates of installation and abandonment.

Table 1-1
Original Process Waste Lines

Pipe Reference	Building Area	Pipe Diameter	Pipe Length	Pipe Material	Date of Installation	Date of Abandonment
P - 1	123	3 inside 4	180 ft	Polyethylene in Steel	1968	June 1982
P - 2	123	4 in.	452 ft	Cast Iron	1952	June 1982
P - 3	441	4 in	162 ft	Vitrified Clay	1952	June 1982
P - 4	441-879	4 in	1750 ft	Cast Iron	1952	April 1981
P - 5	444	2,3,4&6 in	1561 ft	Cast Iron	1952	April 1981
P - 6	881	3 in	1300 ft	Steel/Stainless	1957	Dec. 1980
P - 7	881-887	2&4 in	440 ft	Stainless Steel/C I	1952	Dec. 1980
P - 8	881-887	2 in	150 ft	Stainless Steel/C I	1952	Dec. 1980
P - 9	883	3 in	504 ft	Steel/Stainless	1957	Mar. 1984
P - 10	884-865	3 in.	1190 ft	Stainless Steel	1968	May 1982
P - 11	884	3 inside 10	165 ft	New FG inside old VCP	1975	Mar 1984
P - 12	708	3 inside 10	573 ft	Saran-lined Steel in VCP	1952	Mar 1984
P - 13	708	3 inside 4	523 ft	Ribbed Hose in Fiberglass	1975	Mar 1984
P - 14	707	3 inside 10	942 ft	Saran-lined Steel in VCP	1952	1968
P - 15	707	3&10 in	878 ft	Stainless Steel	1968	Mar 1984
P - 16	528	1 5,2 5&3in	170 ft	Polyvinyl Chloride	1968	July 1982
P - 17	559	3,4&6 in	1130 ft	Pyrex (Glass)	1968	July 1982
P 18	561	2 75 in	150 ft	Rigid Teflon	1968	July 1982
P - 19	707	3 in	980 ft	Stainless Steel	1968	Mar. 1984
P - 20	777	3 in	499 ft	Stainless Steel	1968	Mar 1984
P - 21	774	3 in	386 ft	Stainless Steel	1952	Mar 1984
P - 22	771	6 in	1335 ft	Cast Iron	1966	May 1982
P 23	771	10 in	403 ft	Fiberglass	1969	May 1982
P 24	771	6 in	306 ft	Cast Iron	1966	May 1982
P 25	774	3 in	575 ft	SS/CI/Steel	1972	May 1982
P - 26	774	Two 1 5 in	2750 ft	Polyvinyl Chloride	1972	Late 1970's
P - 27	774	Two 3 in	250 ft	Stainless Steel	1968	Active
P - 28	774	Two 3 in	260 ft	Stainless Steel	1972	Active
P - 29	774	4 in	505 ft	Stainless Steel	1952	Active
P 30	777	2,3,4&6 in	1377 ft	Steel	1957	Oct 1982
P 31	771 774	1&4 in	167 ft	Steel	1952	1972
P - 32	777	4&6 in	907 ft	VCP/Steel/Cast Iron	1957	Dec. 1982
P - 33	771 774	3 in	160 ft	Steel	1966	1972
P - 34	774	3 in	305 ft	Stainless Steel/Steel	1952	Mar 1984
P 35	Pond 207	3 in	144 ft	Steel	1952	Active
P 36	Pond 207	3 in	599 ft	Stainless Steel/PVC	1965	Dec. 1982
P - 37	730 207	3 in	1500 ft	Steel/PVC/VCP	1957	Dec 1982
P - 38	Pond 207	10 in	800 ft	Vitrified Clay/PVC	1952	Dec. 1982
P 39	988-207	6 in	2190 ft	Vitrified Clay	1957	Dec. 1982
P 40	Pond B 2	6 in	1617 ft	Fiberglass	1972	Dec. 1982
P 41	779	3 in	1537 ft	VCP/Black Iron/Stainless	1957	Dec 1982
P 42	779	3 in	280 ft	Stainless	1957	Dec 1982
P 43	703	3 in	103 ft	Steel	1952	Dec 1982
P 44	703	3 in	92 ft	Steel	1952	Dec 1982
P 45	Pond 207	6 in	125 ft	Vitrified Clay	1952	c 1982
P 46	Pond 207	3 in	135 ft	Steel	1953	UK
P 47	Pond 207	3 in	125 ft	Cement Asbestos	1953	UK
P - 48	Pond 207	UK	193 ft	UK	1957	UK
P 49	Pond 207	8 in	85 ft	Cast Iron	1957	UK
P 50	Pond 207	8 in	105 ft	Cast Iron	1960	UK
P 51	778	4 & 6 in	170 ft	Black Iron	1957	1978
P 52	443	4 in	280 ft	UK	1952	1978
P 53	881	2 in	78 ft	Stainless Steel	1952	UK
P 54	881	3 in	140 ft	Stainless Steel	1952	UK
P 55	881	4 in	158 ft	Stainless Steel	1952	UK
P 56	771 774	3 1",2 2"	835 ft	Plastic Hose	UK	UK
P 57	122	4 in	20 ft	Cast Iron	1952	UK

Notes UK = Unknown , Ongoing research is being conducted to determine this information

1.2.3.3 Transfer of Process Wastes

The original process waste lines (OPWL) was not a continuously flowing system. The system was designed to handle one process waste at a time. Prior to shipment of the process waste, an analysis of the waste was made. This analysis was forwarded to Building 774 and a request was made for permission to transfer the process waste. When permission to send the waste was granted, the line was pressurized between 20 and 50 psi (International, 1971). Subsequent to pressurization, the line was opened to allow the process waste to flow under gravity drainage. During this time, the volume of process waste was monitored by gauges at both the points of origin and treatment to ensure that the entire shipment was received.

1.2.3.4 Releases

Releases of process waste from the lines occasionally occurred during the long operating life of the system (Maas, 1986 and U.S. Department of Energy, 1986a). Releases have occurred as a result of:

- leakage of pipe fittings including joints, elbows, reducers, junction boxes and valve vaults;

- breakage of the lines due to construction activities, the settlement of man-placed soil fill or the settlement of building foundations;
- overflows at junction boxes and valve vaults; and
- deterioration of the lines due to the chemistry of the process wastes.

The approximate locations of reported releases are shown on Plate I, and on the Original Process Waste Lines Site Utility Location Maps in Appendix 1, as stippled areas. The size of the areas has been exaggerated for presentation purposes and does not represent the exact lateral extent of the releases.

The lateral and vertical extent of the releases are unknown, but based on past reports are expected to be confined to the trench backfill materials. The typical trench is approximately three feet wide and extends to the depth of the pipe. Sand was commonly used to bed the pipe in the bottom of the trench (Rockwell, 1988b).

Quick identification of some releases occurred due to monitoring of the gauges at both the points of origin and destination. In many reported incidents, the releases

appeared at the ground surface thus permitting early detection (Maas, 1986).

The reason for releases appearing at the ground surface is the relatively low permeability of the alluvial soils in which the lines are laid. For comparison, the permeability of a clayey sand and gravel matrix similar to the Rocky Flats Alluvium is approximately 10^{-5} cm/sec; the permeability of fine to medium sand used for pipe bedding and backfill is approximately 10^{-2} cm/sec. Therefore, the relatively low permeability of the surrounding alluvial soil causes releases to preferentially migrate in the backfill materials rather than migrate into the surrounding soil. Surface releases occur when high system release rates overload the absorption capacity of the limited volume high permeability sand backfill.

A review of operating records indicates that three of the stippled areas shown on Plate I received repeated releases (Maas, 1986 and U.S. Department of Energy, 1986a). The first is located in the north-south zone, between Central Avenue and the valve vault west of Building 707. This area has undergone settlement of man-placed soil fill resulting in two programs of line replacement to repair damage (Maas,

1986 and Rockwell, 1986b). Overflows at the valve vault have also occurred (Maas, 1986 and U.S. Department of Energy, 1986a).

The two other areas are the valve vault and junction boxes north of Tank 207 (T-29 on Plate I) and the old process waste outfall south of Building 995 (Maas, 1986 and U.S. Department of Energy, 1986a).

1.2.3.5 Disposition of the Lines

All lines that were part of the OPWL and were not converted to the new process waste system are summarized in Table 1-1. The line designations are P-1 through P-57. All of these lines have been abandoned and left in place. Small segments of lines within the interior of buildings were removed at the time of their abandonment. These segments mainly consist of riser pipes at the origins of the lines that were above the floor level.

Lines beneath buildings were decontaminated by flushing with water until the water appeared to have removed significant amounts of waste residues. These lines were sealed at wall and floor penetrations with approximately six to 12 inches

of "non-shrinking sealant cement" and abandoned in place. Details of pipe seals are shown on applicable Rockwell International drawings for abandonment of the original process waste lines.

Underground lines outside of the buildings were not sealed or decontaminated. These lines were also abandoned in place. Portions of some of the lines may have been removed during subsequent construction activities. Available data regarding line disposition, including possible removal, is tabulated on the original process waste lines data summary sheets in Appendix 2.

For the activities of this closure plan, it is assumed that all lines are in place unless procedures in the sequence of closure activities determine whole, or portions of, the lines are removed. Even locations at which the OPWL have been removed may still represent a source of potential environmental hazard. In such locations, residual soil contamination may be present, despite line removal, and the contaminated soil may represent a source of continuing release of contaminants to ground water.

All of the lines listed in Table 1-1 will be subject to the requirements of this closure plan. Original process waste lines that were converted to the new process waste system are permitted under the RCRA Part B Operating Permit Application (U.S. Department of Energy, 1987a). Converted lines are not identified in this closure plan.

1.2.4 Process Waste Tanks

1.2.4.1 Introduction

The original process waste tanks are designated T-1 through T-39. The tank reference numbers are summarized in Table 1-2 along with the building number, number of tanks at each location, tank type, tank material, age, volume, and date of abandonment (Maas, 1986 and Rockwell, 1986a). The corresponding Rocky Flats Number and Solid Waste Management Unit Number for each tank is presented in the Original Process Waste Lines Data Summary Sheets in Appendix 2.2.

The location of the tanks is shown on Plate I. The OPWL tanks are located in Areas 100, 400, 500, 700, 800 and 900 (Maas, 1986 and Rockwell, 1986a). The tank locations are

Table 1 2
Original Process Waste Tanks

	Tank Reference	Building No	No. of Tanks	Tank Type	Tank Construction	Age of Tank	Volume of Tank	Date of Abandonment
	T - 1	122	1	AG1	Stainless Steel	33 yrs	800 gal	Jan. 1984
	T - 2	441	1	SU/UG	Concrete	36 yrs	3000 gal	June 1982
	T - 3	429	1	UG	Concrete	36 yrs	3000 gal	June 1982
	T - 4	447	2	SU	Concrete	26 yrs.	UK	April 1982
	T 5	444	5	AG2	Steel	36 yrs	4000 gal	April 1981
	T 6	444	2	UG	Concrete	36 yrs	400 gal	April 1981
	T 7	528	1	AG2	Concrete	20 yrs	UK	July 1982
	T - 8	728	2	SU	Concrete	36 yrs	25000 gal	May 1984
	T - 9	730	2	SU	Concrete	33 yrs	22500 gal	Oct 1984
	T - 10	730	2	UG	Concrete	33 yrs	4500 gal	Dec. 1982
*	T - 11	731	2	SU/UG	Concrete	29 yrs	2000 gal	July 1982
	T 12	771	2	UG	Concrete	36 yrs	20000 gal	May 1984
	T 13	774	1	SU	Concrete	36 yrs	~600 gal	1972
	T - 14	774	1	UG	Concrete	36 yrs	30000 gal.	July 1982
	T - 15	774	2	UG	Concrete	19 yrs	3750 gal	1970
	T 16	774	2	UG	Concrete	36 yrs	14000 gal	1970
	T 17	774	4	UG	Concrete	19 yrs	7500 gal	1970
	T 18	778	1	UG	Concrete	UK	UK	Oct. 1982
	T - 19	779	2	UG	Concrete	24 yrs	1000 gal	Dec. 1982
	T 20	779	2	UG	Concrete	24 yrs	8000 gal	Dec 1982
	T 21	828	1	SU	Concrete	25 yrs	250 gal	1978
	T 22	828	2	AG2	Stainless Steel	25 yrs	250 gal	1978
	T 23	865	2	UG	Concrete	9 yrs	3000 gal	May 1982
*	T 24	887	7	AG2	Stainless Steel	36 yrs	2700 gal	Dec 1980
*	T 25	883	2	AG2	Steel	36 yrs	750 gal	Aug 1984
*	T 26	883	3	AG2	Steel	23 yrs	1000 gal	Aug 1984
	T 27	886	1	AG1	Steel	UK	300 gal	1978
	T 28	889	2	UG	Concrete	23 yrs	1000 gal	May 1983
	T 29	207	1	OG	Steel	38 yrs	200000 gal	1987(?)
*	T 30	731	1	SU	Concrete	29 yrs	UK	JULY 1982
	T 31	990	1	OG	Steel	UK	UK	UK
*	T 32	887	1	SU	Concrete	17 yrs	131160 gal	Dec 1980
	T 33	561	1	AG2	Stainless Steel	UK	5000 gal	July 1982
	T 34	561	2	AG1	Stainless Steel	19 yrs	5000 gal	July 1982
	T 35	561	1	SU	Concrete	19 yrs	UK	July 1982
	T 36	771C	1	AG2	Stainless Steel	23 yrs	500 gal	1984
	T 37	771C	1	SU	Concrete	UK	UK	UK
	T 38	779	1	UG	Concrete	UK	1000 gal	1982
	T 39	881	4	UK	Stainless Steel	36 yrs	250 gal	1952

Notes UK = Unknown Ongoing research is being conducted to determine this information

* = Tanks permitted under RCRA Part B Operating Permit Application

also shown in more detail on the Original Process Waste Lines Site Utility Maps in Appendix 1.

1.2.4.2 Construction Details

The tanks range in age from nine to 38 years. They vary from 250 to 200,000 gallons in volume and are constructed of concrete, steel and stainless steel.

Schematics of the four tank types are presented on Figure 1-2. The tanks and associated designations are:

- above grade (AG1 and AG2);
- underground (UG);
- on grade (OG); and
- sump (SU).

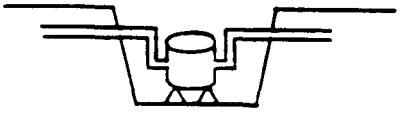
These designations correspond to the column "Tank Type" in Table 1-2.

1.2.4.3 Storage of Process Waste

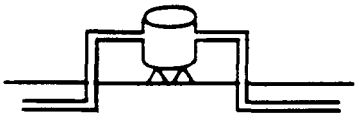
The tanks were used for temporary storage of process waste both at the point of origin prior to transfer through the process waste lines, and at the point of destination prior to treatment and/or disposal.

OPEN TOP SUMP (SU)

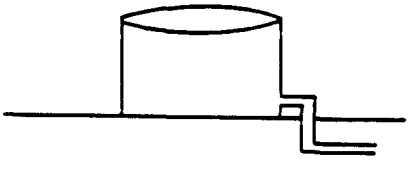
CLOSED TOP UNDERGROUND TANK (UG)



ABOVE GRADE TANK (AG2)



ABOVE GRADE TANK (AG1)



ON GRADE TANK (OG)

6 064 87	Chen & Associates	SCHEMATICS OF TANKS	Fig 1-2

1.2.4.4 Releases

Releases of process waste from the tanks occasionally occurred during the long operating life of the original system (Maas, 1986 and U.S. Department of Energy, 1986a). The releases have occurred as a result of:

- deterioration of the waste tanks from age;
- incompatibility of the process waste with the tank material; and
- overflows due to improper filling of the tank.

Approximate locations of reported releases are shown as stippled areas on Plate I, and on the Original Process Waste Lines Site Utility Location Maps in Appendix 1. The size of these areas has been exaggerated for presentation purposes and does not represent the lateral extent of the release. The lateral and vertical extent of the releases are unknown, but are expected to be confined to backfill materials in the immediate vicinity of the tanks. Sampling activities will be conducted to identify both the lateral and vertical extent of any release, including tank locations where tanks have been removed.

Since abandonment of the OPWL, the underground tank at the southeast corner of Building 559 (Tank Designation T-7) and

north of Building 771 (Tank Designation T-8) have periodically filled with ground water (Hornbacher, 1986; West, 1977; and U.S. Environmental Protection Agency, 1988). The ground water is removed from the tank and treated in the new process waste system.

1.2.4.5 Disposition of the Tanks

All tanks that were part of the original process waste lines (OPWL) system are listed in Table 1-2. The tank designations are T-1 through T-39. Other corresponding designations for the tanks (such as Rocky Flats No. and SWMU No.) are tabulated in Appendix 2.

The disposition of the OPWL tanks falls into one of four categories:

- Incorporated into the new process waste system and permitted under RCRA Part B Operating Permit Application (U.S. Department of Energy, 1987a);
- Removed;
- Active but not permitted under the RCRA Part B Operating Permit Application, such as incorporation into the fire water plenum deluge system; and
- Abandoned in place.

Tanks Permitted Under RCRA Part B Operating Permit Application: All tanks that have been incorporated into the new process waste system are permitted and described in Section D of the Part B Operating Permit Application (U.S. Department of Energy, 1987a). Permitted tanks will be closed in accordance with the Part B permit and the state-of-the-practice at the time. No action will be initiated under interim status. These tanks are listed as follows:

T-11 Part B Secondary Containment Reference No. 2011
T-24 Part B Permitted Unit No. 40.20 through 40.26
T-25 Part B Permitted Unit No. 40.30 and 40.31
T-26 Part B Permitted Unit No. 40.39 through 40.41
T-30 Part B Secondary Containment Reference No. 2011
T-32 Part B Secondary Containment Reference No. 2014

Tanks Removed: All tanks that have been removed will not require action under this closure plan; however, characterization of the soil in the vicinity of the previous tank location must be evaluated (Section 3.4.3). Based on the data in Appendix 2, tanks that have been removed are as follows:

T-1 - Bldg. 122 - One, 800-gallon stainless tank
T-15 - Bldg. 774 - Two, 3,750-gallon concrete tanks
T-17 - Bldg. 774 - Four, 7,500-gallon concrete tanks
T-18 - Bldg. 778 - One, UK gallon concrete tank
T-33 - Bldg. 561 - One, 5,000-gallon stainless tank

Tanks That Are Active But Not Permitted: Active tanks previously used in the OPWL and not permitted under the RCRA Part B Operating Permit Application will be closed in accordance with the Post-Closure Care Permit and this closure plan. Active tanks include those converted to the fire water plenum deluge system or similar non-permitted systems. The continued active use of the tanks will depend on the selected closure alternatives discussed in Section 3.3.4. Active, non-permitted tanks are reported as follows:

T-2 - Bldg. 441 - One, 3,000-gallon concrete tank
T-8 - Bldg. 728 - Two, 25,000-gallon concrete tanks
T-9 - Bldg. 730 - Two, 22,500-gallon concrete tanks
T-10 - Bldg. 730 - Two, 4,500-gallon concrete tanks
T-31 - Bldg. 990 - One, UK gallon steel tank
T-34 - Bldg. 561 - Two, 5,000-gallon stainless tanks
T-38 - Bldg. 779 - One, 1,000-gallon concrete tank

Tanks That Are Abandoned: The remaining 21 tank locations have not been, or are not known to have been, removed or incorporated into active systems. These tanks include:

T-3 - Bldg. 429 - One, 3,000-gallon concrete tank
T-4 - Bldg. 447 - Two, UK gallon concrete tanks
T-5 - Bldg. 444 - Five, 4,000-gallon steel tanks
T-6 - Bldg. 444 - Two, 400-gallon concrete tanks
T-7 - Bldg. 528 - One, UK gallon concrete tank
T-12 - Bldg. 771 - Two, 20,000-gallon concrete tanks
T-13 - Bldg. 774 - One, 600-gallon concrete tank
T-14 - Bldg. 774 - One, 30,000-gallon concrete tank
T-16 - Bldg. 774 - Two, 14,000-gallon concrete tanks
T-19 - Bldg. 779 - Two, 1,000-gallon concrete tanks
T-20 - Bldg. 779 - Two, 8,000-gallon concrete tanks
T-21 - Bldg. 828 - One, 250-gallon concrete tank
T-22 - Bldg. 828 - Two, 250-gallon stainless tanks

T-23 - Bldg. 865 - Two, 3,000-gallon concrete tanks
T-27 - Bldg. 886 - One, 300-gallon steel tank
T-28 - Bldg. 889 - Two, 1,000-gallon concrete tanks
T-29 - Bldg. 207 - One, 200,000-gallon steel tank
T-35 - Bldg. 561 - One, UK gallon concrete tank
T-36 - Bldg. 771C- One, UK gallon concrete tank
T-37 - Bldg. 771C- One, UK gallon concrete tank
T-39 - Bldg. 881 - Four, 250-gallon stainless tanks

Seven tank locations were cleaned and painted prior to their abandonment or incorporation into the fire water deluge collection systems. These are tanks T-4, T-8, T-9, T-10, T-19, T-20, and T-28. Cleaning and painting was performed by on-site contractors.

The cleaning procedures involved removing waste residues and any accumulated sediment by scraping these materials off the inside walls of the tanks. The insides of the tanks were then covered with at least one coat of paint.

One tank, Tank T-14, was filled with gravel and capped with concrete upon its abandonment.

1.3 Maximum Waste Inventory

A closure plan must include "an estimate of the maximum inventory of wastes in storage or in treatment at any time

during the life of the facility" [6 CCR 1007-3 Section 265.112(a)(2)]. The estimate of the tank's maximum inventory should "always be high enough to ensure that if an inspector came onto the facility, the amount of inventory would not exceed the estimate in the plan, assuming normal operating conditions" (U.S. Environmental Protection Agency, 1981). The inventory should include "the tank's contents and any inventory in other forms of storage directly associated with the tank [e.g., wastes requiring storage and/or treatment in the tank]" (U.S. Environmental Protection Agency, 1981). The intent of 6 CCR 1007-3, Section 265.112(a)(2), as clarified by the U.S. Environmental Protection Agency, 1981, and as applicable to this facility is to provide an estimate of the maximum waste inventory from this date until closure.

Most of the original process waste lines drained freely by gravity. Since the lines were gravity drained, no waste inventory is anticipated. At most, a contaminant residue may coat the inside of the lines. Any waste inventory in the lines will be identified during field investigations for closure as discussed in Section 3.2.4. All lines remaining in place will be fully grouted using tremie methods.

The waste inventory in the tanks is anticipated to consist of residual quantities in some of the tanks which were not painted and cleaned or converted to the fire water plenum deluge system. Waste inventory in the tanks will be checked at the time of closure by visual inspection. Any waste inventory will be treated in the existing process waste system as discussed in Section 2.0.

1.4 Description of Auxiliary Equipment

The auxiliary equipment consisted of multi-stage centrifugal pumps connected to the tanks and lines. The pumps ranged in horsepower from 1 to 10. The pumps were disconnected when the tanks or lines were abandoned, or converted to either the process waste system currently in use or the fire water plenum deluge collection system. The pumps were either decontaminated and used elsewhere at the plant or sent to an approved off-site disposal facility.

1.5 Final Closure Plan Summary

1.5.1 Closure Objectives

This closure plan has been prepared to meet the performance standards of 6 CCR 1007-3, Section 265.111. The promulgated standards require a facility must be closed in a manner that:

- minimizes the need for further maintenance, and
- controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous waste constituents, leachate, contaminated rainfall, or waste decomposition products to the ground or surface waters or to the atmosphere.

1.5.2 Closure Plan

The closure plan for the original process waste lines (OPWL) is divided into Sections 1.0 through 9.0. The sections are divided by major closure activities and closure alternatives as follows:

Section 1.0 is the introduction, which presents a facility description and summarizes the closure plan;

Section 2.0 addresses removal, treatment and disposal of any remaining waste inventory;

Section 3.0 addresses characterization and closure performance criteria for each of four potentially contaminated components of the system: 1) lines; 2) tanks; 3) adjacent soil; and 4)ground water;

Section 4.0 addresses the closure alternative of capping and covering with contaminated lines, tanks and adjacent soil remaining in place;

Section 5.0 addresses the closure alternative of removal of contaminated lines, tanks and adjacent soil for "clean" closure'

Section 6.0 addresses decontamination of tanks for "clean" closure, and decontamination of auxiliary and construction equipment associated with the previous operation of the OPWL and/or closure activities;

Section 7.0 addresses ground-water monitoring during the interim closure period;

Section 8.0 addresses closure certification; and

Section 9.0 addresses site security.

The closure plan addresses four separate components of the OPWL: 1) the lines; 2) the tanks; 3) the adjacent soil; and 4) the ground water. Based on the closure performance criteria for the lines and tanks, one of three closure alternatives for the lines and tanks will be implemented:

1) Decontaminate tanks, and "clean" close with no post-closure care and monitoring;

2) Seal or place cap and cover over tanks as a landfill with contaminated tanks remaining in place. Closure with contaminated tanks remaining in place will require

post-closure care and monitoring (6 CCR 1007-3, Section 265 Subpart G and 265.310).

3) Fully grout lines to immobilize any remaining residual waste; and/or

4) Remove the line or tank and dispose at an approved disposal facility, with no post-closure care and monitoring;

The soil adjacent to the OPWL lines and tanks, including soil adjacent to lines and tanks that have been removed, will be characterized to evaluate potential contamination from uncontrolled releases. Based on the closure performance criteria for the soils, one of three closure alternatives for the soil will be implemented:

1) No action for soils that meet the closure performance criteria, with no post-closure care and monitoring;

2) Remove contaminated soil and dispose at an approved disposal facility, with no post-closure care and monitoring; or

3) Place a cap and cover over contaminated soil and close as a landfill with waste in place. Closure with waste in place will require post-closure care and monitoring (6 CCR 1007-3, Section 265 Subpart G and 265.310).

Soils contaminated with radionuclides will be removed and disposed at an approved facility, with no option for capping and covering, if the activity of transuranic compounds

exceeds 20 pCi/gm as determined by the site characterization study (Section 3.4.3 and Appendix 6).

All lines, tanks and soil beneath building areas will remain in place due to the nature of the Rocky Flats Plant and the potential for disruption. In these cases, the building roof and floors will provide any required capping and covering. Since potentially contaminated soils may exist beneath buildings, thus implementing the alternative for capping and covering without soil sampling, post-closure care and monitoring will be conducted for the life of the Rocky Flats Plant. Upon closing Rocky Flats, all remaining facilities, including the OPWL, will be removed and/or handled in a manner consistent with state-of-the-practice at that time.

Ground-water quality will be evaluated to determine if corrective action is required to meet 6 CCR 264 Subpart F. If necessary, the type of ground-water corrective action will be determined and implemented as part of an area-wide ground-water corrective action.

The activities necessary to complete closure and, if necessary, comply with the ground-water corrective action requirements of 6 CCR 264 Subpart F, are indicated on the

activity diagram in Plate II. Details of the closure activities identified on the activity diagram are addressed in the referenced sections of this closure plan.

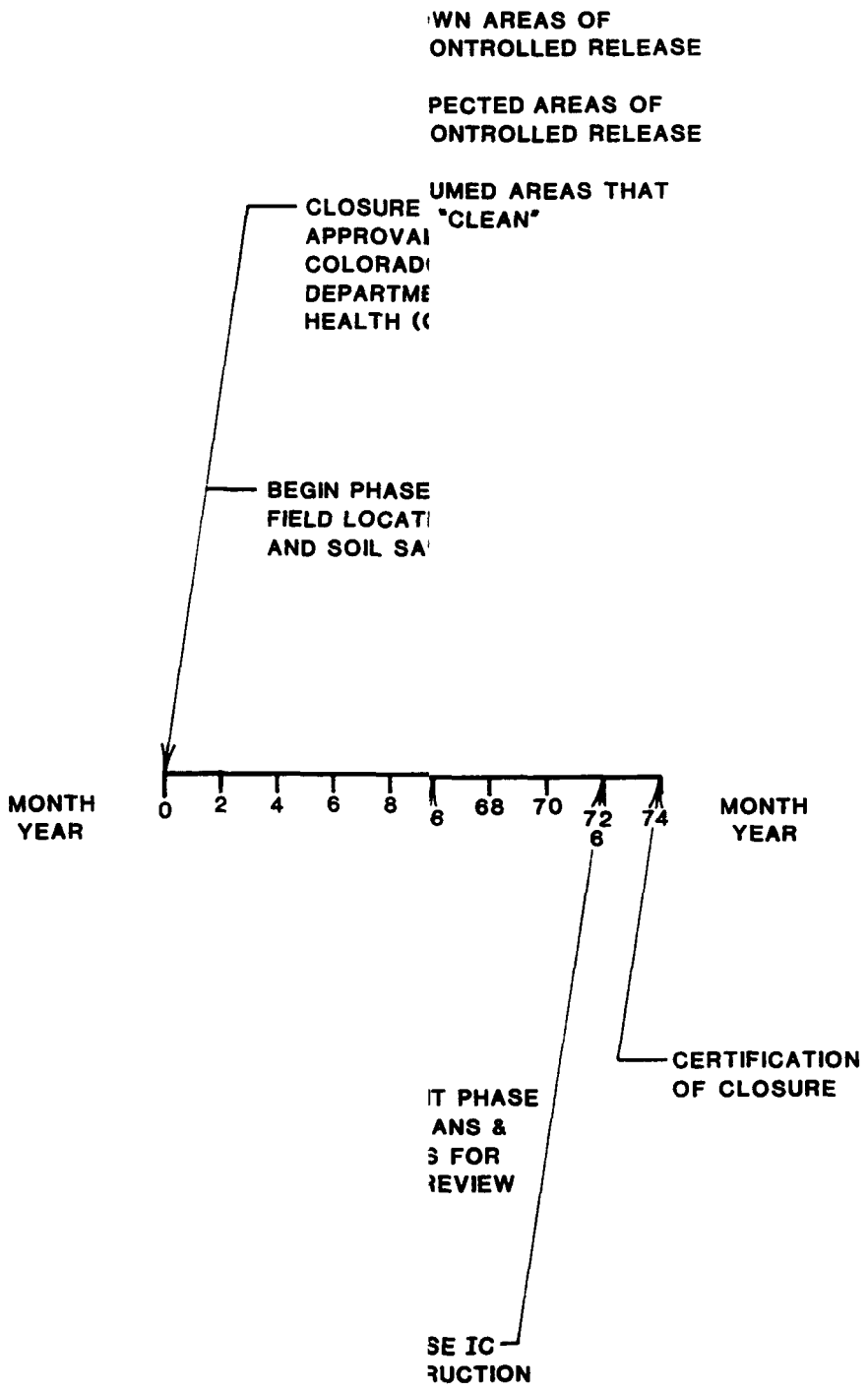
1.5.3 Closure Schedule

The estimated time for closure activities is shown on Figure 1-3. Additional investigations, as discussed in Sections 3.2.5, 3.3.5, 3.4.5 and 3.5.5, are required to characterize the existing conditions.

Soil characterization will be conducted in phases:

1) Phase IA - Known areas of uncontrolled releases;
2) Phase IB - Suspected areas of uncontrolled releases; and
3) Phase IC - Assumed areas that are "clean."

The three phases of field location and soil sampling for the OPWL will be initiated immediately after approval of the closure schedule for Phase IA; in month 12 for Phase IB; and in month 24 for Phase IC. Characterization reports on each phase will be completed and submitted to the Colorado Department of Health (CDH) in months 24, 36, 48. Plans and



6 064 87	Chen & Associates	SCHEDULE OF ORIGINAL PROCESS WASTE LINES CLOSURE ACTIVITIES	Fig 1-3

specifications for Phases IA, IB, and IC will be initiated in months 30, 42, and 54, assuming CDH approval of the characterization reports within six months of submittal. Plans and specifications for the first three phases will be submitted to the Colorado Department of Health (CDH) for approval in months 39, 51 and 63. Construction will be initiated in months 42, 54 and 66. All closure activities will be completed in month 72 and closure certification will be conducted in month 74 (six years, two months). The exact schedule is dependent on approval by the CDH of the closure plan, subsequent characterization reports, and plans and specifications, and upon approval for funding by the U.S. Department of Energy.

1.5.4 Justification for Extension of Schedule

The regulations in 6 CCR 1007-3 Section 265.113(a) require:

> "Within 90 days after receiving the final volume of hazardous wastes, or 90 days after approval of the closure plan, if that is later, the owner or operator must treat, remove from the site, or dispose of all on-site hazardous wastes in accordance with the approved closure plan."

The intent of this regulation is to avoid causing serious environmental damage due to accumulating inventory over long

periods of time. Additional regulations outlined in 6 CCR 1007-3, Section 265.113(b), require:

> "The owner or operator must complete closure activities in accordance with the approved closure plan and within 180 days after receiving the final volume of wastes or 180 days after approval of the closure plan, if that is later."

The activities required to remove, treat and dispose of possible wastes from the tanks and lines, characterize and remove and/or cap the tanks and lines, and characterize and remove and/or cap any contaminated soils will take longer than the schedules required by the referenced regulations. An extended schedule will be required due to the time involved with:

- removal, treatment and disposal of possible wastes within the lines and tanks,
- sampling, analysis and decontamination of the lines, tanks and soils,
- removing, grouting, and/or capping the lines, tanks, and adjacent contaminated soil, and
- Providing time frames sufficient to allow the preparation of good quality documents with adequate QA/QC.

Closure activities are also dependent on the allocation of funds to conduct closure at the original process waste lines.

1.5.5 Protection of Human Health and the Environment

In accordance with 6 CCR 1007-3, Section 265.113(b)(2), threats to human health and the environment during interim closure are prevented by the routine monitoring activities conducted at Rocky Flats and by restricted access to the facility. Specific details of the routine monitoring program are summarized in the "Annual Environmental Monitoring Report" (Rockwell, 1987). This document is reviewed and updated on an annual basis. Brief discussions of the monitoring activities that are conducted and the security procedures at the plant are presented below.

The routine environmental monitoring program includes the sampling and analysis of airborne effluents, ambient air, surface and ground water, and soil. External penetrating gamma radiation exposures are also measured using thermoluminescent dosimeters Samples are collected from on-site, boundary and off-site locations.

Particulate and tritium sampling of building exhaust systems is conducted continuously. For immediate detection of abnormal conditions, ventilation systems that service areas containing plutonium are equipped with Selective Alpha Air

Monitors. These monitors trigger an alarm automatically if out-of-tolerance conditions are experienced. Particulate samples are collected from ambient air samplers operated continuously on site. The ambient air samples are analyzed for Total Long-Lived (TLL) Alpha activity or for plutonium activity. There are currently 51 of these ambient air samplers. Twenty-three are located within and adjacent to the Rocky Flats exclusion area, 14 are located along or near the plant's perimeter and 14 are located in nearby communities.

The majority of the water used for plant process operations and sanitary purposes is treated and evaporated and/or reused for cooling tower makeup or steam plant use. The discharge of water off-site is minimized to the greatest extent possible. Water discharges from the Rocky Flats Plant are monitored for compliance with appropriate CDH standards and EPA National Pollutant Discharge Elimination System (NPDES) permit limitations. Surface runoff from precipitation is collected in surface water control ponds and discharged off site after monitoring. Routine water monitoring is conducted for two downstream reservoirs and

for drinking water sources in nine communities. Ground-water monitoring was conducted during 1987 and 1988 at approximately 160 ground-water sampling locations.

Soil samples are routinely collected on an annual basis from 40 sites located on radii from Rocky Flats at distances of 1.6 and 3.2 kilometers (one and two miles) The purpose of this soil sampling is to determine if there are any changes in plutonium concentrations in the soil around the plant.

When higher concentrations than usual are found in any of the routine monitoring activities or when out-of-compliance conditions are identified, the cause of the problem is investigated. If the original process waste lines are found to be the cause of an out-of-compliance condition, then this closure plan will be revised within 30 days.

Access to the plant is limited by:

- a three-strand barbed wire cattle fence surrounding the facility (Figure 1-1) posted to identify the land as a government reservation/ restricted area,
- a fence surrounding and guards posted 24 hours per day at two gates to the controlled area of the facility (Figure 1-1),
- a six-foot high chain link fence topped by two feet of three-strand barbed wire surrounding and

guards posted 24 hours per day at gates to the perimeter security zone (PSZ),

- guards patrolling the controlled area and the PSZ 24 hours per day, and
- surveillance by security cameras 24 hours per day.

The existing fences and gates are operated and maintained by the U.S. Department of Energy.

The monitoring and security measures outlined above are designed to protect human health and the environment by threats to the plant as a whole. More specifically, they protect human health and the environment from threats posed by the OPWL. Additionally, the majority of the OPWL is buried beneath a three-foot soil cover. This cover minimizes potential direct contact and wind dispersal of contamination material and reduces contamination of runoff. Surface runoff from the plant site is collected in surface water control ponds and discharged off site only after monitoring. Ground water at the site is monitored quarterly by plant monitoring wells. These conditions at the plant site further protect human health and the environment from threats posed by the OPWL.

1.6 Administration of Closure Plan

Closure plans for the original process waste lines (OPWL) will be kept at the Rocky Flats area office, Building 115, U.S. Department of Energy. The person responsible for storing and updating the copy of the closure plan is:

Mr. Albert E. Whiteman
Area Manager

His address and phone number are:

U.S. Department of Energy
Rocky Flats Plant
P.O. Box 928
Golden, Colorado 80402
Phone: (303) 966-2025

Mr. Whiteman is also responsible for updating all other copies of the closure plan held off-site by sending additions or revisions by registered mail.

1.7 Closure Cost Estimates and Financial Assurance

State and Federal governments are exempt from the financial requirements imposed by Subpart H of 6 CCR 1007-3, Section 265.140(c). Because the Rocky Flats Plant is a federally-owned facility, no cost estimates or financial

assurance documentation are required nor have any been prepared for the OPWL closure plan.

Cost estimates have been presented in the "Conceptual Design Report, Environmental Improvement Projects," by Rockwell International in December, 1985. The project study considered complete removal of the OPWL lines and tanks with construction scheduled between 1989 and 1994. The following is a summary of the published cost estimates which are presented with complete text of the report in Appendix 3.

Engineering	$ 900,000
Project Costs	$26,500,000
Standard Equipment	$ 20,000
Radiation Monitoring	$ 4,700,000
Contingency @ 26.5%	$ 8,480,000
Total project Cost	$40,600,000

Present costs for the activities of this closure plan will be increased from this estimate by the expanded scope of work, elevated cost of disposal of mixed waste since the 1985 report, and general inflation; however, alternatives to total removal of the OPWL that are presented in this closure plan may result in cost savings. Actual costs will depend to a great extent on the selected closure alternatives which will in turn depend on the results of the characterization studies to be completed (Section 1.5.3).

2.0 REMOVAL, TREATMENT AND DISPOSAL OF WASTE FROM TANKS AND LINES

2.1 Introduction

This section of the closure plan responds to 6 CCR 1007-3, Section 265.112(a)(2) through (4) by providing the following information:

- Estimates of the maximum inventory of process wastes expected during the closure period;
- Discussion of the volumes, removal methods, treatment procedures and disposal plans for any wastes or residues encountered; and
- Time schedules for closure activities.

2.2 Maximum Amount of Remaining Waste

2.2.1 Tanks

All tanks identified in Table 1-2 that have not been removed, permanently sealed according to applicable plans and specifications for abandonment, or converted to the new process waste system, will be visually inspected as part of the tank system survey to confirm that no waste inventory remains in the tanks. Should process wastes be encountered,

the wastes will be evaluated for proper removal and disposal either on-site in the new process waste system or at an approved off-site disposal facility. The procedures for handling wastes encountered are presented in Section 2.4.

2.2.2 Lines

The original process waste lines (OPWL) drained freely by gravity as discussed in Section 1.2. Therefore, no remaining wastes in the lines are anticipated.

However, all lines that remain in place for closure will be fully grouted using a tremie method. If waste inventory remains in the lines, it will be displaced by the grout and collected for treatment and disposal. Tremie grouting avoids the use of pressure methods to remove the waste, which could otherwise result in further contaminant release if the line is compromised. Further discussion of tremie grouting of the lines is presented in Section 3.2.4. The displaced waste inventory, if any, will be handled by approved procedures as discussed in Section 2.4. Wastes that are encountered will be treated in the new process waste system.

2.3 Pretreatment

Pretreatment of any remaining wastes is not anticipated to be necessary.

2.4 Removing, Treating, or Disposing Inventory

2.4.1 Introduction

No waste inventory is anticipated in the OPWL. A waste inventory survey of applicable tanks will be conducted as discussed in Section 2.2.1. Wastes may also be encountered during grouting of the lines that will remain in place as discussed in Section 2.2.2. Should wastes be encountered in the tanks or lines, the wastes will be characterized, as discussed in Section 2.4.2. Based upon the waste characterization, a waste management procedure will be selected, as presented in Section 2.4.3.

2.4.2 Waste Characterization

The waste characterization will meet the requirements of 6 CCR 1007-3, Section 265.13(a)(1). The characterization will include a detailed chemical and physical analysis, and

a volume estimate that would be necessary to remove, treat and dispose of the waste.

During the tank system survey, a visual estimate of the waste volume will be made. A representative sample of the waste will be obtained in accordance with the proposed Waste Analysis Plan in Section C of the RCRA Part B Permit Application (U.S. Department of Energy, 1987a).

The detailed chemical and physical analysis will include radioactive screening, radionuclide analyses and chemical analyses. Radioactive screening will be in accordance with Rocky Flats' radioactive monitoring procedures (Rockwell, 1986b). The screening will include the following parameters:

- Gross Alpha;
- Gross Beta; and
- Gamma.

Radionuclide analyses of the waste will include the following parameters:

- Americium 241;
- Plutonium 239; and
- Uranium 233, 234 and 238.

Chemical analyses of the waste will include those parameters which would identify the waste as a hazardous waste as specified in 6 CCR 261.1. The following parameters will be used to classify the waste's chemical characteristics:

- Base, Neutrals and Acids;
- Corrosivity;
- Reactivity;
- Hazardous Substance List Volatile Organics:
  - Chloromethane
  - Bromomethane
  - Vinyl Chloride
  - Chloroethane
  - Methylene Chloride
  - Acetone
  - Carbon Disulfide
  - 1,1-Dichloroethene
  - 1,1-Dichloroethane
  - trans-1,2-Dichloroethene
  - Chloroform
  - 1,2-Dichloroethane
  - 2-Butanone
  - 1,1,1-Trichloroethane
  - Carbon Tetrachloride
  - Vinyl Acetate
  - Bromodichloromethane
  - 1,1,2,2-Tetrachloroethane
  - 1,2-Dichloropropane
  - trans-1,3-Dichloropropene
  - Trichloroethene
  - Dibromochloromethane
  - 1,1,2-Trichloroethane
  - Benzene
  - cis-1,3-Dichloropropene
  - 2-Chloroethyl Vinyl Ether
  - Bromoform
  - 2-Hexanone
  - 4-Methyl-2-pentanone
  - Tetrachloroethene
  - Toluene
  - Chlorobenzene
  - Ethyl Benzene
  - Styrene
  - Total Xylenes

- Hazardous Substance List Metals:
  - Antimony (Sb)
  - Arsenic (As)
  - Barium (Ba)
  - Beryllium (Be)
  - Cadmium (Cd)
  - Chromium (Cr)
  - Lead (Pb)
  - Mercury (Hg)
  - Nickel (Ni)
  - Selenium (Se)
  - Silver (Ag)
  - Thallium (Tl)

2.4.3 Methodology for Selection of Waste Management Procedure

Upon completion of the waste characterization, the information obtained will be used to select a removal, treatment and disposal procedure. The selection methodology results in four classes of waste management. The four classes of waste management are:

- TRU Waste;
- Low-Level Radioactive Waste;
- Hazardous Waste; and
- Solid Waste.

The details of the methodology for selection of the waste management procedure and a discussion of the decision diagram is contained in the proposed Waste Analysis Plan presented in Section C of the RCRA Part B Permit Application (U.S. Department of Energy, 1987a).

2.5 Schedule for Residual Waste Removal, Treatment and Disposal

Waste characterization and disposition will be conducted during closure. A detailed schedule of activities to complete waste characterization, removal, and disposal will be included in the respective phase characterization reports to be submitted to the CDH for approval as discussed in Section 1.5.3.

2.5.1 Tanks

Waste characterization and disposition, if waste is encountered, will be conducted following the tank survey that will be performed during the respective phases of field location and soil sampling presented in Section 1.5.3. Removal, treatment and disposal of waste inventory, if any, will be conducted during construction for the respective phases between months 42 and 72.

2.5.2 Lines

Lines that remain in place will be tremie grouted during the construction period of each respective work phase. If waste is displaced and recovered during tremie grouting of

the lines, or during demolition and removal of the lines, wastes will be characterized in accordance with Section 2.4.2 within the respective construction period in Section 1.5.3. Wastes will be treated in the new process waste system in accordance with Section 2.4.3. Waste processing, if any waste is encountered, will be conducted during the construction period for the respective work phase (Section 1.5.3).

3.0 CLOSURE PERFORMANCE CRITERIA FOR LINES, TANKS, SOIL AND GROUND WATER

3.1 Introduction

At closure of the original process waste lines (OPWL), all waste residues, contaminated system components, contaminated soils, and structures and equipment contaminated with waste must be removed or decontaminated, as specified in 6 CCR 1007-3, Section 265.197(a), "Closure and Post-Closure Care for Tank Systems."

Since complete removal or decontamination of the system is not feasible, portions of the process waste lines may be closed in accordance with the closure and post-closure requirements that apply to land disposal facilities [6 CCR 1007-3, Section 265.197(b)]. As a minimum, portions of the original waste lines beneath buildings will be closed in place with post-closure care and monitoring.

Ground-water quality will be evaluated to determine if ground-water corrective action is necessary.

The OPWL is divided into four components for discussion in this closure plan. Closure performance criteria for the lines (Section 3.2), tanks (Section 3.3), soil (Section 3.4), and ground water (Section 3.5) associated with the OPWL are presented below. Within each section is a discussion of: 1) background information, and 2) an estimated quantity of the system component being addressed. Also presented is: 3) available information on previous decontamination, 4) alternatives for closure, and 5) closure performance standards. Finally, each section includes: 6) a schedule for completion of closure activities.

3.2 Lines

3.2.1 Background

A discussion of background and construction details for the lines is presented in Section 1.2. In general, the lines have been abandoned in place in utility trenches, buried three to five feet below the ground surface, and beneath building floors. The lines have been gravity drained of waste inventory. Lines beneath buildings have been flushed and sealed with six to 12 inches of non-shrinking cement

grout at building and floor penetrations. No waste inventory is anticipated in the lines, except for a film of waste residue on the pipe walls. The closure of the lines is intimately related to soil closure, and therefore, Section 3.4 and Appendix 6 should also be reviewed and considered for their bearing on closure of the lines.

3.2.2 Quantity of Pipes

The OPWL consists of approximately 35,000 feet of pipe extending between 73 tanks and 24 buildings. Approximately 35 percent of the total line length is located beneath buildings and another 30 to 40 percent is located within areas where other utility lines are interwoven with the system. Several active and inactive utility lines have been placed in the same trench excavation parallel to the original process waste lines. This has resulted in congestion of numerous underground lines at several locations. Therefore, removal of the entire OPWL system is impractical.

The OPWL pipes have been identified by systems of similar waste sources, pipe size, and pipe material. Designated P-1 through P-57, the pipe locations are shown on the Original

Process Waste Lines Location Map, Plate I. Pipe locations are shown in greater detail (larger scale) on the Original Process Waste Lines Site Utility Location Maps in Appendix 1. Data on the lines are summarized on Table 1-1. Data sheets with tabulated information from available references on each pipe system is presented in Appendix 2.1.

3.2.3 Past Decontamination

Decontamination of some lines involved flushing them with clean water until the water appeared to have removed significant amounts of waste residues. The rinsate was treated in the process waste system. These lines were sealed at building and floor penetrations with plugs of "non-shrinking sealant cement," and abandoned in place. The plugs extended approximately six to 12 inches beyond flush wall and floor penetrations. This procedure was used on lines beneath building floors. Underground lines outside the buildings were not sealed or decontaminated. Details of the pipe grouting and plugging of lines beneath buildings are shown on applicable Rockwell International drawings for abandonment of the OPWL. These drawings have been assembled and are on file at the Rocky Flats Plant.

3.2.4 Closure Alternatives

This section discusses closure alternatives for lines only. Selected remedial action may be dependent on available closure alternatives and performance standards for other components of the OPWL; i.e., tanks (Section 3.3.4); soil (Section 3.4.4); and ground water (Section 3.5.4).

The lines will be: 1) removed; or 2) fully grouted using tremie methods. The selected closure alternative will depend on the relative cost and feasibility of implementation.

Lines that are removed will be excavated using approved procedures consistent with the Rocky Flats Operational Safety Analysis (RFOSA) procedure. OSHA regulations, DOE orders and Rocky Flats Plant policies will be followed.

All lines that remain in place will be fully grouted to immobilize any remaining contamination. No method to ensure adequate pipe integrity exists that does not involve filling the lines with a liquid, possibly causing an environmental release. Pipe integrity must be ensured before introducing decontamination fluids.

Tremie grouting will consist of filling the lines with a lean concrete mix. The grout will have at least five percent bentonite added in slurry form to provide a consistent mix. The grout will have a minimum design strength of 1,000 pounds per square inch (psi). Due to the varying lengths of pipe to be grouted, final mix proportions will be determined during closure. Clean sand may be added to the grout as a filler.

The lines will be filled by inserting a tremie pipe from the upgradient end for the length of line to be grouted. This may require excavating the line at intermediate locations for long lengths and cutting the pipe for access. The downgradient end of the pipe will be plugged to contain the grout. The pipe will be filled from the downgradient end toward the upgradient end in order to reduce the potential for voids forming in the pipe.

The tremie pipe will be withdrawn as grout fills the line in order to minimize grout pressure. Due to the brittle nature of some of the pipe materials and unknown extent of pipe deterioration, grout pressures will not exceed 10 psi and will be kept as low as possible during grouting. This is necessary to prevent uncontrolled releases of grout that may

become contaminated by mixing with residual waste in the lines.

The upgradient end of the pipe will be observed during grouting to determine if possible waste inventory in the line is displaced. Any waste that is displaced will be collected at the upgradient end of the line and handled according to the procedures discussed in Section 2.4.

3.2.5 Closure Performance Standard

All lines will be checked as a result of removal or grouting to determine that no waste inventory remains (Section 2.2.2).

Lines that are removed will be packaged and disposed at an approved facility or the Nevada Test Site (NTS) as discussed in Section 5.0.

The criteria for grout performance for closure of the lines that will remain in place will be based on the estimated volume of the lines to be grouted and visual inspection of the grout injection and discharge points. Based on the estimated volume of the pipes to be grouted, a volume of

grout equal to at least 90 percent and not greater than 110 percent of the estimated volume shall be placed into the line.

If the grout volume exceeds the specified limit before the time grout fluid is observed at the upgradient end, grouting operations shall cease. An inspection of the line will be conducted to determine the cause of grout loss, using excavation pits if necessary. Uncontrolled grout releases will be handled as a mixed waste and will be packaged and disposed at an approved facility or NTS.

On all grouted lines, the final grout surface should be visible after the grout has set for consistency and to verify grout set has been achieved.

3.2.6 Schedule

The schedule for line closure is in accordance with the closure schedule presented in Section 1.5.3.

3.3 Tanks

3.3.1 Background

A discussion of background and construction details for the tanks is presented in Section 1.2.

Tanks which have been converted to the fire water plenum deluge system will require compliance with the closure performance standard in Section 3.3.5. Compliance may be accomplished by previous documentation of approved decontamination procedures (Section 6.2.1) and performing tests to characterize residual contamination (Section 6.3), or performing an approved decontamination and characterization procedure (Sections 6.2.1 and 6.3). If the tanks are no longer required in active status, they may, as an alternative, be removed, sealed or capped (Section 3.3.4). Tanks which have been previously removed do not require action under this closure plan.

Tanks which have been abandoned will comply with the closure alternatives in Section 3.3.4 and closure performance standards in Section 3.3.5.

3.3.2 Quantity of Tanks

The original process waste system consists of a total of 73 tanks at 39 locations. The tanks are identified by similar waste sources, tank size, and tank material. The tanks are identified for this closure plan as T-1 through T-39. A single tank identification may include one or more individual tanks.

Data on the tanks are summarized in Table 1-2 and tabulated in Appendix 2.2 with reference to available document sources. The tank locations are shown on the Original Process Waste Lines Location Map, Plate I. The tank locations are also shown in more detail on the large scale Original Process Waste Lines Site Utility Location Maps in Appendix 1.

3.3.3 Past Decontamination

Seven tank locations were cleaned and painted prior to their abandonment or incorporation into the fire water deluge collection systems. These are tanks T-4, T-8, T-9, T-10, T-19, T-20 and T-28. Cleaning and painting was performed by on-site contractors.

The cleaning procedures involved removing waste residues and any accumulated sediment by scraping these materials off the inside walls of the tanks. The insides of the tanks were then covered with at least one coat of paint.

Based on information from facility personnel, only those tanks within the buildings which were accessible were decontaminated prior to abandonment or incorporation into the fire water deluge collection systems (Maas, 1986 and Edwards, 1986). The tanks were scrubbed and then rinsed. This procedure was repeated until a FIDLER probe indicated no change in the radioactivity of the rinsate. The tanks were then painted with a "Carbonmastic #14" paint. Repeated applications were made until a dry film thickness of 8 mils was achieved. The paint was used as an alpha barrier.

Five of the 39 tanks in Table 1-2 have been removed. One tank was filled with gravel and capped with concrete upon abandonment. Six tanks were converted for use in the new process waste system. The remaining 20 tanks have not been or are not known to have been removed, cleaned, filled, or incorporated into the new process waste system.

3.3.4 Closure Alternatives

This section discusses closure alternatives for tanks only. Selected remedial action may be dependent on available closure alternatives and performance standards for other components of the OPWL; i.e., lines (Section 3.2.4); soil (Section 3.4.4); and ground water (Section 3.5.4).

Remedial action for the tanks include: 1) no action; 2) sealing or capping; and 3) removal and disposal off-site. Remedial actions to meet the closure performance standard in 6 CCR 1007-3, Section 265.111 are keyed to:

- previous documented decontamination;
- feasibility of decontamination and characterization; and
- cost and feasibility of permanently sealing the tanks, capping or removal.

The closure alternatives for the tanks are as follows:

1) No Action - The closure alternative of no action will be implemented if the tanks are documented as "clean" by:

   - previous documentation of approved procedures to decontaminate the tanks (meets requirements in Sections 6.2.1 and 6.3), or
   - conducting an accepted decontamination procedure with results indicating acceptably low contamination (Section 6.2.1 and 6.3).

2) Permanently Seal or Cap the Tank - The closure alternative of sealing or capping will be implemented if the tank is contaminated and removal is impractical. Sealing will consist of permanently closing all penetrations, such as welding openings in steel tanks and grouting openings in concrete tanks. Capping, particularly for underground tanks, may be feasible and cost effective at some locations. Underground storage tanks will be filled with a non-compressible material prior to sealing or capping.

3) Removal - The closure alternative of removal will be implemented if it is more protective of human health and the environment than decontamination, sealing or capping. The alternative for removal will also be acceptable for tanks that may otherwise be decontaminated, sealed or capped, depending on feasibility and economic considerations.

3.3.5 Closure Performance Standard

All tanks will be surveyed to determine that no waste inventory remains (Section 2.2.1). Tanks will be determined to be "clean" by one of the following:

1) Documentation that approved decontamination procedures have been implemented meeting the requirements of Sections 6.2.1 and 6.3; or

2) Conducting an approved rinsing and decontamination procedure (Section 6.2.1). Subsequent characterization tests must be performed to determine that acceptably low contamination exists (Section 6.3).

Contaminated, or potentially contaminated tanks without characterization, that remain in place, will be permanently sealed or capped (Section 4.0) Tanks that are removed will

be packaged and disposed at an approved facility or the Nevada Test Site (NTS) (Section 5.0).

3.3.6 Schedule

The schedule for tank closure is in accordance with the closure schedule presented in Section 1.5.3.

3.4 Soil

3.4.1 Background

The soil adjacent to and surrounding the original process waste lines and tanks may have been contaminated at numerous locations by uncontrolled releases. The approximate locations of reported releases are shown on Plate I as stiple shading. The shading only represents the approximate location of reported and documented releases and does not represent the lateral extent of contaminant migration.

3.4.2 Volume of Contaminated Soil

The volume of contaminated soil will be determined following the three phases (Phase IA, IB, and IC) of soil characterization in accordance with the closure schedule in Section 1.5.3. In general, contaminated soils are anticipated to be confined to the backfill around pipelines and underground tanks, and the supporting soil beneath aboveground tanks.

An estimated 6,000 lineal feet of trench will be investigated in each of the three phases. Assuming a three-foot wide trench, four feet deep, each phase constitutes a trench volume of 2,700 cubic yards. However, since the extent of contamination has not been determined, this calculated volumes does not necessarily represent the volume of contaminated soil.

3.4.3 Soil Characterization

A limited number of soil samples were obtained and analyzed prior to September 1, 1976 (Sunday, 1976). The samples were obtained from areas of known leaks and repairs along the OPWL. The soil samples were tested for levels of nitrate

and plutonium, both of which were used extensively in the processes at the plant and are characteristic of the process wastes. The locations of the soil samples and the results of the analyses are presented in Table 3-1. All soil samples were obtained from the bit of an auger after drilling to depths of approximately four feet (Sunday, 1976).

Background levels of nitrate in soil at Rocky Flats have not been determined; however, the Safe Drinking Water Act (SDWA) standard is 10 parts per million (ppm). Background levels of plutonium in soil at Rocky Flats was reported in September, 1976, to be 0.014 pCi/g. The U.S. EPA has developed proposed guidance levels of 20 pCi/g of transuranics in surface soil (assuming 1 gm/cc soil density) to be used for protection of public health in areas where significant contamination by transuranic elements may exist (U.S. Environmental Protection Agency, 1986).

Site characterization information is presented in the Original Process Waste Lines Geologic Characterization Report (Appendix 4). Additional investigation of background concentrations for transuranics will be completed in future

TABLE 3-1

RESULTS OF SOIL ANALYSES FOR NITRATES AND PLUTONIUM(1)
September, 1976

Sampling Location	NO_3 (ppm)	Pu^{239} pCi/g
32' north of NW corner of Bldg. 663	62	0.017
West of Bldg. 884 and east of P-6 and P-9	110	0.022
West of SW corner of Bldg. 707 and east of P-12	54	0.065
Between Bldgs. 777 and 778, near where P-14 enters Bldg. 778	148	0.218
8' east of easternmost edge of Tank 207	70	0.083
~30' north of northernmost edge of Tank 207 and ~4' east of P-27 and P-28	76	0.824
Near intersection of P-24 and P-25, north of Bldgs. 771 and 774	44	1.523

(1) Ref: Sunday, G., 1976

studies by Rockwell International, and used in identifying and assessing locations at which soil has been contaminated.

Additional soil sampling will be conducted as part of this closure plan to evaluate the extent and degree of contamination of the adjacent soils. The soil sampling and analyses will conducted in four phases as discussed in Section 1.5.3. The site characterization plan for soil sampling at the OPWL is presented in Appendix 6.

Briefly, the goals of the three phases of the characterization studies are: 1) to determine the presence of contamination; and 2) to evaluate the lateral extent of contamination. The phases are designated Phase IA, IB, and IC. Phase IA will focus on characterizing high risk areas that have a history of reported releases. Phase IB will focus on characterizing medium risk areas that are suspected of releases. Phase IC will focus on investigating low risk areas that are assumed to be "clean."

The phased characterization reports will provide information to allow selection of closure alternatives and completion of plans and specifications for construction. The

characterization studies will be sequentially initiated and completed in accordance with the schedule in Section 1.5.3.

3.4.4 Closure Alternatives

This section discusses closure alternatives for soil only. Selected remedial action may be dependent on available closure alternatives and performance standards for other components of the OPWL; i.e., lines (Section 3.2.4); tanks (Section 3.3.4); and ground water (Section 3.5.4).

Indicator parameters to evaluate adjacent soil contamination have been selected and are discussed in Section 3.4.5. Remedial efforts to meet the closure performance standard in 6 CCR 1007-3, Section 265.111 are keyed to concentration levels of the indicator parameters. Remedial alternatives for the adjacent soils include: 1) no action; 2) capping; and 3) removal and disposal off-site.

Figure 3-1 presents a flow diagram showing the process of selecting closure activities for the adjacent soils. This diagram refers to "level I" and "level II." Indicator parameter concentrations will drive selection of closure alternatives. Level I defines a level below which no

closure activities are required to protect human health and the environment. Level II defines a level above which capping will not protect human health or the environment and removal is required. If level I indicator parameter concentrations are exceeded and capping is required, removal and disposal may be selected if it is more economical.

Contaminated soil that is left in place will be capped and covered. Such areas already covered by asphalt or concrete will be considered adequately capped. The cap systems outside building, roadway, and areas otherwise paved will consist of a soil layer and a low-permeability flexible membrane liner. This cap may be covered with vegetation, gravel, or concrete. The type of cover to be used outside building areas will be selected based on the existing surfacing in the area and the anticipated maintenance requirements for the alternatives. The cap and cover in building, roadway, and areas otherwise paved will consist of the pavement or the concrete floor and building roof. These existing covers, along with filling the OPWL with grout, should provide adequate protection of human health and the environment. Details of capping and covering are discussed in Section 4.0.

As shown on Figure 3-1, characterization of adjacent soil will be performed for any section of line prior to resolving the questions posed in the decision diamonds. If all contaminated system components and adjacent soils are removed, post-closure care is not required. If any contaminated soil remains in place, post-closure care and monitoring will be required. Contaminated soil includes any soil which requires one of the closure activities above "no action." Soil with contaminant characteristics less than level I are not considered contaminated.

If required, or determined to be more practical than capping, contaminated soil will be removed and packaged for disposal at an approved facility or the Nevada Test Site (NTS). Soil removal is discussed in Section 5.0.

3.4.5 Closure Performance Standard

Indicator parameters, i.e., identifying one or more parameters in a category such as metals, that are representative of the components in that category, will be used to define the requirements for closure.

Five groups of contaminants have been chosen for the OPWL. They are: nitrates, volatile organics, metals, transuranics and uranium. These groups were chosen because either they are known or suspected to have been introduced to the OPWL. for purposes of this closure plan, transuranics are defined as elements with atomic weights greater than uranium.

3.4.5.1 Indicator Parameter Selection

All of the indicator parameters discussed below will be used in the initial phases of the characterization studies. Based on the results of the initial characterization, the indicator parameters may be selectively eliminated from successive characterization phases. Elimination of selected indicator parameters will be substantiated in the characterization reports submitted to CDH for approval (Section 1.5.3).

Nitrates

Low-level radioactive wastes with high nitrate concentrations have been one of the forms of waste sent through the OPWL. The drinking water standard for nitrates is 10 mg/l.

Volatile Organics

The volatile organics that may have been transferred through the OPWL are unknown, but were limited to small flows. All

of the hazardous substance list (HSL) volatile organics, listed on Table 3-2 below, will be included for the initial characterization phases.

Three major volatile organics were used in the plant processes, and, therefore, are most likely to occur in the process waste. These include trichloroethane (TCA), trichloroethene (TCE), and carbon tetrachloride (CCl_4). Depending on the results of the initial characterization phases, subsequent characterization phases may focus on these three volatile organics to identify contamination from the OPWL. As previously mentioned, any deletions from the HSL volatile organic list will be detailed in reports submitted to CDH/EPA. Deletions will not be instituted until regulatory approval for deletion is obtained.

Metals

At present, the soil-water system at the OPWL is not characterized sufficiently to predict which metals are likely to be a problem. Therefore, all of the hazardous substance list (HSL) metals have been selected for indicator parameters for the characterization phases. Table 3-3 lists the HSL metals that will be evaluated for the characterization studies.

TABLE 3-2

HAZARDOUS SUBSTANCE LIST (HSL)
VOLATILE ORGANICS

Volatiles	CAS Number
Chloromethane	74-87-3
Bromomethane	74-83-9
Vinyl Chloride	75-01-4
Chloroethane	75-00-3
Methylene Chloride	75-09-2
Acetone	67-64-1
Carbon Disulfide	75-15-01
1,1-Dichloroethene	75-35-4
1,1-Dichloroethane	75-35-3
trans-1,2-Dichloroethene	156-60-5
Chloroform	67-66-3
1,2-Dichloroethane	107-06-2
2-Butanone	78-93-3
1,1,1-Trichloroethane	71-55-6
Carbon Tetrachloride	56-23-5
Vinyl Acetate	108-05-4
Bromodichloromethane	75-27-4
1,1,2,2-Tetrachloroethane	79-34-5
1,2-Dichloropropane	78-87-5
trans-1,3-Dichloropropene	100061-02-6
Trichloroethene	79-01-6
Dibromochloromethane	124-48-1
1,1,2-Trichloroethane	79-00-5
Benzene	71-43-2
cis-1,3-Dichloropropene	10061-01-5
2-Chloroethyl Vinyl Ether	110-75-8
Bromoform	75-25-2
2-Hexanone	591-78-6
4-Methyl-2-pentanone	108-10-1
Tetrachloroethene	127-18-4
Toluene	108-88-3
Chlorobenzene	108-90-7
Ethyl Benzene	100-41-4
Styrene	100-42-5
Total Xylenes	100-42-5

TABLE 3-3

HAZARDOUS SUBSTANCE LIST (HSL)
METALS

Antimony (Sb)

Arsenic (As)

Barium (Ba)

Beryllium (Be)

Cadmium (Cd)

Chromium (Cr)

Lead (Pb)

Mercury (Hg)

Nickel (Ni)

Selenium (Se)

Silver (Ag)

Thallium (Tl)

Uranium

Uranium is the only radionuclide (excluding the transuranic elements, plutonium and americium) that was considered representative of the wastes in the OPWL. Uranium -233, -234 and -238 were chosen as indicator parameters.

Transuranics

The only transuranic used on site is plutonium. However, americium is a daughter product of plutonium, and can be found at the Rocky Flats Plant due to ingrowth. Plutonium and americium were considered together for soil removal criteria (Level II performance standard criteria) since the U.S. EPA, in consultation with other federal agencies, has developed proposed recommendations to be used for protection of public health in areas where contamination by transuranium elements exist.

The single element plutonium is used as an indicator parameter for soil capping (Level I performance standard criteria).

3.4.5.2 Indicator Parameter Concentration Levels

Two contaminant levels will be used. Level I will define the upper limit for the closure alternative of no action. Level II will define the lower limit for the closure alternative of removal. Concentrations between Level I and Level II will require capping as a minimum for protection of human health and the environment. Soil removal is an option for concentrations between Level I and Level II if feasibility and economic considerations are more favorable.

Level I concentrations, which define the upper limit for no closure action, are based on the Safe Drinking Water Act (SDWA), background concentrations, and state and federal guidelines. Nitrates and volatile organics are limited to ten times the SDWA. Since the SDWA applies to water, an elevated concentration is acceptable in the soil due to adsorption and transport partitioning. Ten times the SDWA is a conservative limit for protection of human health and the environment.

Since some HSL volatiles are not limited by the SDWA, a conservative concentration limit of ten times the Certified Laboratory Protocol (CLP) Contract Required Detection Limit

(CRDL) will be used. The use of detection limits for volatile organics in soil is quite conservative based on the results of the risk assessment performed as part of the feasibility study for the 881 Hillside (U.S. Department of Energy, 1988). The results of the assessment indicate acceptable soil concentrations far in excess of water standards or detection limits. The concentration limits based on the SDWA or CLP/CRDL have been adopted for the purpose of ground-water protection and protection of human health and the environment.

HSL metals are limited to the mean background concentration plus two standard deviations. The mean background concentration and standard deviation will be determined as part of a background characterization study currently being conducted.

The International Committee of Radiological Protection presents an acceptable standard of 100 millirems (mrem) of effective dose equivalent per year of exposure for long-term exposure for radionuclides from man-made sources (ICRP, 1977). The National Council on Radiological Protection (NCRP) has published soil guides for uranium, radium and lead-210 based on a dose rate of 500 mrem/year. Adjusting

these guides to reflect the 100 mrem/year effective dose equivalent from ICRP (reducing each guide by a factor of five), results in adjusted guides of 320 pCi of uranium per gram of soil, 8 pCi of radium per gram of soil, and 3 pCi of lead-210 per gram of soil (NCRP, 1984). Since all of these materials are found in soil, the sum of the fractions (the observed concentration divided by the concentration limit) must not exceed unity (one). The sum of the fractions technique is used by the Nuclear Regulatory Commission (NRC), U.S. DOE, and Colorado regulations when addressing mixtures. If any fraction is less than ten percent, the material is considered non-existent for the purposes of the sum of fractions calculation. Based on the above guides, preliminary analyses will be for uranium only. If the uranium concentration exceeds ten percent of the guide (32 pCi/gm), the radium and lead-210 concentrations in the soil sample will be determined. If the sum of the fractions is found to exceed unity, and the activity at the unit is significantly greater than the background activity for these compounds, soil removal will be used to reduce the sum of fractions to unity or less.

Plutonium is limited to 0.9 pCi/g for Level I (Colorado Department of Health, 1973). Below this concentration, no action is required.

Level II, which defines the lower limit for removal, is defined for combined plutonium and americium activity. Proposed recommendations by EPA are intended to provide long-term radiation protection for all exposed persons in a "critical segment of the general population" and specify that both the individual and collection radiation doses should be "as-low-as-reasonably-achievable (ALARA)." These interim recommendations present a soil screening level of 0.2 microcuries of transuranics per square meter in the upper 1 cm of soil. This represents a combined inhalation and ingestion incremental cancer risk of 1×10^{-6}. At activity levels greater than this, additional evaluation is recommended to determine the actual dose rates to exposed persons (U.S. Environmental Protection Agency, 1986). Assuming a soil density of 1 gm/cm^3, this activity level translates to 20 picocuries per gram (pCi/gm) of soil.

Combined Pu and Am were selected for use as an indicator parameter for soil removal with an acceptable combined level of 20 pCi/gm (assuming 1 gm/cm^3 soil density). Detectable

levels of Pu and Am below this concentration level will be covered with a multi-layered cap. Soil with concentrations above this level will be removed and disposed at an approved facility. Similar wastes from the Rocky Flats Plant have been sent to the Nevada Test Site (NTS).

Transuranic activity is the only indicator parameter that will determine soil removal. Soil removal will only be specified outside building areas. Soil beneath buildings that may cannot be characterized or handled until removal of the respective buildings upon plant closing.

A summary of the selected indicator parameters and concentrations of Level I and Level II are shown on Table 3-4.

3.4.6 Schedule

The schedule for conducting soil related closure activities is in accordance with the closure schedule in Section 1.5.3.

TABLE 3-4

INDICATOR PARAMETERS AND CONTAMINANT PERFORMANCE LEVELS

	Level I	Level II
Nitrate	10 x SDWA(1)	(4)
HSL Volatile Organics	10 x SDWA(2) or 10 x detection limit	(4)
HSL Metals	BG + 2SD(3)	(4)
Uranium		
U-233, 234 & 238	32 pCi/g	(4)
Transuranics		
Pu-239 & 240	1 pCi/g (Pu only)	20 pCi/g (combined Pu & Am)
Am-241		

(1) SDWA - Safe Drinking Water Act

(2) Level I closure action will be initiated for volatile organic concentrations in the soil that exceed ten times SDWA or, where volatile compound limits are not specified by the SDWA, ten times the Certified Laboratory Protocol (CLP) Contract Required Detection Limit (CRDL).

(3) Level I closure action will be initiated for Hazardous Substance List (HSL) metals that exceed background concentrations plus two standard deviations. Background levels will be determined by Rockwell International in a study currently being conducted.

(4) No removal concentration limit.

3.5 Ground Water

3.5.1 Background

Ground-water quality will be evaluated to determine if corrective action is required to meet 6 CCR 1007-3, Section 264 Subpart F. If necessary, the type of ground-water corrective action will be determined and implemented as part of an area-wide ground-water corrective action. Geologic characterization of the OPWL is presented in Appendix 4.

3.5.2 Volume of Contaminated Ground Water

The volume of ground water that may require treatment will be evaluated as part of an area-wide ground-water corrective action program. Further discussion is presented in Appendix 4.

3.5.3 Ground-Water Quality

6 CCR 1007-3, Section 265.197(b) requires post-closure care only for tank systems, such as the OPWL, that close with contaminated components in place. Based on the locations

and operating history of the original process waste lines, it is anticipated that at least portions of the system will require post-closure care. Additionally, a tank system that closes "clean" may still have ground-water contamination that would subject it to the 6 CCR 1007-3, Section 264 Subpart F standards for ground-water monitoring and corrective action.

In addition to the OPWL, other solid waste management units (SWMUs) in the vicinity of and upgradient of the process waste lines may have impacted ground-water quality. Therefore, it may be necessary to implement Subpart F requirements due to impacts from the OPWL and other SWMUs. Due to the complexity of potential ground-water contamination resulting from multiple SWMUs in the vicinity or upgradient of the lines, any ground-water compliance monitoring or corrective action will be conducted as part of an area-wide ground-water program.

3.5.4 Closure Alternatives

Closure alternatives for ground-water corrective action will be determined by the area-wide ground-water program.

Further discussion is presented in the geologic characterization report for the OPWL in Appendix 4.

3.5.5 Closure Performance Standard

Closure performance criteria for ground-water corrective action will be determined as part of the area-wide ground-water program.

3.5.6 Schedule

The schedule for ground-water corrective action will be in accordance with the schedule for the area-wide ground-water program.

4.0 CLOSURE ALTERNATIVE OF REGRADING, CAP AND COVER

4.1 Introduction

If portions of the OPWL are closed with contaminated system components or contaminated soils remaining in place, those portions must meet the closure requirements that apply to land disposal facilities (6 CCR 265.310), as specified in 6 CCR 265.197(b). Closure for land disposal facilities requires a final cap and cover to be designed and constructed over the land disposal facilities (i.e. contaminated system components).

The necessity for capping will be determined by the phased characterization studies to be completed in accordance with the closure schedule in Section 1.5.3. The phased plans and specifications to be submitted to the CDH for approval will detail those areas requiring capping based on the closure performance standard for the lines (Section 3.2.5), tanks (Section 3.3.5), and soil (Section 3.4.5).

This section discusses demolition (Section 4.2), regrading the contaminated areas (Section 4.3), design and construction of the cap (Section 4.4), and cover protection

(Section 4.5). Quality Assurance and Quality Control Procedures for construction of the cap and cover are presented in Section 4.6. The procedures for a health and safety plan are presented in Section 4.7. Post-closure maintenance is presented in Section 4.8.

4.2 Demolition

Approximately 22,000 feet of the process waste lines are not located beneath buildings. Out of this 22,000 feet, approximately 6,000 feet is located beneath existing asphalt or concrete pavement, 1,000 feet below existing sidewalks, and approximately 100 sections cross under existing fences.

Demolition may be required in some areas where capping is necessary outside building areas beneath existing asphalt, concrete, or fences. As necessary, the asphalt, concrete or fencing will be removed prior to capping.

4.3 Regrading

Areas requiring post-closure care and maintenance will be determined upon completion of the characterization studies. If necessary, regrading will be utilized to reshape the land

surface in the vicinity of the contaminated portions of the tank system or contaminated soils remaining in place. Regrading will be conducted to manage surface water infiltration and runoff while controlling erosion. Regrading will also be required where cuts are necessary in preparation of the cap. Since surface water infiltration, runoff and erosion are already controlled for portions of the OPWL beneath buildings, regrading will not be required in these areas.

If necessary, regrading will also be required in areas where portions of the process waste system or adjacent soils are removed. In these areas, grading will be utilized to reshape the land surface in the vicinity of the removed components or soils to manage surface water infiltration and runoff while controlling erosion.

Surface grading will be designed to reduce ponding and subsequent infiltration. In addition, slopes will be kept to a minimum to reduce erosion as result of surface runoff velocities. Areas to be capped outside buildings will be regraded to slopes of at least one percent, if flatter slopes currently exist. The regraded surface will be

loosened in preparation of vegetation or compacted to receive a cap.

4.4 Cap

A cap will be utilized to cover areas where contaminated tank system components or contaminated soils are left in place. The design of the cap will conform to the closure requirements for a tank system (6 CCR 265.197) and the performance standards in 6 CCR 265.310. The cap will be a multi-layered section, designed and constructed to meet the following performance standards:

- Provide a long-term minimization of the migration of liquids through the closed unit;
- Function with minimum maintenance;
- Promote drainage and minimize erosion or abrasion of the cover;
- Accommodate settling and subsidence so that the cover's integrity is maintained; and
- Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.

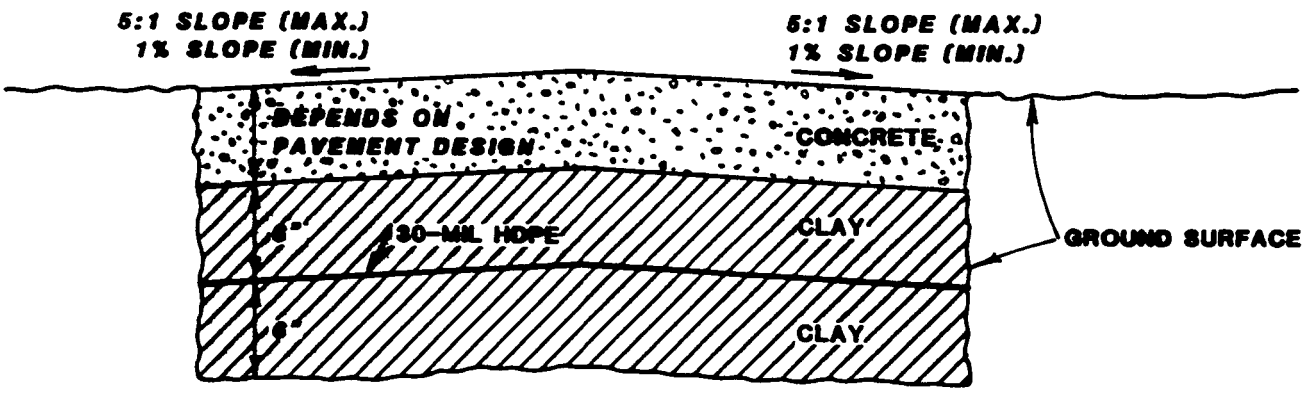
The standards outlined above can be achieved by utilizing a cap consisting of a building roof and floor or a multi-layered cap that consists of a low-permeability synthetic membrane between two layers of low-permeability soils.

4.4.1 Extent of Cap

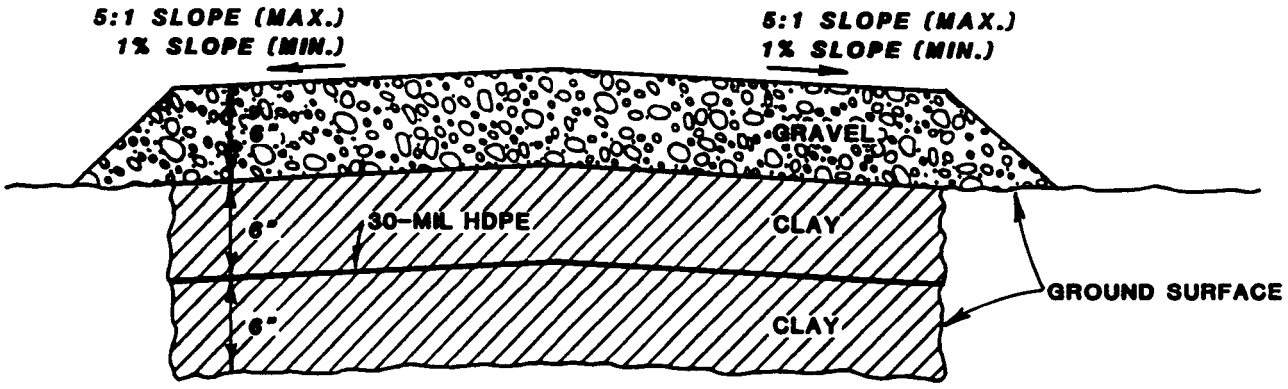
The segments of the OPWL with contaminated soil adjacent to the lines that will remain in place will be capped. The cap will cover the lateral extent of contamination. The width of the cap will be determined based on the results of evaluating the lateral extent of contamination during the characterizations studies as scheduled in Section 1.5.3. Details of the extent of the cap will be provided in the plans and specifications to be submitted to the CDH in accordance with the closure schedule.

4.4.2 Cap Design

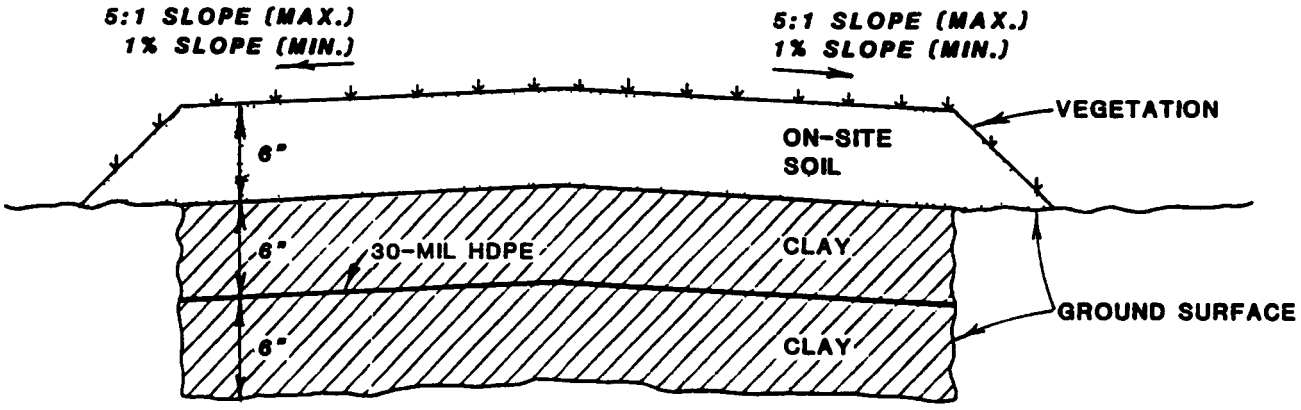
The design of the multi-layered cap will conform to the performance standards in 6 CCR 1007-3, Section 265.310. Typical cross sections of three alternative cap designs for different locations are shown on Figure 4-1.



CONCRETE COVER



GRAVEL COVER



VEGETATED COVER

6 064 87	Chen & Associates	TYPICAL CROSS-SECTIONS FOR CAP AND COVER ALTERNATIVES	Fig 4-1

A multi-layered cap will consist of two soil layers above and below a synthetic membrane. Both soil layers will have a relatively low permeability. The lower layer will provide a bedding layer for the membrane. The upper soil layer will provide a bedding layer for the cover. The membrane will minimize liquid migration and reduce the permeability to less than or equal to the underlying natural soil. A cover placed over the soil and membrane cap will have low maintenance requirements and provide high resistance to erosion damage. The cover design is discussed in Section 4.5.

4.4.3 Type of Materials

Clay: The two soil layers above and below the synthetic membrane will consist of clay. The clay will have a hydraulic conductivity of 10^{-7} centimeters per second (cm/sec) or less when compacted in the laboratory to 95 percent of the maximum standard Proctor density (ASTM D-698). The clay will be compacted between plus or minus two percent of optimum moisture content. The specified moisture content at compaction will promote low permeability and decrease the potential for cracks resulting from a brittle compacted structure.

Suitable clay will be imported to the site or obtained from on-site borrow sources if the location of suitable soils are identified prior to construction. Previous studies at the site indicate local sources of available material; however, large quantities suitable for borrow without contamination of higher permeability materials may require import from an off-site location. Published data (Hunt, 1984) indicate a hydraulic conductivity of 10^{-7} centimeters per second will be achieved with soils containing 30 to 50 percent colloidal clay fraction (percentage less than two micrometers). The clay will have a liquid limit less than 50 to reduce potential for shrinkage cracks prior to placement of the membrane.

Synthetic Membrane A 30-mil high density polyethylene (HDPE) synthetic membrane will be placed between the low permeability clay layers as shown on the cross sections on Figure 4-1. The membrane will be manufactured from virgin first quality resin designed and formulated specifically for use in hazardous waste environments. The HDPE membrane will meet the following minimum specifications:

Property	Test Method	Test Value
Density (g/cc)	ASTM D-792	0.935
Environmental Stress Crack (min., hrs.)	ASTM D-1693	1,500
Low Temp Brittleness	ASTM D-746	-75°C
Thickness	ASTM D-2103 ASTM D-751	-5% to +10%
Tensile Strength at Yield (psi)	ASTM D-638	2,000
Elongation at Yield	ASTM D-638	13%
Tear Resistance (lb)	ASTM D-1004 Die C	20 for 30-mil 40 for 60-mil
Carbon Black	ASTM D-1603	2% to 3%

4.4.4 Depth of Materials

The soil layers will each consist of six inches of clay. The depth of the materials were determined to provide the specified performance for protection of human health and the environment while maintaining an efficient design.

The low permeability clay is a redundant component to the synthetic membrane to minimize surface infiltration. The two, six-inch layers of soil will have a maximum hydraulic conductivity of 1×10^{-7} cm/sec. The clay will be placed in separate six-inch lifts. The lift thickness will permit good quality control during construction to achieve the design performance.

The synthetic membrane liner will consist of a 30-mil high-density polyethylene (HDPE) liner.

4.4.5 Volume of Materials

The material volumes will depend on the extent of the cap. Assuming an average ten-foot width over an estimated length of lines outside of building areas of 22,000 feet results in the following quantities:

Clay (above and below the synthetic membrane) = 8,200 yd^3

Synthetic membrane = 220,000 ft^2

The material volumes will vary depending on the final cap configuration.

4.4.6 Source of Materials

The low permeability clay may be imported to the site or obtained from on-site borrow sources. The material specified is available through local suppliers from borrow sources in the region. Maximum haul distances will range up to 15 miles. On-site sources at the Rocky Flats Plant will likely be located in the vicinity of the landfill and/or

west spray fields. The distance of these borrow sources is approximately 0.5 and 1.5 miles, respectively.

4.4.7 Cap Stability

In general, the cap will be placed on nearly level surfaces. For these conditions, stability against sliding will not be a concern. However, since the exact locations of capped portions of the process waste system have not been determined, stability of the cap to resist sliding from shear failure was evaluated.

The stability of the final cover design was evaluated for the maximum slope of 20 percent (five horizontal to one vertical). Based on a review of design stability charts and infinite slope analyses, the synthetic membrane is considered the critical surface for sliding since the frictional resistance between the membrane and the clay is approximately 60 percent of that in the clay itself.

In addition, seepage forces may be present in the clay above the membrane to further reduce stability. Using conservative assumptions for sliding resistance and seepage forces in the clay, the cap will have a factor of safety

against sliding in excess of 1.5 for slopes up to 20 percent.

4.4.8 Differential Settlement

Differential settlement is not anticipated to be a concern for closure of the OPWL. Existing pipe and tank backfill is relatively compact from initial construction activities with sufficient time to incur settlement from primary consolidation. The maximum depth of fill placement during regrading will be on the order of five feet. The fill will be relatively compact as a result of construction activities during closure. Since the existing and new fill consist entirely of earthen materials, and the depths of fill are relatively shallow, significant long-term settlement is not a concern. Therefore, evaluation of the cover stability as a result of differential settlement was not evaluated.

4.4.9 Infiltration Control

Infiltration through the cap will initially be reduce by surface grading to promote surface runoff. When a vegetation cover is used, evapotranspiration will further reduce infiltration.

However, some infiltration will likely migrate into the upper layer of low permeability clay. The impermeable synthetic liner will effectively prevent further vertical migration. Due to the relatively narrow width of the cap covering contaminated process waste lines outside building areas, water that infiltrates the upper clay layer above the membrane will migrate laterally during conditions of high infiltration. This will prevent leaching of contaminated soils and waste system components beneath the cover.

In most instances, the synthetic membrane will retain any infiltration water until water content decrease occurs from evapotranspiration or surface evaporation promoted by capillary rise.

4.4.10 Surface Drainage Control

Surface runoff from the cap will be collected in existing drainage channels throughout the plant site. Since the collection area of the cap is dispersed throughout the process waste system, runoff volumes will be handled by existing drainage features.

4.4.11 Subsurface Drainage Control

Due to the relatively shallow depth of the process waste lines, limited surface water infiltration and dispersed drainage collection area of the cap, subsurface drainage control is not a concern.

4.4.12 Construction Procedures

Conventional construction equipment will be used for demolition, earth moving and compaction of the cap. Such equipment may include scrapers, haul trucks, front-end loaders, Bobcat loaders, compactors, water trucks, and jack hammers. Equipment required for placing the synthetic membrane may include front-end loaders and liner seaming equipment.

During capping construction activities, the area where work is being conducted will be surrounded with barricades and ropes to restrict access. Signs with the legend, "Danger-Unauthorized Personnel Keep Out," will be posted on all sides of the restricted area. The equipment used for these activities will remain in the restricted area as much as possible. Equipment will be allowed to leave the restricted

area when the equipment is no longer needed or when construction in one area is completed.

4.5 Cover

A cover will be placed over the upper six-inch clay layer. The cover will consist of concrete, gravel, or topsoil and vegetation. Cross sections of the three cap and cover alternatives are shown on Figure 4-1.

The cover will be stabilized to decrease erosion by wind and water and contribute to the development of a stable surface environment. This will be accomplished by placing concrete or gravel or by establishing a vegetative cover on the cap.

Concrete will be used as the cover in areas where the cap is overlain by roads or sidewalks. Capped areas not covered with concrete will be covered with a vegetated soil layer or gravel. The decision to utilize a vegetated soil cover or a gravel cover will be based on the present and planned use of the area in question and the costs associated with the two alternatives.

The soil layer for the vegetation will consist of on-site soils with a maximum size of one inch, compacted to 90 percent of the maximum standard Proctor density at a moisture content near optimum (ASTM D-698). The soil layer will have a thickness of six inches.

The gravel cover will be six inches in thickness and will meet the following gradation characteristics.

Sieve Size of Designation	Percent Passing
6"	100
1/4"	$\geq$50
#200	$\leq$5

Vegetation of the cover will be conducted by seeding with a mixture of native grasses. The mixture will consist of:

Grass	Quantity (pounds)
Western Wheatgrass	6.0
Thickspike Wheatgrass	3.0
Little Bluestem	2.0
Green Needlegrass	2.0
Canby or Canada Bluegrass	1.0
	14.0 pounds/acre

The properties of the native grass mix are:

- A root structure which will not penetrate the cover;
- Require no irrigation;

- Be capable of withstanding the temperature range experienced at Rocky Flats;
- Require little fertilization after initial seeding; and
- Be compatible with soil properties, such as pH, of the vegetative layer.

Preparation of the topsoil layer will include loose placement of the upper six inches of on-site soil, applying two tons per acre of weed free native hay mulch and crimping the mulch with a crimper disc. The fertility of the topsoil layer will be analyzed in the first year and appropriate fertilizers applied to the cover in the second year, if needed. Irrigation will not be required.

A maximum of 20 percent slope will control surface erosion for the vegetated cover. Calculations to determine maximum surface velocities relative to permissible velocities for vegetated soil cover were determined for the larger cap and cover at the solar evaporation ponds at the Rocky Flats Plant (Rockwell International, 1988a). Velocities were calculated using the rational formula for surface runoff assuming a 100-year, 60-minute storm event, adjusted for the time of concentration for the longest flow path on the cover. An area equal to the longest flow length, having a

unit width, was used in conjunction with a flow concentration factor (Nelson, 1986) of 3.0 to account for potential gully erosion from sheet flow conditions. Flow velocities of 2.7 feet per second were calculated using Manning's equation. Maximum velocities will occur along the limits of the cover on the north slope. Permissible flow velocities below which surface erosion will not occur were obtained from referenced sources (Nelson, 1986; NAVFAC, 1982). The average permissible velocity for the conditions anticipated on the cover is three feet per second. Therefore, the erosion of the soil and vegetation cover is not anticipated as a result of the design storm event.

Additional periodic maintenance will be performed, including reseeding and weed control as necessary. The cover and vegetative growth will be inspected quarterly as specified in the Part B Post-Closure Care Permit Application. During this inspection, trees and bushes will be removed, and the condition of the vegetation will be observed.

4.6 Quality Assurance/Quality Control Procedures

A detailed quality assurance/quality control manual for cap construction will be completed and submitted with the plans

and specifications for the cap. These plans and specifications will be submitted in accordance with the closure schedule presented in Section 1.5.3. A brief explanation of anticipated actions follows.

4.6.1 Quality Control

Quality control of the closure of the OPWL will include materials, lines and grades, and material placement. The method for controlling the quality of each of these areas will be presented in the final construction specifications.

Control of material quality will be by random sampling at specified intervals. Earthen materials will be tested for their characteristics such as gradation, Atterberg limits, moisture-density relation, specific gravity and durability. Manufactured materials will be certified by the manufacturer to meet the required specifications. Throughout the closure of the OPWL, material utilized will be visually observed during placement to see that the materials meet the intended use and project specifications.

Control of lines and grades during closure will be by surveying. Surveys will be conducted under the supervision

of a registered land surveyor. Deviation from construction drawings will be indicated and as-built drawings showing constructed lines and grades will be prepared upon completion.

Control of placement will be by visual observation of the methods, equipment and practices utilized for placement of materials. Earthen materials shall also be tested for proper placement by in-place testing of moisture, densities and gradations, as applicable. Manufactured materials will be tested, as appropriate, to determine that field installation methods have produced the required quality of product. The synthetic membrane will have all field seams tested in accordance with the manufacturer's recommendations. As a minimum, all field seams will be visually inspected.

Quality control testing will be performed in accordance with ASTM or other recognized test procedures.

4.6.2 Quality Assurance

To assure that the quality control plan is being implemented during closure of the facility, a quality assurance plan

will be set forth as part of the final construction documents. The quality assurance plan will set the time intervals between quality assurance reviews, information to be reviewed and procedures for correction of quality control problems if present. The quality assurance plan will be dependent on the final quality control specifications and the time schedule set for closure. It is anticipated that the certifying engineer for closure will provide quality assurance reviews.

4.7 Health and Safety Plan

A site specific Health and Safety Plan for cap construction, including such health and safety procedures identified in the Rocky Flats Operational Safety Analysis (RFOSA) procedure covering contaminated soil removal, will be prepared two months before soil removal activities begin. The plan will be submitted to the Colorado Department of Health for information and will comply with all applicable requirements. The procedures presented below are guidelines that will be followed during closure activities. Additional procedures and details from those outlined herein will be presented in the site specific Health and Safety Plan or the RFOSA. Worker safety guidelines, such as OSHA regulations,

DOE orders and Rocky Flats Plant policies will be followed. Protective clothing will be similar in nature to:

- hardhats,
- steel-toe boots,
- protective overboots,
- Tyvek suits,
- dust masks, and
- air-purifying respirators or self-contained breathing apparatus (optional).

The intent of this equipment is to provide a barrier to inhalation, ingestion and absorption of contaminated materials. Appropriate protective gloves will be used based on the contamination found at any particular site.

Air monitoring will be conducted in the work area. Portable high-volume (40 cfm) samplers or fixed radioactive ambient air samplers (25 cfm) will be located around the excavation area, including at probable downwind locations.

Air monitoring will also be conducted using hand-held photoionization detectors. The site specific health and safety plan or OSA will present levels, which if exceeded, will require some action be taken, such as increasing respiratory protection or work cessation.

A Rocky Flats Environmental Sciences representative will be monitoring conditions during excavation activities. This person will have the authority and responsibility to terminate the work if any of the following events occur.

- Wind speeds exceed 24 km/hr (15 mph).
- Any visible dust is present or there is any indication that dust control measures are inadequate.
- The total long-lived alpha concentrations measured on filters from high-volume samplers exceed 0.06 pCi/m^3 in order to re-evaluate dust control procedures.
- Power failure.
- Heavy rainfall or snow.

Airborne contamination may require upgrading dust masks to air-purifying respirators or self-contained breathing apparatus. Sudden increases in airborne contamination due to excavation in localized highly contaminated areas may be addressed by a temporary cessation of work until natural dissipation reduces contamination.

4.8 Maintenance of Final Cover

Maintenance of the final cover is required to meet the performance standards of 6 CCR 265.310(b)(1) and (3).

Periodic maintenance of the final cover will be conducted as required. Periodic maintenance may include:

- Regrading to maintain slope and grade,
- Revegetation,
- Replacing the gravel,
- Replacement of the membrane or soil cap, and
- Sealing cracks that develop in the concrete.

The amount of periodic maintenance will depend largely on the types of cap and cover used and the forces the cap and cover are exposed to. Routine repairs of the cap or cover may be needed to prevent ponding and drainage problems due to local subsidence.

Construction activities conducted in capped areas will be performed in a manner to minimize disturbance of the cap and cover. However, some disturbance is anticipated before the end of the post-closure care period. Cap and cover areas may be disturbed due to new building, roadway, or sidewalk construction; repairs, resurfacing and replacing existing roads or sidewalks; and repair, replacement or new construction of underground utilities. Any portion of the cap and cover disturbed before the end of the post-closure care period will be repaired or replaced with an equivalent method.

Visual inspection of the final cover will be conducted quarterly throughout the post-closure care period.

5.0 CLOSURE ALTERNATIVE OF REMOVAL AND DISPOSAL OF CONTAMINATED LINES, TANKS AND SOIL

5.1 Introduction

If the soil characterization indicates the concentration of transuranics exceed level II, as discussed in Section 3.4.5.2, the contaminated soil in those areas will be removed. However, if soil characterization indicates the concentrations of the indicator parameters are between levels I and II, which indicates capping is required, removal and disposal may be selected if it is more economical.

All soil removal activities must comply with a Rocky Flats Plant Operational Safety Analysis (OSA) procedure. These OSAs are required for all activities with a potential risk for serious injury, radiation exposure to personnel, or damage to property or the environment. The OSA requirement and definition are currently under review. The current draft of this requirement, RFOSA-1 (Rockwell, 1988c), describes the procedures for removal of plutonium and/or uranium contaminated soil at the Rocky Flats Plant. The approved OSA appropriate for soil removal activities at the

OPWL will be submitted to the CDH and EPA at least two months before soil removal activities begin, for review.

If soil contamination at the OPWL (based on the soil characterization) is found, these procedures will be reviewed in light of the physical constraints of the contaminated area, as well as the levels of contamination identified. If necessary, these procedures will be revised to protect human health and the environment of both the workers and the public.

5.2 Removal, Packaging and Disposal

A front end loader or backhoe will be used to excavate contaminated soil along the original process waste lines. If soil and tank characterization indicates the soils are clean but one or more tanks are contaminated, the (front end loader/backhoe) will be used to excavate soil as necessary to access the tank(s). Hand excavation will be conducted in areas where a (front end loader/backhoe) cannot be used.

Lines and tanks to be removed will be broken down by mechanical means as necessary for removal and packaging. Since the lines and tanks are composed of a variety of

materials (i.e., concrete, steel, stainless steel, cast iron, vitrified clay, hose, polyvinyl chloride, glass, teflon, fiberglass), the type of equipment required for size reduction will be based on the section of line or the tank requiring removal. Jack hammers, concrete saws, and pipe cutters are some of the types of equipment that may be used.

Following removal, any contaminated soil or lines and tanks will be packaged in either 55-gallon steel drums or boxes made of plastic-lined, triple-wall fiberboard with capacities of approximately 15 cubic feet. As an alternative, four-foot by four-foot by seven-foot steel boxes may be used. The containers selected for use will depend upon the requirements of the facility used for disposal.

The boxes will be labeled and shipped off-site for disposal at an approved disposal site for mixed radioactive and hazardous wastes or the Nevada Test Site (NTS).

A Rocky Flats Environmental Sciences representative will be within the work area during all operations. This person will have the authority and responsibility to terminate the work if any of the following events occur.

- Wind speeds exceed 24 km/hr (15 mph).
- Any visible dust is present or there is any indication that dust control measures were inadequate.
- The total long-lived alpha concentrations measured on filters from portable ambient air samplers exceed 0.06 pCi/m^3. Air monitoring is discussed in Section 5.4.

The amount of area excavated at any given time will depend on the anticipated total area to be excavated. Water and/or dust palliatives will be used to control resuspension and transport by wind of contaminated soil during excavation. The need to implement dust control and the procedures selected will be based on visual observations of the work area and the results of air monitoring.

5.3 Site Restoration

Subsequent to removing any contaminated soil, lines or tanks, the excavation will be backfilled with clean, on-site soils. Soils removed from the excavation that are clean may be reused for backfill. Clean soils from other areas of Rocky Flats may also be used. The soils will be adjusted to near optimum moisture content and placed and compacted to at least 90 percent of the maximum standard Proctor density (ASTM D-698) in landscape areas and at least 95 percent of

the maximum standard Proctor density (ASTM D-698) in paved or unpaved roadway or parking lot areas or sidewalk areas. If any of the excavations are in planned building or structure areas, soils beneath proposed shallow foundations should be placed and compacted to at least 100 percent of ASTM D-698 and soils beneath proposed floor slabs should be placed and compacted to at least 95 percent of ASTM D-698, at a moisture content near optimum.

The equipment used for compaction will be appropriate to achieve the required compaction characteristics for the types of soils being compacted. For example, a sheepsfoot compactor may be used for clay soils and a smooth-drum roller may be used for granular soils.

The surface of the backfill will be graded to the approximate elevations that existed prior to tank, line or soil removal. The graded surface will be finished in a manner consistent with surrounding use, such as paving with asphalt or concrete, covering with gravel or vegetating.

The length of excavation to remain open at any given time will depend on the anticipated total length to be excavated and the restrictions imposed on plant personnel and

operations by a barricaded and marked excavation. It is desirable to maximize the length of excavation restored at any given time because soil placement and compaction achieves better results and becomes more time efficient if the excavation length can be increased.

5.4 Air Monitoring

Air monitoring will be conducted in the work area. Portable high-volume (40 cfm) samplers or fixed radioactive ambient air samplers (25 cfm) will be located around the excavation area, including at probable downwind locations.

Air monitoring will also be conducted using hand-held photoionization detectors. The site specific health and safety plan or OSA will present levels, which if exceeded, will require some action be taken, such as increasing respiratory protection or work cessation.

A Rocky Flats Environmental Sciences representative will be monitoring conditions during excavation activities. This person will have the authority and responsibility to terminate the work if any of the following events occur.

- Wind speeds exceed 24 km/hr (15 mph).
- Any visible dust is present or there is any indication that dust control measures were inadequate.
- The total long-lived alpha concentrations measured on filters from high-volume samplers exceed 0.06 pCi/m^3 in order to re-evaluate dust control procedures.
- Power failure.
- Heavy rainfall or snow.

Airborne contamination may require upgrading dust masks to air-purifying respirators or self-contained breathing apparatus. Sudden increases in airborne contamination due to excavation in localized highly contaminated areas may be addressed by a temporary cessation of work until natural dissipation reduces contamination.

5.5 Access Control

Access to the work area will be limited to authorized personnel only.

An area immediately outside the excavation area will be used for equipment decontamination and for personnel decontamination. The equipment decontamination area will be used to scrape or brush chunks of soil or debris off the

equipment when it leaves the building. Additional information on this area is presented in Section 6.0. The personnel decontamination area will be used by personnel about to leave the site for removing and discarding the disposal protective clothing. This clothing will be temporarily stored in containers to be transported to and disposed of at an approved disposal site or the Nevada Test Site. Entry to the working area will be through clean, restricted areas in the decontamination area.

5.6 Dust Control

Dust palliatives, such as water and/or soil stabilizer sprays, will be used to control resuspension of soil during excavation. The need to implement dust control and the procedures selected will be based on visual observations of the work area and the results of air monitoring inside and outside the building.

5.7 Health and Safety Plan

A site specific Health and Safety Plan, or such health and safety procedures identified in the Rocky Flats Operational Safety Analysis (RFOSA) procedure, covering contaminated

soil removal will be prepared two months before soil removal activities begin. The plan will be submitted to the Colorado Department of Health for information and will comply with all applicable requirements. The procedures presented below are guidelines that will be followed during closure activities. Additional procedures and details will be presented in the site specific Health and Safety Plan. Worker safety guidelines, such as OSHA regulations, DOE orders and Rocky Flats Plant policies will be followed. Protective clothing will be similar in nature to:

- hardhats,
- steel-toe boots,
- protective overboots,
- Tyvek suits,
- dust masks, and
- air purifying respirators or self-contained breathing apparatus (optional).

The intent of this equipment is to provide a barrier to inhalation, ingestion and absorption of dust particles. Appropriate protective gloves will be used.

Air monitoring will be conducted in the work area, as discussed in Section 5.4. Airborne contamination may require upgrading dust masks to air-purifying respirators or self-contained breathing apparatus. Sudden increases in airborne contamination due to excavation in localized highly

contaminated areas may be addressed by a temporary cessation of work until natural dissipation reduces contamination.

Windblown releases from the site will be minimized with dust control measures, as discussed in Section 5.6.

6.0 DECONTAMINATION OF TANKS, LINES AND EQUIPMENT

6.1 Introduction

In accordance with 6 CCR 1007-3, Sections 256.112(b)(4) and 265.114, a detailed description is required of the steps needed to remove and dispose, or decontaminate, all hazardous waste residues and contaminated containment system components and equipment, including construction equipment used during removal of contaminated soils, lines or tanks. Auxiliary equipment associated with the original process waste lines will also be decontaminated. Construction equipment used during capping activities will be decontaminated if the soils being removed are contaminated. Decontamination will involve the procedures described in the following sections.

6.2 Decontamination Procedures

6.2.1 Tanks

Tanks will be decontaminated by hydroblasting using a solution consisting of 0.5 percent

ethylenediaminetetraacetic acid (EDTA), and 0.25M citric acid in deionized (DI) water. The hydroblasting will be conducted three times. Small tanks with restricted access will be flushed three times. This procedure will be assumed to adequately decontaminate tanks for hazardous constituents. However, following decontamination, the tanks will be checked for any remaining radioactive contamination, as discussed in Section 6.3.

6.2.2 Lines

Lines will be filled with non-shrinking grout. No decontamination of lines is anticipated. See Section 3.2.4 for additional details.

6.2.3 Auxiliary Equipment

As discussed in Section 1.4, the auxiliary equipment associated with the original process waste lines were previously decontaminated and used elsewhere at the plant or were sent to an approved off-site facility at the time the tanks or lines were abandoned or converted to the new process waste system or fire water deluge collection system.

6.2.4 Construction Equipment

Construction equipment anticipated to be used during closure may include backhoes, front-end loaders, Bobcat loaders, compactors, water trucks and liner seaming equipment. If large quantities of soil are to be removed, additional equipment, such as haul trucks and scrapers, may be used.

All construction equipment involved with removing contaminated soils, lines and tanks will be scraped or brushed to remove chunks of soil or debris whenever the equipment leaves the excavation area or building used during excavation. Similarly, construction equipment used during capping to remove soils which are contaminated will also be scraped or brushed to remove chunks of soil or debris whenever the equipment is moved to an area where there are no contaminated soils. The areas used for scraping or brushing will be raked and/or swept to collect all removed chunks. The collected material will be handled as a mixed radioactive and hazardous waste and will be packaged using approved methods and containers, and shipped to an approved disposal facility or the Nevada Test Site (NTS).

At the end of all closure activities, all large construction equipment that came into contact with contaminated materials, and all large, movable auxiliary equipment associated with the original process waste lines will be decontaminated by hydroblasting at a temporary decontamination facility that may be constructed specific to this project as discussed in Section 6.4. Hydroblasting will be conducted using a solution of 0.5 percent EDTA and 0.25M citric acid in deionized water. The hydroblasting will be conducted three times. This procedure will be assumed to adequately decontaminate equipment for hazardous constituents. However, following decontamination, the equipment will be checked for any remaining radioactive contamination as discussed in Section 6.3.

Small construction and auxiliary equipment, and equipment used for demolition of the temporary decontamination facility, will be of proper size to be subsequently decontaminated in Building 889. This facility is currently equipped to decontaminate up to moderately sized construction equipment. The facility is planned to be enlarged by January 1989 to accommodate slightly larger construction equipment.

At the temporary decontamination facility and in Building 889, equipment will be triple rinsed with a spray system. The decontamination spray system to be used will heat water to approximately 359 degrees Fahrenheit under 250 pounds per square inch (psi) gauge pressure. The super-heated, high pressure steam will be sprayed on the contaminated surface through a series of nozzles incorporated into the vacuum/spray cleaning head. The exact equipment used for decontamination will vary depending on contractor selection. The decontamination equipment used will provide for adequate decontamination of the construction equipment.

6.3 Evaluating Radioactive Contamination

6.3.1 Surveying for Alpha

The exposed area of the item will be surveyed for removable alpha contamination by smearing the item with a 5.5-square centimeter (cm^2) Reeve-Angel filter paper and counting the smear in a scintillation-type smear counter instrument. To be considered "clean," the item must have removable alpha contamination less than 20 disintegrations per minute (dpm) per 100 square centimeters (cm^2). To facilitate surveys of

larger surfaces, an area of one square meter will be smeared. For these large surfaces, the total activity must be less than 50 dpm to be considered "clean."

The exposed area of the item will also be surveyed for non-removable or fixed contamination using the air proportional-type alpha survey instrument. The direct count must be less than 250 counts per minute (cpm) to be considered "clean."

If the removable alpha contamination is greater than 20 dpm/100 cm^2, or the fixed contamination is greater than 250 cpm, the item may be used within the PSZ. If not reused, the item will be broken down, packaged and shipped off site for disposal at a facility approved for disposal of radioactive wastes.

6.3.2 Surveying for Beta-Gamma

The exposed areas of the item will be surveyed for removable beta-gamma contamination by smearing the component with a 5.5-cm Reeve-Angel filter paper and counting the smear with a Ludlum Model 31 instrument. To be "clean," the item must have removable beta-gamma contamination less than 200 cpm/100 CM^2, provided the background count does not

exceed 100 cpm. For larger surfaces, an area of one square meter will be smeared. For these larger surfaces, the total activity must be less than 400 cpm, provided the included background count does not exceed 100 cpm.

The exposed areas of the item will also be surveyed for fixed beta-gamma contamination using a Ludlum Model 31, Geiger-Mueller type instrument. The instrument probe will be placed close to and moved slowly over the item and the count rate reading noted. The reading must be less than 600 cpm. to be considered "clean," provided the background count does not exceed 100 cpm.

To be considered "clean," the combined total of removable and fixed beta-gamma contamination must be less than 60 cpm, provided the removable contamination is less than 200 cpm/100 cm^2 and the background count does not exceed 100 cpm.

If the background count exceeds 100 cpm, the count must be performed in a different area or sufficient shielding must be provided so the background level is not greater than 100 cpm.

6.4 Decontamination Facility

A temporary decontamination facility may be constructed specifically for this project. If other ongoing remediation projects have adequate decontamination facilities, such as the solar ponds, existing facilities will be used in lieu of a new facility. The facility, if constructed, will be approximately 100 feet by 200 feet in plan dimension. A temporary barrier will be erected around the facility.

The temporary decontamination area will consist of a concrete or metal wash rack overlying a geomembrane. The geomembrane will be sloped to allow collection of rinsate. This area will measure approximately 30 feet by 50 feet in plan dimension. A gravel pad will be placed around the area for ease of working. The equipment will be driven or placed on the rack after entering the decontamination facility and hydroblasting will be conducted three times. The rinsate will be collected and will be transported to a temporary holding tank.

The rinsate will be characterized according to the procedures outlined in the Waste Management and Waste Analysis Plan, Section C of the RCRA Part B Operating Permit

Application (U.S. Department of Energy, 1987a). Upon characterization, the rinsate will be treated on site in the appropriate Rocky Flats process waste treatment facility.

7.0 GROUND-WATER MONITORING

7.1 Introduction

If portions of the OPWL are closed with contaminated tank system components or contaminated soils remaining in place, those portions must meet the post-closure care requirements that apply to land disposal facilities (6 CCR 265.310) as specified in 6 CCR 265.197(b). Post-closure care for land disposal facilities require ground-water monitoring as specified in 6 CCR 265.90 et seq. This section discusses the ground-water monitoring requirements.

7.2 Ground-Water Monitoring

Ground-water monitoring is addressed in the hydrogeologic characterization report in Appendix 4.

8.0 CLOSURE CERTIFICATION

8.1 Certification Requirements

Closure certification requirements are outlined in 6 CCR 1007-3, Section 265.115 and 40 CFR 265.115:

> "When closure is completed, the owner or operator must submit to the (Department of Health/Regional Administrator) certification both by the owner or operator and by an independent registered professional engineer that the facility has been closed in accordance with the specifications in the approved closure plan."

Certification by an independent registered professional engineer does not guarantee the adequacy of the closure procedures and does not necessarily involve detailed testing and analyses. It implies that, based on periodic facility inspections, closure has been completed in accordance with the specifications in the approved closure plan (U.S. Environmental Protection Agency, 1981).

8.2 Activities Requiring Inspections by a Registered Professional Engineer

The following closure activities will require reviews and/or inspections by a registered professional engineer:

- results of survey to determine if wastes remain in the tanks,
- disposition of any remaining wastes,
- results of tank/line and soil characterization,
- tank, line and/or soil removals, and
- cap and cover construction.

8.3 Anticipated Schedule of Inspections by a Registered Professional Engineer

An independent registered professional engineer will periodically review the closure operations in order that a final certification of closure can be developed which states that the closure has been carried out according to the plan. The engineer will observe construction activities and be present during performance and completion of key closure activities. The engineer will periodically obtain and review the results of chemical testing which provide a record of the progress and effectiveness of the implemented closure plan, where outlined by the closure plan to be required.

The independent engineer and the owner will, at the end of closure, inspect the site and certify that the closure plan was carried out as described. Prior to final certification,

deficiencies noted by the engineer will be corrected. When deficiencies have been corrected, the engineer will issue a written report to the regulatory agencies certifying that the facility has been closed according to this closure document.

9.0 SITE SECURITY

The existing security measures at the Rocky Flats plant include:

- a three-strand barbed wire cattle fence surrounding the facility (Figure 1-1) posted to identify the land as a government reservation/ restricted area,
- a fence surrounding and guards posted 24 hours per day at two gates to the controlled area of the facility (Figure 1-1),
- a six-foot high chain link fence topped by two feet of three-strand barbed wire surrounding and guards posted 24 hours per day at gates to the perimeter security zone (PSZ),
- guards patrolling the controlled area and the PSZ 24 hours per day, and
- surveillance by security cameras 24 hours per day.

The existing security measures are sufficient to meet the requirements of 6 CCR 1007-3, Section 265.14.

The existing fences and gates are operated and maintained by the U.S. Department of Energy. Maintenance requirements will be performed by the U.S. Department of Energy regardless of the activities at the original process waste lines.

NOTICE

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Document # 000296

Titled: Original Process Waste Lines Location Map Plate I

Fiche location: A-SW-M16

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Document # 000296

Titled: Closure Plan Activity Diagram Plate II

Fiche location: A-SW-M16

APPENDIX 1

ORIGINAL PROCESS WASTE LINES
SITE UTILITY LOCATION MAPS

APPENDIX 1 : Original Process Waste Lines
Site Utility Location Maps

The 15 Original Process Waste Lines (OPWL) Site Utility Location Maps in Appendix 1 show details on the location of all the OPWL pipes and tanks in Table 1-1 (Summary of Original Process Waste Lines) and Table 1-2 (Summary of Original Process Waste Tanks) from Section 1.2 of the closure plan.

The approximate location of the lines and tanks are shown on the OPWL Location Map, Figure 1-3 from Section 1.2 of the closure plan. The OPWL Location Map is keyed by lettered rows (A through F) and numbered columns (1 through 8) which correspond to applicable OPWL Site Utility Location Maps as shown by shaded map keys near the bottom of Fig. 1-3.

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Document # 000296

Titled: Original Process Waste Lines Site Utility Location Map B-4 Fig A1-1

Fiche location: A-SW-M17

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Document # 000296

Titled: Original Process Waste Lines Site Utility Location MAP B-6 Fig. A1-3

Fiche location: A-SW-M17

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Document # 000296

Titled: Original Process Waste Lines Site, Utility Location Map C-5 Fig A1-5

Fiche location: A-SW-M17

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Titled: Original Process Waste Lines Site Utility Location MAP C-7 Fig. A1-7

Fiche location: A-SW-M18

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Titled: Original Process Waste Lines Site Utility Location MAP C-8 Fig. A1-8

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Titled: Original Process Waste Lines Site Utility Location MAP E-2 Fig. A1-10

Fiche location: A-SW-M18

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Titled: Original Process Waste Lines Site Utility Location MAP E-3 Fig A1-11

Fiche location: A-SW-M18

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Document # 000296

Titled: Original Process Waste Lines Site Utility Location MAP E-5 Fig. A1-13

Fiche location: A-SW-M19

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Document # 000296

Titled: Original Process Waste Lines Site Location Utility MAP F-3 Fig A1-14

Fiche location: A-SW-M19

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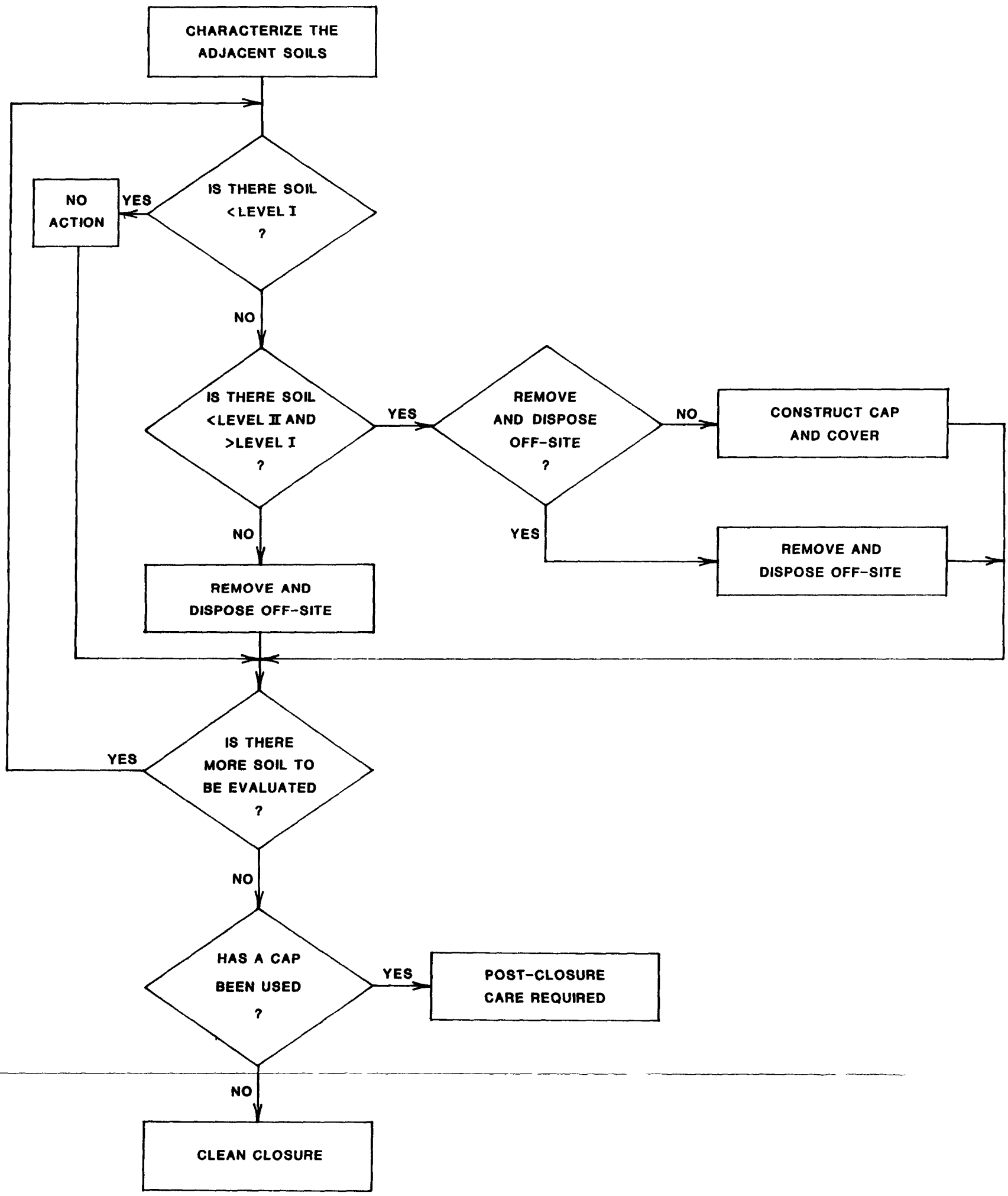
Document # 000296

Titled: Original Process Waste Lines Site Utility Location MAP F-5 Fig. A1-15

Fiche location: A-SW-M19



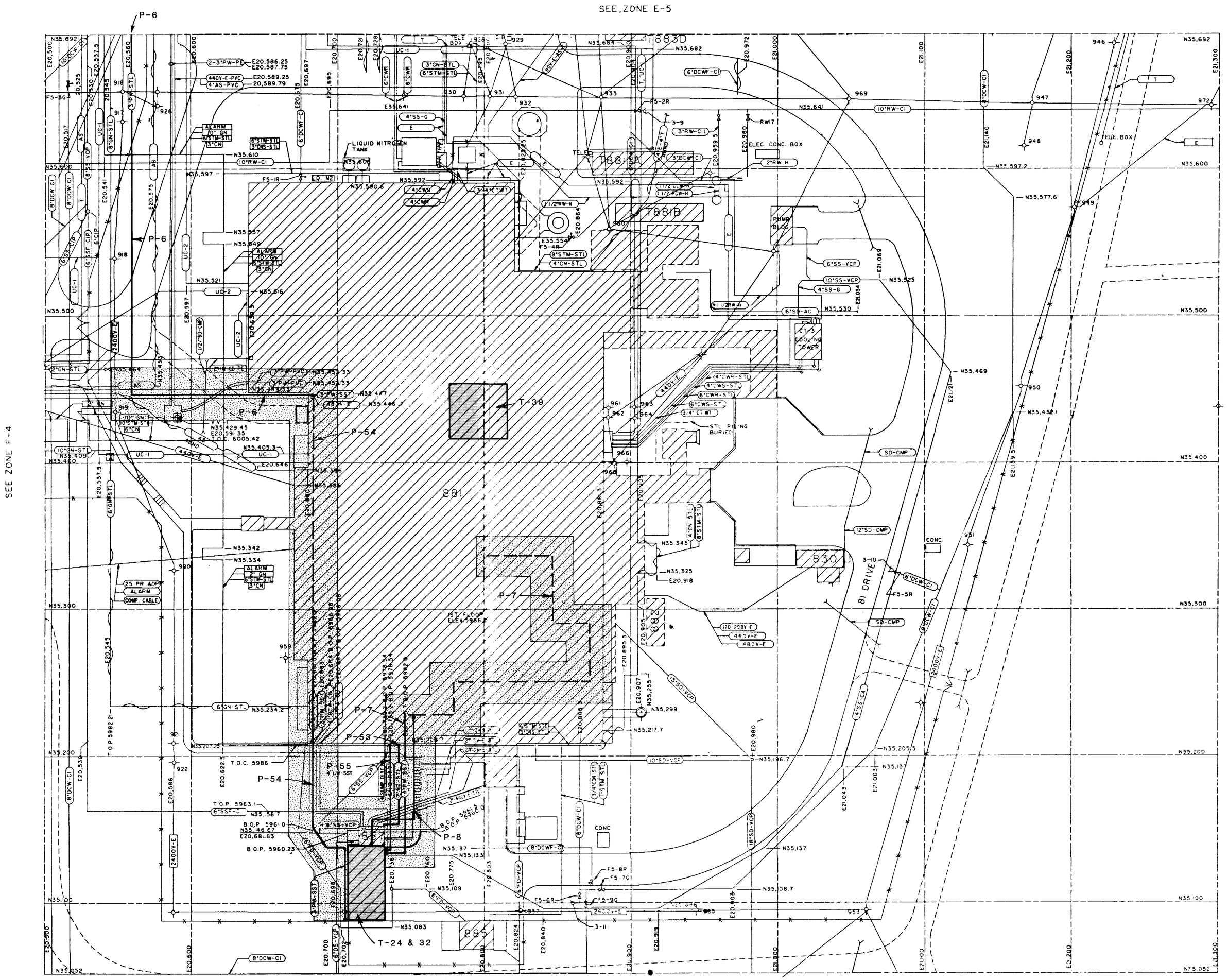
6 064 87

Chen & Associates

SOIL CLOSURE ACTIVITIES FLOW DIAGRAM

Fig 3-1

88280



MAP F-5

ABREVIATIONS

ABDN	ABANDONED
ASM	ALARM AND METERING
AR	ARGON
AS	ALARM SYSTEM-------2'-6" TO 3'-0" DEEP
BD	BLOW DOWN
BM	BENCH MARK (ALSO ABM)
B.O.P.	BOTTOM OF DUCT
B.O.P.	BOTTOM OF PIPE
BA	BREATHING AIR
CA OR CAP	CEMENT-ASBESTOS PIPE
CB	CATCH BASIN
CCL4	CARBON TETRACHLORIDE
CD	CONDUIT
CI	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CN	CONDENSATION, STEAM
CNA	CONCENTRATED NITRIC ACID
CONC	CONCRETE
CWNP	COLD WATER NOT POTABLE
CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
CU	COPPER PIPE
CO	CLEAN OUT
DCW	DOMESTIC COLD WATER } 5'-0" TO 8'-0" DEEP
DCWF	DOMESTIC COLD WATER-FIRE } 5'-0" TO 8'-0" DEEP
D.I.	DUCTILE IRON PIPE
DUCT	DUCT PLASTIC, TRANSITE OR STEEL IN CONC.
E	ELECTRICAL---------1'-6" TO 3'-0" DEEP
EL OR ELEV.	ELEVATION
EMH	ELECTRICAL MANHOLE
E-N	N_2 LOW PRESSURE ALARM
FD	FOUNDATION DRAIN
FG	FIBERGLASS PIPE
FH	FIRE HYDRANT
FO	FUEL OIL
G	GLASS LINED PIPE } 4'-0" DEEP
GLP	GAS, LIQUID PETROLEUM } 4'-0" DEEP
GN	GAS, NATURAL } 4'-0" DEEP
HF	HYDROFLORIC ACID } 4'-0" DEEP
HH	HAND HOLE } 4'-0" DEEP
HW	HONEYWELL ALARM SYSTEM } 4'-0" DEEP
KV	KILOVOLT
KOH	POTASSIUM HYDROXIDE
IA	INSTRUMENT AIR
LW	LAUNDRY WASTE
MH	MANHOLE
N_2	NITROGEN } 2'-0" TO 4'-0" DEEP
O_2	OXYGEN } 2'-0" TO 4'-0" DEEP
OS	OUTFALL SEWER } 2'-0" TO 4'-0" DEEP
PA	PLANT AIR
PB	PULL BOX
PE	POLYETHYLENE PIPE
POW	PROCESS OIL WASTE
PVC	POLYVINYL CHLORIDE PIPE
PW	PROCESS WASTE } 4'-0" TO 8'-0" DEEP
PWF	PROCESS WASTE-FORCED } 4'-0" TO 8'-0" DEEP
PWR	PROCESS WASTE RETURN } 4'-0" TO 8'-0" DEEP
PWS	PROCESS WASTE SUPPLY } 4'-0" TO 8'-0" DEEP
RCP	REINFORCED CONCRETE PIPE
RT	RIGID TEFLON PIPE
RW	RAW WATER
SD	STORM DRAIN } 4'-0" TO 8'-0" DEEP
SS	SANITARY SEWER } 4'-0" TO 8'-0" DEEP
SSF	SANITARY SEWER FORCED } 4'-0" TO 8'-0" DEEP
SST	STAINLESS STEEL PIPE } 4'-0" TO 8'-0" DEEP
STM	STEAM (5 P.S.I. & ABOVE) } 4'-0" TO 8'-0" DEEP
STL	STEEL PIPE } 4'-0" TO 8'-0" DEEP
T	TELEPHONE---------1'-0" TO 8'-0" DEEP
TMH	TELEPHONE MANHOLE
TWR	TOWER WATER RETURN
TWS	TOWER WATER SUPPLY
UC-1	UNDERGROUND CABLE-CLASS 1 } 2'-6" TO 3'-0" DEEP
UC-2	UNDERGROUND CABLE-CLASS 2 } 2'-6" TO 3'-0" DEEP
VCP	VITRIFIED CLAY PIPE
VV	VALVE VAULT
SE+	SEWAGE EFFLUENT
ROF	REVERSE OSMOSIS FEED
ROPW	REVERSE OSMOSIS PRODUCT WATER
PFBW	PREGDA FILTER BACKWASH
PROB	PRIMARY REVERSE OSMOSIS BRINE
SROP	SECONDARY REVERSE OSMOSIS
DBF	DRYING BED FILTRATE

N

40 20 0 40 80 120

SCALE IN FEET (1" = 40')

LEGEND

- Lines present underground
- Lines present beneath buildings
- Location of Tanks
- Starting or ending point of line segments
- P-1 Pipe Reference, see Table 1-1
- T-1 Tank Reference, see Table 1-2
- Area of reported release. Size is for presentation and does not represent the extent of release.

UTILITY INDENTIFICATION

12" ⌀ CI — SIZE OF PIPE OR CONDUIT; TYPE OF UTILITY; MATERIAL OF PIPE OR CONDUIT

3" PW-PE, 4" PW-PE — GANGED SYMBOLS INDICATE 2 OR MORE UTILITIES IN THE SAME AREA

85 - 3 - R — INDICATES FIRE LINE (RED); VALVE NO. WITHIN INDICATED ZONE; ZONE NUMBER

85 - 3 - G — INDICATES DOMESTIC WATER (GREEN); VALVE NO. WITHIN INDICATED ZONE; ZONE NUMBER

6 - 10 — INDICATES FIRE LINE (RED)

SYMBOLS

- UTILITY BELOW GRADE
- UTILITY ABOVE GRADE
- UTILITY LINE IN SERVICE
- UTILITY LINE ABANDONED
- VALVE
- POST INDICATOR VALVE
- FIRE HYDRANT
- POWER POLE
- POWER POLES WITH ANCHORS
- MANHOLE OR VALVE VAULT
- BENCH MARK MONUMENT
- CULVERT
- CLEAN OUT
- SLUICE GATE

BASE MAP: ROCKWELL INTERNATIONAL DRAWING 15501-54 P F-5

ORIGINAL PROCESS WASTE LINES SITE UTILITY LOCATION MAP F-5

Chen & Associates
Consulting Geotechnical Engineers
96 South Zuni St. • Denver, Colorado 80223

Drawn L.D.M. Check G.J.	Date OCT. 1, 1988	Figure A1-15
Revised 1	Job Number 6 064 87	

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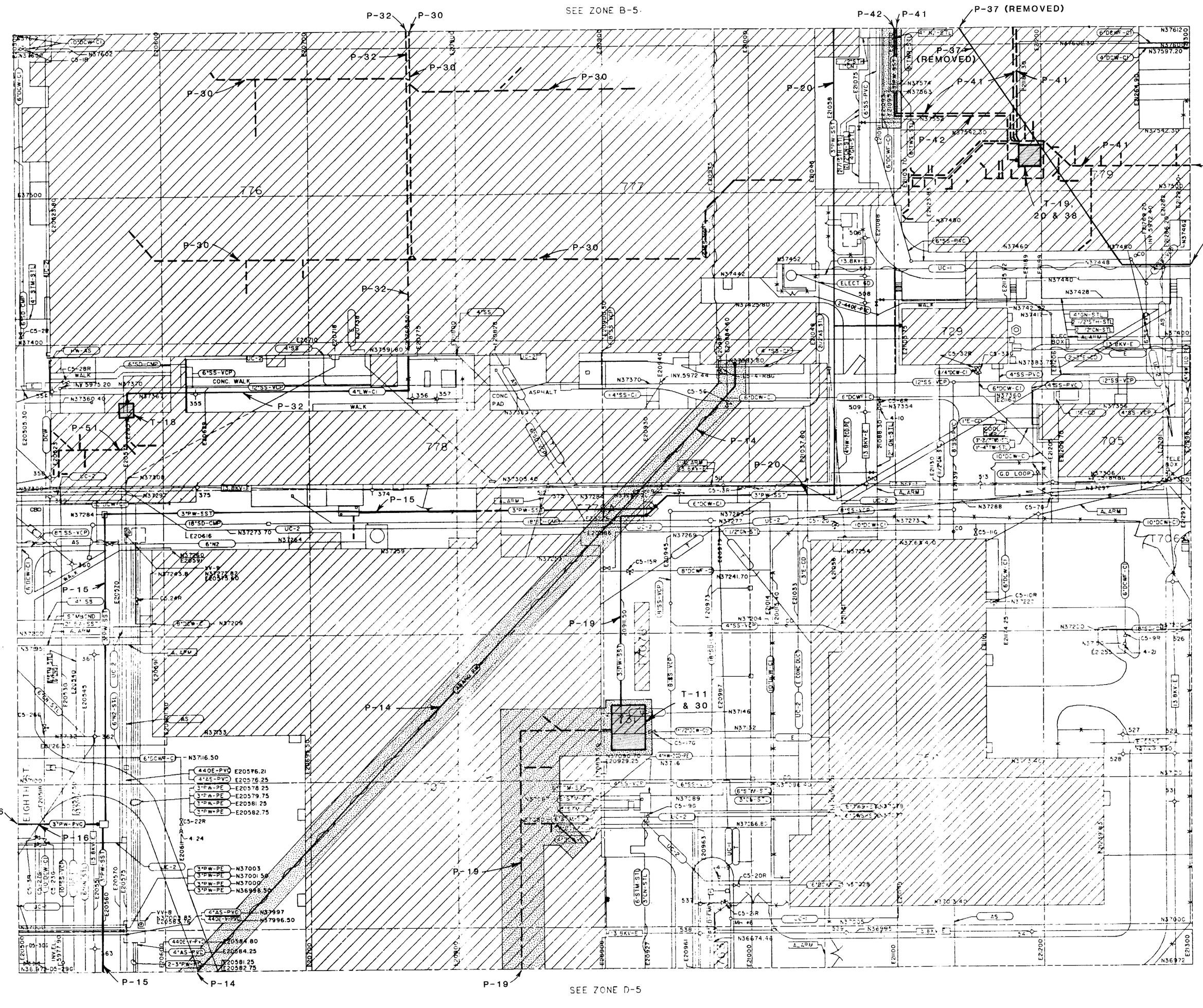

MAP C-5

ABREVIATIONS

ABDN	ABANDONED
ABM	ALARM AND METERING
AR	ARGON
AS	ALARM SYSTEM-------2'6" TO 3'0" DEEP
BD	BLOW DOWN
BM	BENCH MARK (ALSO ABM)
B O D	BOTTOM OF DUCT
B O P	BOTTOM OF PIPE
B.A.	BREATHING AIR
CA OR CAP	CEMENT-ASBESTOS PIPE
CB	CATCH BASIN
CCL4	CARBON TETRACHLORIDE
CD	CONDUIT
CI	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CN	CONDENSATION, STEAM
CNA	CONCENTRATED NITRIC ACID
CONC	CONCRETE
CWNP	COOLING WATER NON POTABLE
CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
CU	COPPER PIPE
CO	CLEAN OUT
DCW	DOMESTIC COLD WATER
DCWF	DOMESTIC COLD WATER-FIRE
DI	DUCTILE IRON PIPE
DUCT	DUCT PLASTIC, TRANSITE OR STEEL IN CONC.
(DCW, DCWF, DI, DUCT)	5'-0" TO 8'-0" DEEP
E	ELECTRICAL----------1'-6" TO 3'-0" DEEP
EL OR ELEV.	ELEVATION
EMH	ELECTRICAL MANHOLE
E-N	N_2 LOW PRESSURE ALARM
FD	FOUNDATION DRAIN
FG	FIBERGLASS PIPE
FH	FIRE HYDRANT
FO	FUEL OIL
G	GLASS LINED PIPE
GLP	GAS, LIQUID PETROLEUM
GN	GAS, NATURAL
(G, GLP, GN)	4'-0" DEEP
HF	HYDROFLORIC ACID
HH	HAND HOLE
HW	HONEYWELL ALARM SYSTEM
KV	KILOVOLT
KOH	POTASSIUM HYDROXIDE
IA	INSTRUMENT AIR
LW	LAUNDRY WASTE
MH	MANHOLE
N_2	NITROGEN
O_2	OXYGEN
OS	OUTFALL SEWER
(N_2, O_2, OS)	2'-0" TO 4'-0" DEEP
PA	PLANT AIR
PB	PULL BOX
PE	POLYETHYLENE PIPE
POW	PROCESS OIL WASTE
PVC	POLYVINYL CHLORIDE PIPE
PW	PROCESS WASTE
PWF	PROCESS WASTE-FORCED
PWR	PROCESS WASTE RETURN
PWS	PROCESS WASTE SUPPLY
(PW, PWF, PWR, PWS)	4'-0" TO 8'-0" DEEP
RCP	REINFORCED CONCRETE PIPE
RT	RIGID TEFLON PIPE
RW	RAW WATER
SD	STORM DRAIN
SS	SANITARY SEWER
SSF	SANITARY SEWER FORCED
SST	STAINLESS STEEL PIPE
STM	STEAM (5 P.S.I. & ABOVE)
STL	STEEL PIPE
(SS, SSF, SST, STM, STL)	4'-0" TO 8'-0" DEEP
T	TELEPHONE--------1'-0" TO 8'-0" DEEP
TMH	TELEPHONE MANHOLE
TWR	TOWER WATER RETURN
TWS	TOWER WATER SUPPLY
UC-1	UNDERGROUND CABLE-CLASS 1
UC-2	UNDERGROUND CABLE-CLASS 2
(UC-1, UC-2)	2'-6" TO 3'-0" DEEP
VCP	VITRIFIED CLAY PIPE
VV	VALVE VAULT
SE	SEWAGE EFFLUENT
ROF	REVERSE OSMOSIS FEED
ROPW	REVERSE OSMOSIS PRODUCT WATER
PFBW	PRECOAT FILTER BACKWASH
PROB	PRIMARY REVERSE OSMOSIS BRINE
SROP	SECONDARY REVERSE OSMOSIS
DBF	DRYING BED FILTRATE

SCALE IN FEET (1" = 40')

LEGEND

- Lines present underground
- Lines present beneath buildings
- Location of Tanks
- Starting or ending point of line segments
- P-1 Pipe Reference, see Table 1-1
- T-1 Tank Reference, see Table 1-2
- Area of reported release. Size is for presentation and does not represent the extent of release.

UTILITY INDENTIFICATION

12" JCA CI — SIZE OF PIPE OR CONDUIT; TYPE OF UTILITY; MATERIAL OF PIPE OR CONDUIT

3" PW-PE, 4" PW-PE — GANGED SYMBOLS INDICATE 2 OR MORE UTILITIES IN THE SAME AREA

85 - 3 - R — INDICATES FIRE LINE (RED); VALVE NO. WITHIN INDICATED ZONE; ZONE NUMBER

85 - 3 - G — INDICATES DOMESTIC WATER (GREEN); VALVE NO. WITHIN INDICATED ZONE; ZONE NUMBER

6 - 10 — INDICATES FIRE LINE (RED)

SYMBOLS

- UTILITY BELOW GRADE
- UTILITY ABOVE GRADE
- UTILITY LINE IN SERVICE
- UTILITY LINE ABANDONED
- VALVE
- POST INDICATOR VALVE
- FIRE HYDRANT
- POWER POLE
- POWER POLES WITH ANCHORS
- MANHOLE OR VALVE VAULT
- BENCH MARK MONUMENT
- CULVERT
- CLEAN OUT
- SLUICE GATE

BASE MAP: ROCKWELL INTERNATIONAL DRAWING 15501-21 L C-5

ORIGINAL PROCESS WASTE LINES SITE UTILITY LOCATION MAP C-5

Chen & Associates
Consulting Geotechnical Engineers
96 South Zuni St. • Denver, Colorado 80223

Drawn L.D.M. Check G.J.	Date OCT. 1, 1988	Figure A1-5
Revised 1	Job Number 6 064 87	

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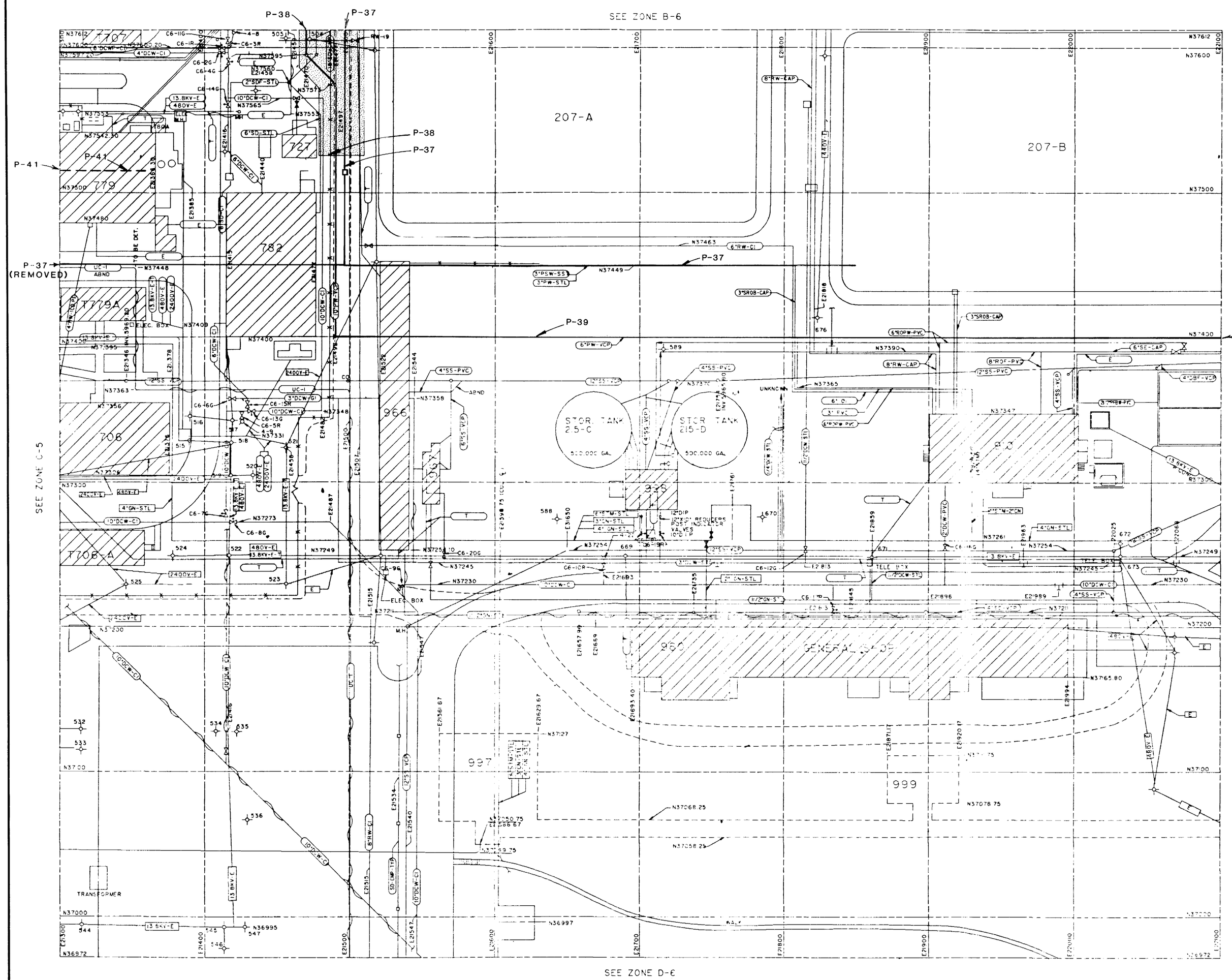

MAP C-6

ABREVIATIONS

ABDN	ABANDONED
ABM	ALARM AND METERING
AR	ARGON
AS	ALARM SYSTEM--------2'-6" TO 3'-0" DEEP
BD	BLOW DOWN
BM	BENCH MARK (ALSO ABM)
B.O.P.	BOTTOM OF DUCT
B.O.P.	BOTTOM OF PIPE
BA	BREATHING AIR
CA OR CAP	CEMENT-ASBESTOS PIPE
CB	CATCH BASIN
CCL4	CARBON TETRACHLORIDE
CD	CONDUIT
CI	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CN	CONDENSATION STEAM
CNA	CONCENTRATED NITRIC ACID
CONC	CONCRETE
CWNP	COLD WATER NOT POTABLE
CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
CU	COPPER PIPE
CO	CLEAN OUT
DCW	DOMESTIC COLD WATER } 5'-0" TO 8'-0" DEEP
DCWF	DOMESTIC COLD WATER-FIRE } 5'-0" TO 8'-0" DEEP
D.I.	DUCTILE IRON PIPE
DUCT	DUCT PLASTIC, TRANSITE OR STEEL IN CONC.
E	ELECTRICAL----------1'-6" TO 3'-0" DEEP
EL OR ELEV.	ELEVATION
EMH	ELECTRICAL MANHOLE
E-N	N_2 LOW PRESSURE ALARM
FD	FOUNDATION DRAIN
FG	FIBERGLASS PIPE
FH	FIRE HYDRANT
FO	FUEL OIL
G	GLASS LINED PIPE } 4'-0" DEEP
GLP	GAS, LIQUID PETROLEUM } 4'-0" DEEP
GN	GAS, NATURAL } 4'-0" DEEP
HF	HYDROFLORIC ACID } 4'-0" DEEP
HH	HAND HOLE } 4'-0" DEEP
HW	HONEYWELL ALARM SYSTEM } 4'-0" DEEP
KV	KILOVOLT
KOH	POTASSIUM HYDROXIDE
IA	INSTRUMENT AIR
LW	LAUNDRY WASTE
MH	MANHOLE
N_2	NITROGEN } 2'-0" TO 4'-0" DEEP
O_2	OXYGEN } 2'-0" TO 4'-0" DEEP
OS	OUTFALL SEWER } 2'-0" TO 4'-0" DEEP
PA	PLANT AIR
PB	PULL BOX
PE	POLYETHYLENE PIPE
POW	PROCESS OIL WASTE
PVC	POLYVINYL CHLORIDE PIPE
PW	PROCESS WASTE } 4'-0" TO 8'-0" DEEP
PWF	PROCESS WASTE-FORCED } 4'-0" TO 8'-0" DEEP
PWR	PROCESS WASTE RETURN } 4'-0" TO 8'-0" DEEP
PWS	PROCESS WASTE SUPPLY } 4'-0" TO 8'-0" DEEP
RCP	REINFORCED CONCRETE PIPE
RT	RIGID TEFLON PIPE
RW	RAW WATER
SD	STORM DRAIN } 4'-0" TO 8'-0" DEEP
SS	SANITARY SEWER } 4'-0" TO 8'-0" DEEP
SSF	SANITARY SEWER FORCED } 4'-0" TO 8'-0" DEEP
SST	STAINLESS STEEL PIPE } 4'-0" TO 8'-0" DEEP
STM	STEAM (5 P.S.I. & ABOVE) } 4'-0" TO 8'-0" DEEP
STL	STEEL PIPE } 4'-0" TO 8'-0" DEEP
T	TELEPHONE--------1'-0" TO 8'-0" DEEP
TMH	TELEPHONE MANHOLE
TWR	TOWER WATER RETURN
TWS	TOWER WATER SUPPLY
UC-1	UNDERGROUND CABLE-CLASS 1 } 2'-6" TO 3'-0" DEEP
UC-2	UNDERGROUND CABLE-CLASS 2 } 2'-6" TO 3'-0" DEEP
VCP	VITRIFIED CLAY PIPE
VV	VALVE VAULT
SE	SEWAGE EFFLUENT
ROF	REVERSE OSMOSIS FEED
RODPW	REVERSE OSMOSIS PRODUCT WATER
PRBW	PRECOAT FILTER BACKWASH
PROB	PRIMARY REVERSE OSMOSIS BRINE
SROP	SECONDARY REVERSE OSMOSIS
DBF	DRYING BED FILTRATE

LEGEND

- Lines present underground
- Lines present beneath buildings
- Location of Tanks
- Starting or ending point of line segments
- P-1 Pipe Reference, see Table 1-1
- T-1 Tank Reference, see Table 1-2
- Area of reported release. Size is for presentation and does not represent the extent of release.

40 20 0 40 80 120
SCALE IN FEET (1" = 40')

UTILITY INDENTIFICATION

SIZE OF PIPE OR CONDUIT
TYPE OF UTILITY
12" CK A C1
MATERIAL OF PIPE OR CONDUIT

3" PW-PE
4" PW-PE
GANGED SYMBOLS INDICATE 2 OR MORE UTILITIES IN THE SAME AREA

85 - 3 - R
INDICATES FIRE LINE (RED)
VALVE NO. WITHIN INDICATED ZONE
ZONE NUMBER

85 - 3 - G
INDICATES DOMESTIC WATER (GREEN)
VALVE NO. WITHIN INDICATED ZONE
ZONE NUMBER

6 - 10
INDICATES FIRE LINE (RED)

SYMBOLS

- UTILITY BELOW GRADE
- UTILITY ABOVE GRADE
- UTILITY LINE IN SERVICE
- UTILITY LINE ABANDONED
- VALVE
- POST INDICATOR VALVE
- FIRE HYDRANT
- POWER POLE
- POWER POLES WITH ANCHORS
- MANHOLE OR VALVE VAULT
- BENCH MARK MONUMENT
- CULVERT
- CLEAN OUT
- SLUICE GATE

BASE MAP: ROCKWELL INTERNATIONAL DRAWING 15501-22 M C-6

ORIGINAL PROCESS WASTE LINES SITE UTILITY LOCATION MAP C-6

Chen & Associates
Consulting Geotechnical Engineers
96 South Zuni St. • Denver, Colorado 80223

Drawn L.D.M. Check G.J.	Date OCT. 1, 1988	Figure A1-6
Revised 1	Job Number 6 064 87	

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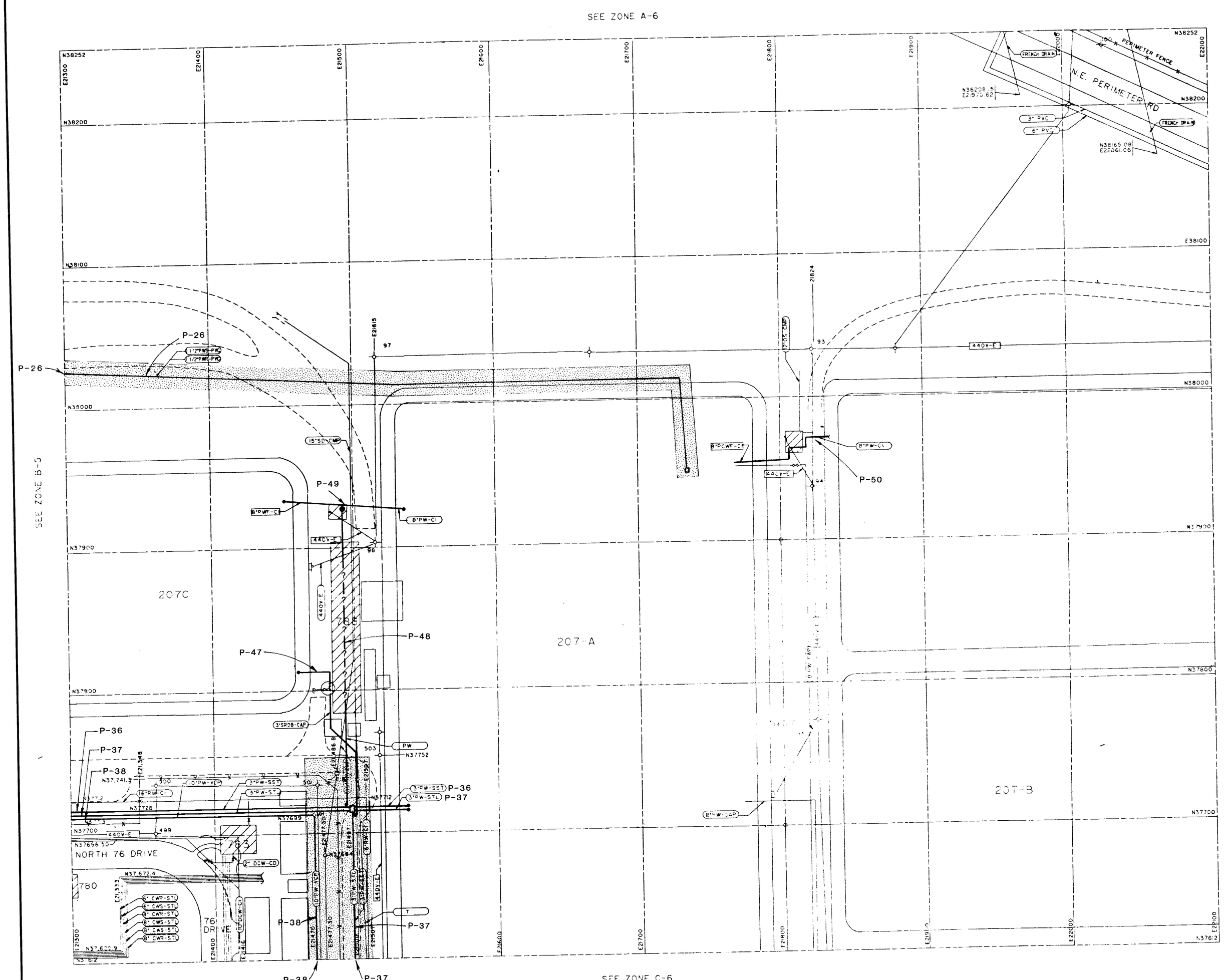

MAP B-6

ABREVIATIONS

ABDN	ABANDONED
ABM	ALARM AND METERING
AR	ARGON
AS	ALARM SYSTEM-------2'6" TO 3'0" DEEP
BD	BLOW DOWN
BM	BENCH MARK (ALSO ABM)
B.U.P.	BOTTOM UP DUCT
B.O.P.	BOTTOM OF PIPE
BA.	BREATHING AIR
CA OR CAP	CEMENT-ASBESTOS PIPE
CB	CATCH BASIN
CCL4	CARBON TETRACHLORIDE
CD	CONDUIT
CI	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CN	CONDENSATION, STEAM
CNA	CONCENTRATED NITRIC ACID
CONC	CONCRETE
CWNP	COLD WATER NOT POTABLE
CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
CU	COPPER PIPE
CO	CLEAN OUT
DCW	DOMESTIC COLD WATER
DCWF	DOMESTIC COLD WATER-FIRE
DCW, DCWF: 5'-0" TO 8'-0" DEEP	
DI	DUCTILE IRON PIPE
DUCT	DUCT PLASTIC, TRANSITE OR STEEL IN CONC.
E	ELECTRICAL----------1'-6" TO 3'-0" DEEP
EL. OR ELEV.	ELEVATION
EMH	ELECTRICAL MANHOLE
E-N	N_2 LOW PRESSURE ALARM
FD	FOUNDATION DRAIN
FG	FIBERGLASS PIPE
FH	FIRE HYDRANT
FO	FUEL OIL
G	GLASS LINED PIPE
GLP	GAS, LIQUID PETROLEUM
GN	GAS, NATURAL
HF	HYDROFLORIC ACID
HH	HAND HOLE
HW	HONEYWELL ALARM SYSTEM
G, GLP, GN, HF, HH, HW: 4'-0" DEEP	
KV	KILOVOLT
KOH	POTASSIUM HYDROXIDE
IA	INSTRUMENT AIR
LW	LAUNDRY WASTE
MH	MANHOLE
N_2	NITROGEN
O_2	OXYGEN
OS	OUTFALL SEWER
N_2, O_2, OS: 2'-0" TO 4'-0" DEEP	
PA	PLANT AIR
PB	PULL BOX
PE	POLYETHYLENE PIPE
POW	PROCESS OIL WASTE
PVC	POLYVINYL CHLORIDE PIPE
PW	PROCESS WASTE
PWF	PROCESS WASTE-FORCED
PWR	PROCESS WASTE RETURN
PWS	PROCESS WASTE SUPPLY
PW, PWF, PWR, PWS: 4'-0" TO 8'-0" DEEP	
RCP	REINFORCED CONCRETE PIPE
RT	RIGID TEFLON PIPE
RW	RAW WATER
SD	STORM DRAIN
SS	SANITARY SEWER
SSF	SANITARY SEWER FORCED
SST	STAINLESS STEEL PIPE
STM	STEAM (5 P.S.I. & ABOVE)
STL	STEEL PIPE
SD, SS, SSF, SST, STM, STL: 4'-0" TO 8'-0" DEEP	
T	TELEPHONE-------1'-0" TO 8'-0" DEEP
TMH	TELEPHONE MANHOLE
TWR	TOWER WATER RETURN
TWS	TOWER WATER SUPPLY
UC-1	UNDERGROUND CABLE-CLASS 1
UC-2	UNDERGROUND CABLE-CLASS 2
UC-1, UC-2: 2'-6" TO 3'-0" DEEP	
VCP	VITRIFIED CLAY PIPE
VV	VALVE VAULT
SE+	SEWAGE EFFLUENT
ROF	REVERSE OSMOSIS FEED
ROPW	REVERSE OSMOSIS PRODUCT WATER
PFBW	PRECOAT FILTER BACKWASH
PROB	PRIMARY REVERSE OSMOSIS BRINE
SROP	SECONDARY REVERSE OSMOSIS
DBF	DRYING BED FILTRATE

40 20 0 40 80 120

SCALE IN FEET (1" = 40')

LEGEND

- Lines present underground
- Lines present beneath buildings
- Location of Tanks
- Starting or ending point of line segments
- P-1 Pipe Reference, see Table 1-1
- T-1 Tank Reference, see Table 1-2
- Area of reported release. Size is for presentation and does not represent the extent of release.

UTILITY INDENTIFICATION

SIZE OF PIPE OR CONDUIT
TYPE OF UTILITY
12" DCWA S1
MATERIAL OF PIPE OR CONDUIT

3" PW-PE
4" PW-PE
GANGED SYMBOLS INDICATE 2 OR MORE UTILITIES IN THE SAME AREA

85 - 3 - R
INDICATES FIRE LINE (RED)
VALVE NO. WITHIN INDICATED ZONE
ZONE NUMBER

85 - 3 - G
INDICATES DOMESTIC WATER (GREEN)
VALVE NO. WITHIN INDICATED ZONE
ZONE NUMBER

6 - 10
INDICATES FIRE LINE (RED)

SYMBOLS

- UTILITY BELOW GRADE
- UTILITY ABOVE GRADE
- UTILITY LINE IN SERVICE
- UTILITY LINE ABANDONED
- VALVE
- POST INDICATOR VALVE
- FIRE HYDRANT
- POWER POLE
- POWER POLES WITH ANCHORS
- MANHOLE OR VALVE VAULT
- BENCH MARK MONUMENT
- CULVERT
- CLEAN OUT
- SLUICE GATE

BASE MAP: ROCKWELL INTERNATIONAL DRAWING 15501-14 L B-6

ORIGINAL PROCESS WASTE LINES SITE UTILITY LOCATION MAP B-6

Chen & Associates
Consulting Geotechnical Engineers
96 South Zuni St. • Denver, Colorado 80223

Drawn L.D.M. Check G.J.	Date OCT. 1, 1988	Figure A1-3
Revised 1	Job Number 6 064 87	

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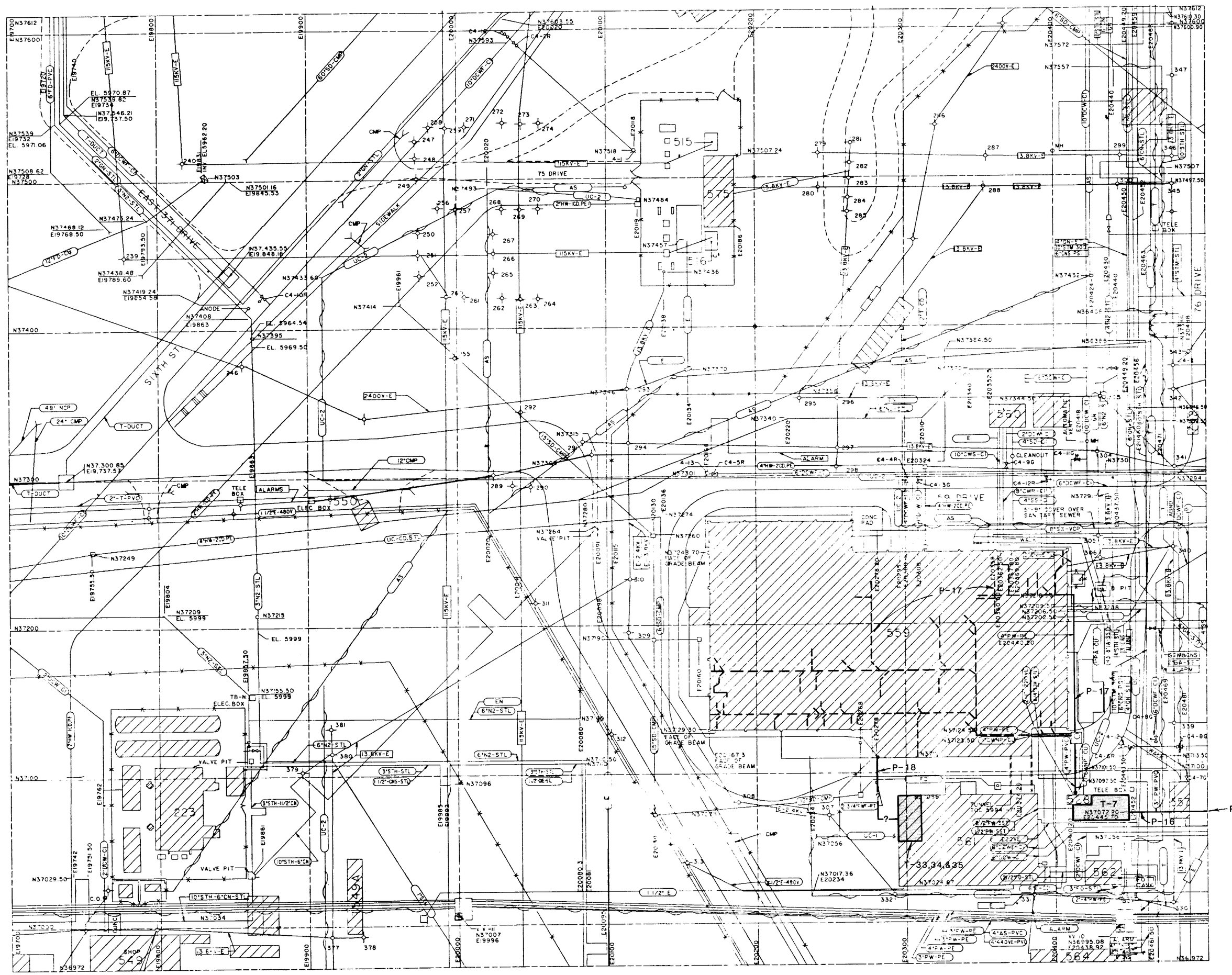
SEE ZONE B-4

SEE ZONE C-3



SEE ZONE C-5

SEE ZONE D-4

MAP C-4

ABREVIATIONS

ABDN	ABANDONED
ABM	ALARM AND METERING
AR	ARGON
AS	ALARM SYSTEM-------2'6" TO 3'0" DEEP
BD	BLOW DOWN
BM	BENCH MARK (ALSO ABM)
B.O.P.	BOTTOM OF DUCT
B.O.D.	BOTTOM OF PIPE
BA	BREATHING AIR
CA OR CAP	CEMENT-ASBESTOS PIPE
CB	CATCH BASIN
CCL4	CARBON TETRACHLORIDE
CD	CONDUIT
CI	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CN	CONDENSATION, STEAM
CNA	CONCENTRATED NITRIC ACID
CONC	CONCRETE
CWNP	COLD WATER NON POTABLE
CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
CU	COPPER PIPE
CO	CLEAN OUT
DCW	DOMESTIC COLD WATER] 5'-0" TO 8'-0" DEEP
DCWF	DOMESTIC COLD WATER-FIRE] 5'-0" TO 8'-0" DEEP
D.I.	DUCTILE IRON PIPE
DUCT	DUCT PLASTIC, TRANSITE OR STEEL IN CONC
E	ELECTRICAL---------1'-6" TO 3'-0" DEEP
EL OR ELEV.	ELEVATION
EMH	ELECTRICAL MANHOLE
E-N	N_2 LOW PRESSURE ALARM
FD	FOUNDATION DRAIN
FG	FIBERGLASS PIPE
FH	FIRE HYDRANT
FO	FUEL OIL
G	GLASS LINED PIPE] 4'-0" DEEP
GLP	GAS, LIQUID PETROLEUM] 4'-0" DEEP
GN	GAS, NATURAL] 4'-0" DEEP
HF	HYDROFLORIC ACID
HH	HAND HOLE
HW	HONEYWELL ALARM SYSTEM
KV	KILOVOLT
KOH	POTASSIUM HYDROXIDE
IA	INSTRUMENT AIR
LW	LAUNDRY WASTE
MH	MANHOLE
N_2	NITROGEN] 2'-0" TO 4'-0" DEEP
O_2	OXYGEN] 2'-0" TO 4'-0" DEEP
OS	OUTFALL SEWER] 2'-0" TO 4'-0" DEEP
PA	PLANT AIR
PB	PULL BOX
PE	POLYETHYLENE PIPE
POW	PROCESS OIL WASTE
PVC	POLYVINYL CHLORIDE PIPE
PW	PROCESS WASTE] 4'-0" TO 8'-0" DEEP
PWF	PROCESS WASTE-FORCED] 4'-0" TO 8'-0" DEEP
PWR	PROCESS WASTE RETURN] 4'-0" TO 8'-0" DEEP
PWS	PROCESS WASTE SUPPLY] 4'-0" TO 8'-0" DEEP
RCP	REINFORCED CONCRETE PIPE
RT	RIGID TEFLON PIPE
RW	RAW WATER
SD	STORM DRAIN] 4'-0" TO 8'-0" DEEP
SS	SANITARY SEWER] 4'-0" TO 8'-0" DEEP
SSF	SANITARY SEWER FORCED] 4'-0" TO 8'-0" DEEP
SST	STAINLESS STEEL PIPE] 4'-0" TO 8'-0" DEEP
STM	STEAM (5 P.S.I. & ABOVE)] 4'-0" TO 8'-0" DEEP
STL	STEEL PIPE] 4'-0" TO 8'-0" DEEP
T	TELEPHONE--------1'-0" TO 8'-0" DEEP
TMH	TELEPHONE MANHOLE
TWR	TOWER WATER RETURN
TWS	TOWER WATER SUPPLY
UC-1	UNDERGROUND CABLE-CLASS 1] 2'-6" TO 3'-0" DEEP
UC-2	UNDERGROUND CABLE-CLASS 2] 2'-6" TO 3'-0" DEEP
VCP	VITRIFIED CLAY PIPE
VV	VALVE VAULT
SE_4	SEWAGE EFFLUENT
ROF	REVERSE OSMOSIS FEED
ROPW	REVERSE OSMOSIS PRODUCT WATER
PFBW	PRECOAT FILTER BACKWASH
PROB	PRIMARY REVERSE OSMOSIS BRINE
SROP	SECONDARY REVERSE OSMOSIS
DBF	DRYING BED FILTRATE

N

40 20 0 40 80 120

SCALE IN FEET (1" = 40')

LEGEND

- Lines present underground
- Lines present beneath buildings
- Location of Tanks
- Starting or ending point of line segments
- P-1 Pipe Reference, see Table 1-1
- T-1 Tank Reference, see Table 1-2
- Area of reported release. Size is for presentation and does not represent the extent of release.

UTILITY INDENTIFICATION

SIZE OF PIPE OR CONDUIT
TYPE OF UTILITY
12" SCA CI
MATERIAL OF PIPE OR CONDUIT

3" PW-PE
4" PW-PE
GANGED SYMBOLS INDICATE 2 OR MORE UTILITIES IN THE SAME AREA

85 - 3 - R
INDICATES FIRE LINE (RED)
VALVE NO. WITHIN INDICATED ZONE
ZONE NUMBER

85 - 3 - G
INDICATES DOMESTIC WATER (GREEN)
VALVE NO. WITHIN INDICATED ZONE
ZONE NUMBER

6 - 10
INDICATES FIRE LINE (RED)

SYMBOLS

- UTILITY BELOW GRADE
- UTILITY ABOVE GRADE
- UTILITY LINE IN SERVICE
- UTILITY LINE ABANDONED
- VALVE
- POST INDICATOR VALVE
- FIRE HYDRANT
- POWER POLE
- POWER POLES WITH ANCHORS
- MANHOLE OR VALVE VAULT
- BENCH MARK MONUMENT
- CULVERT
- CLEAN OUT
- SLUICE GATE

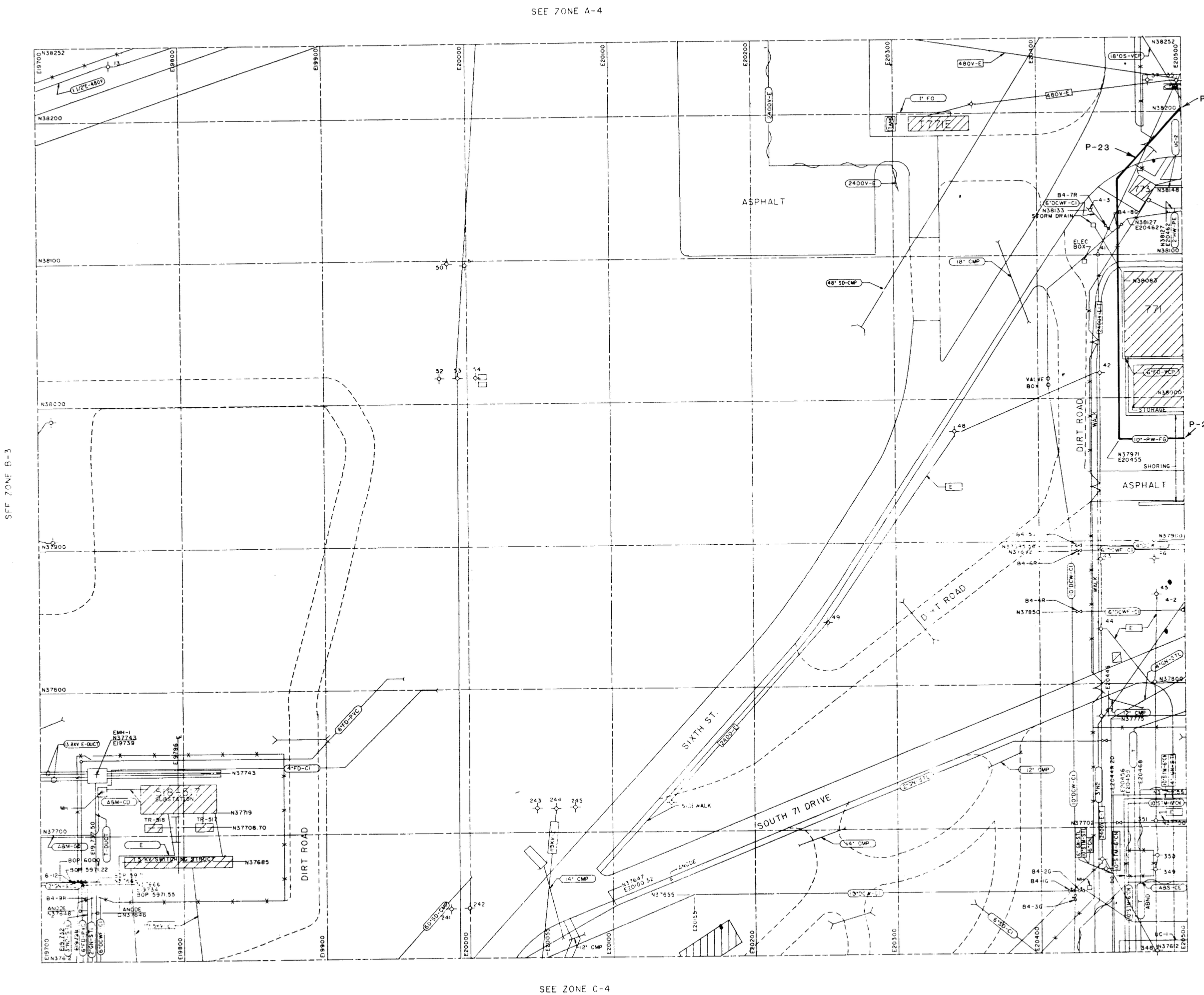
BASE MAP: ROCKWELL INTERNATIONAL DRAWING 15501-20 P C-4

ORIGINAL PROCESS WASTE LINES SITE UTILITY LOCATION MAP C-4

Chen & Associates
Consulting Geotechnical Engineers
96 South Zuni St. • Denver, Colorado 80223

Drawn L.D.M. Check G.J.	Date OCT. 1, 1988	Figure A1-4
Revised 1	Job Number 6 064 87	

88280



40 20 0 40 80 120

SCALE IN FEET (1" = 40')

LEGEND

- Lines present underground
- Lines present beneath buildings
- Location of Tanks
- Starting or ending point of line segments
- P-1 Pipe Reference, see Table 1-1
- T-1 Tank Reference, see Table 1-2
- Area of reported release. Size is for presentation and does not represent the extent of release.

UTILITY INDENTIFICATION

12" DCW CI — SIZE OF PIPE OR CONDUIT; TYPE OF UTILITY; MATERIAL OF PIPE OR CONDUIT

3" PW-PE, 4" PW-PE — GANGED SYMBOLS INDICATE 2 OR MORE UTILITIES IN THE SAME AREA

85 - 3 - R — INDICATES FIRE LINE (RED); VALVE NO WITHIN INDICATED ZONE; ZONE NUMBER

85 - 3 - G — INDICATES DOMESTIC WATER (GREEN); VALVE NO WITHIN INDICATED ZONE; ZONE NUMBER

6 - 10 — INDICATES FIRE LINE (RED)

ABREVIATIONS

ABDN	ABANDONED
ABM	ALARM AND METERING
AR	ARGON
AS	ALARM SYSTEM--------2'-6" TO 3'-0" DEEP
BD	BLOW DOWN
BM	BENCH MARK (ALSO ABM)
B.O.D.	BOTTOM OF DUCT
B.O.P.	BOTTOM OF PIPE
BA	BREATHING AIR
CA OR CAP	CEMENT-ASBESTOS PIPE
CB	CATCH BASIN
CCL4	CARBON TETRACHLORIDE
CD	CONDUIT
CI	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CN	CONDENSATION, STEAM
CNA	CONCENTRATED NITRIC ACID
CONC	CONCRETE
CWNP	COLD WATER NOT POTABLE
CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
CU	COPPER PIPE
CO	CLEAN OUT
DCW	DOMESTIC COLD WATER
DCWF	DOMESTIC COLD WATER-FIRE
D.I.	DUCTILE IRON PIPE
DUCT	DUCT PLASTIC, TRANSITE OR STEEL IN CONC
DCW, DCWF	5'-0" TO 8'-0" DEEP
E	ELECTRICAL---------1'-6" TO 3'-0" DEEP
EL OR ELEV.	ELEVATION
EMH	ELECTRICAL MANHOLE
E-N	N_2 LOW PRESSURE ALARM
FD	FOUNDATION DRAIN
FG	FIBERGLASS PIPE
FH	FIRE HYDRANT
FO	FUEL OIL
G	GLASS LINED PIPE
GLP	GAS, LIQUID PETROLEUM
GN	GAS, NATURAL
HF	HYDROFLORIC ACID
HH	HAND HOLE
HW	HONEYWELL ALARM SYSTEM
G, GLP, GN, HF, HH, HW	4'-0" DEEP
KV	KILOVOLT
KOH	POTASSIUM HYDROXIDE
IA	INSTRUMENT AIR
LW	LAUNDRY WASTE
MH	MANHOLE
N_2	NITROGEN
O_2	OXYGEN
OS	OUTFALL SEWER
N_2, O_2, OS	2'-0" TO 4'-0" DEEP
PA	PLANT AIR
PB	PULL BOX
PE	POLYETHYLENE PIPE
POW	PROCESS OIL WASTE
PVC	POLYVINYL CHLORIDE PIPE
PW	PROCESS WASTE
PWF	PROCESS WASTE-FORCED
PWR	PROCESS WASTE RETURN
PWS	PROCESS WASTE SUPPLY
PW, PWF, PWR, PWS	4'-0" TO 8'-0" DEEP
RCP	REINFORCED CONCRETE PIPE
RT	RIGID TEFLON PIPE
RW	RAW WATER
SD	STORM DRAIN
SS	SANITARY SEWER
SSF	SANITARY SEWER FORCED
SST	STAINLESS STEEL PIPE
STM	STEAM (5 P.S.I. & ABOVE)
STL	STEEL PIPE
SD, SS, SSF, SST, STM, STL	4'-0" TO 8'-0" DEEP
T	TELEPHONE---------1'-0" TO 8'-0" DEEP
TMH	TELEPHONE MANHOLE
TWR	TOWER WATER RETURN
TWS	TOWER WATER SUPPLY
UC-1	UNDERGROUND CABLE-CLASS 1
UC-2	UNDERGROUND CABLE-CLASS 2
UC-1, UC-2	2'-6" TO 3'-0" DEEP
VCP	VITRIFIED CLAY PIPE
VV	VALVE VAULT
SE	SEWAGE EFFLUENT
ROF	REVERSE OSMOSIS FEED
ROPW	REVERSE OSMOSIS PRODUCT WATER
PFBW	PRECOAT FILTER BACKWASH
PROB	PRIMARY REVERSE OSMOSIS BRINE
SROP	SECONDARY REVERSE OSMOSIS
DBF	DRYING BED FILTRATE

SYMBOLS

- UTILITY BELOW GRADE
- UTILITY ABOVE GRADE
- UTILITY LINE IN SERVICE
- UTILITY LINE ABANDONED
- VALVE
- POST INDICATOR VALVE
- FIRE HYDRANT
- POWER POLE
- POWER POLES WITH ANCHORS
- MANHOLE OR VALVE VAULT
- BENCH MARK MONUMENT
- CULVERT
- CLEAN OUT
- SLUICE GATE

BASE MAP: ROCKWELL INTERNATIONAL DRAWING 15501-12 M B-4

MAP B-4

ORIGINAL PROCESS WASTE LINES SITE UTILITY LOCATION MAP B-4

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Drawn L.D.M. Check G.J.	Date OCT. 1, 1988	Figure A1-1
Revised 1	Job Number 6 064 87	

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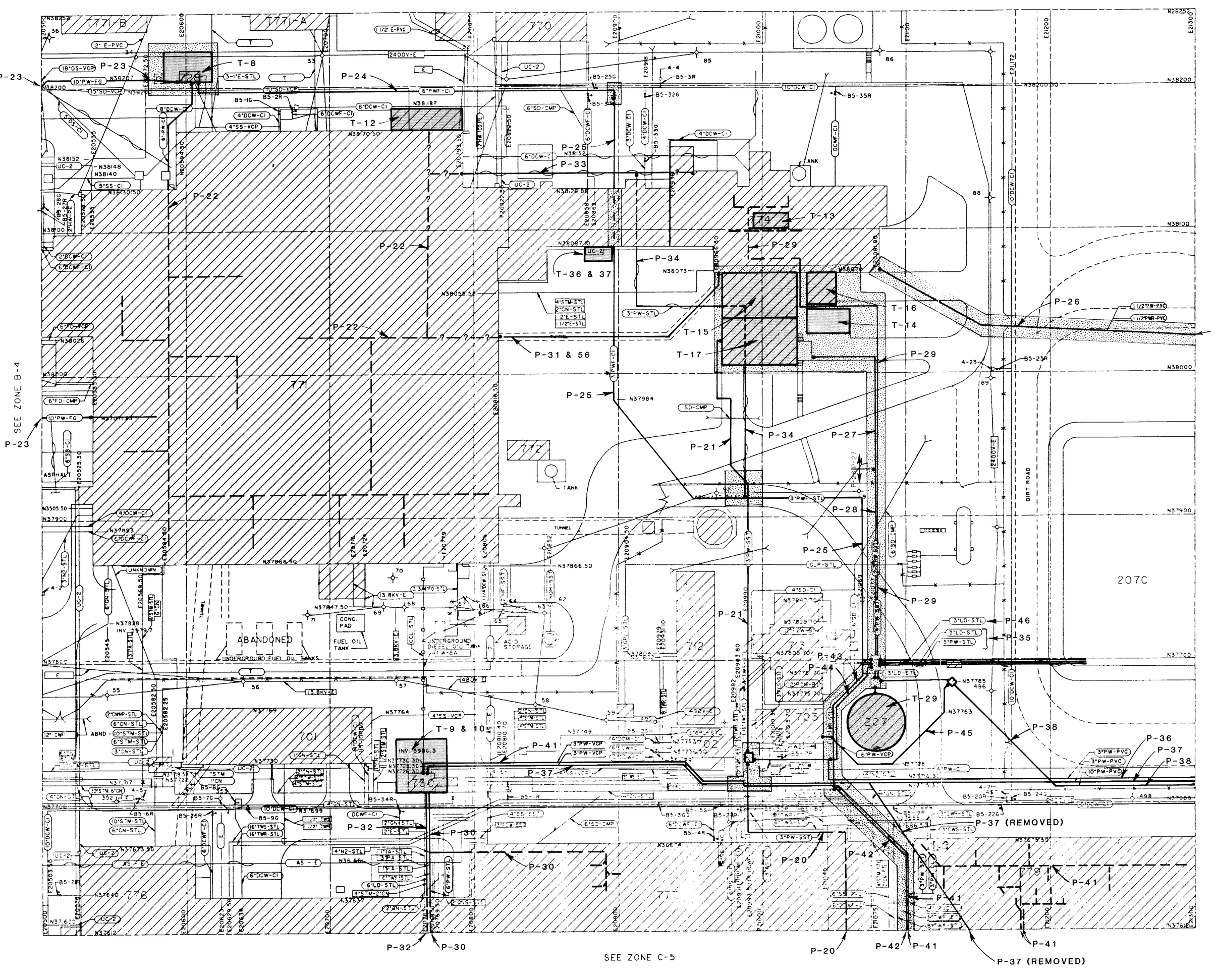

ABREVIATIONS

ABDN	ABANDONED
ABM	ALARM AND METERING
AR	ARGON
AS	ALARM SYSTEM--------2'-6" TO 3'-0" DEEP
BD	BLOW DOWN
BM	BENCH MARK (ALSO ABM)
B.O.P.	BOTTOM OF PIPE
B.O.D.	BOTTOM OF DUCT
BA	BREATHING AIR
CA OR CAP	CEMENT-ASBESTOS PIPE
CB	CATCH BASIN
CCL4	CARBON TETRACHLORIDE
CD	CONDUIT
CI	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CN	CONDENSATION STEAM
CNA	CONCENTRATED NITRIC ACID
CONC	CONCRETE
CWNP	COOLING WATER NOT POTABLE
CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
CU	COPPER PIPE
CO	CLEAN OUT
DCW	DOMESTIC COLD WATER
DCWF	DOMESTIC COLD WATER-FIRE] 5'-0" TO 8'-0" DEEP
D.I.	DUCTILE IRON PIPE
DUCT	DUCT PLASTIC, TRANSITE OR STEEL IN CONC.
E	ELECTRICAL----------1'-6" TO 3'-0" DEEP
EL OR ELEV.	ELEVATION
EMH	ELECTRICAL MANHOLE
E-N	N_2 LOW PRESSURE ALARM
FD	FOUNDATION DRAIN
FG	FIBERGLASS PIPE
FH	FIRE HYDRANT
FO	FUEL OIL
G	GLASS LINED PIPE
GLP	GAS, LIQUID PETROLEUM
GN	GAS, NATURAL] 4'-0" DEEP
HF	HYDROFLORIC ACID
HH	HAND HOLE
HW	HONEYWELL ALARM SYSTEM
KV	KILOVOLT
KOH	POTASSIUM HYDROXIDE
IA	INSTRUMENT AIR
LW	LAUNDRY WASTE
MH	MANHOLE
N_2	NITROGEN
O_2	OXYGEN] 2'-0" TO 4'-0" DEEP
OS	OUTFALL SEWER
PA	PLANT AIR
PB	PULL BOX
PE	POLYETHYLENE PIPE
POW	PROCESS OIL WASTE
PVC	POLYVINYL CHLORIDE PIPE
PW	PROCESS WASTE
PWF	PROCESS WASTE-FORCED
PWR	PROCESS WASTE RETURN] 4'-0" TO 8'-0" DEEP
PWS	PROCESS WASTE SUPPLY
RCP	REINFORCED CONCRETE PIPE
RT	RIGID TEFLON PIPE
RW	RAW WATER
SD	STORM DRAIN
SS	SANITARY SEWER
SSF	SANITARY SEWER FORCED] 4'-0" TO 8'-0" DEEP
SST	STAINLESS STEEL PIPE
STM	STEAM (5 P.S.I. & ABOVE)
STL	STEEL PIPE
T	TELEPHONE--------1'-0" TO 8'-0" DEEP
TMH	TELEPHONE MANHOLE
TWR	TOWER WATER RETURN
TWS	TOWER WATER SUPPLY
UC-1	UNDERGROUND CABLE-CLASS 1] 2'-6" TO 3'-0" DEEP
UC-2	UNDERGROUND CABLE-CLASS 2
VCP	VITRIFIED CLAY PIPE
VV	VALVE VAULT
SE	SEWAGE EFFLUENT
ROF	REVERSE OSMOSIS FEED
ROPW	REVERSE OSMOSIS PRODUCT WATER
PFBW	PREGOA FILTER BACKWASH
PROB	PRIMARY REVERSE OSMOSIS BRINE
SROP	SECONDARY REVERSE OSMOSIS
DBF	DRYING BED FILTRATE

SCALE IN FEET (1" = 40')

LEGEND

- Lines present underground
- Lines present beneath buildings
- Location of Tanks
- Starting or ending point of line segments
- P-1 Pipe Reference, see Table 1-1
- T-1 Tank Reference, see Table 1-2
- Area of reported release. Size is for presentation and does not represent the extent of release.

UTILITY INDENTIFICATION

- SIZE OF PIPE OR CONDUIT
- TYPE OF UTILITY
- MATERIAL OF PIPE OR CONDUIT
- 3" PW-PE / 4" PW-PE — GANGED SYMBOLS INDICATE 2 OR MORE UTILITIES IN THE SAME AREA
- 85 - 3 - R — INDICATES FIRE LINE (RED); VALVE NO WITHIN INDICATED ZONE; ZONE NUMBER
- 85 - 3 - G — INDICATES DOMESTIC WATER (GREEN); VALVE NO WITHIN INDICATED ZONE; ZONE NUMBER
- 6 - 10 — INDICATES FIRE LINE (RED)

SYMBOLS

- UTILITY BELOW GRADE
- UTILITY ABOVE GRADE
- UTILITY LINE IN SERVICE
- UTILITY LINE ABANDONED
- VALVE
- POST INDICATOR VALVE
- FIRE HYDRANT
- POWER POLE
- POWER POLES WITH ANCHORS
- MANHOLE OR VALVE VAULT
- BENCH MARK MONUMENT
- CULVERT
- CLEAN OUT
- SLUICE GATE

BASE MAP: ROCKWELL INTERNATIONAL DRAWING 15501-13 P B-5

MAP B-5

ORIGINAL PROCESS WASTE LINES SITE UTILITY LOCATION MAP B-5

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Drawn L.D.M. Check G.J.	Date OCT. 1, 1988	Figure A1-2
Revised 1	Job Number 6 064 87	

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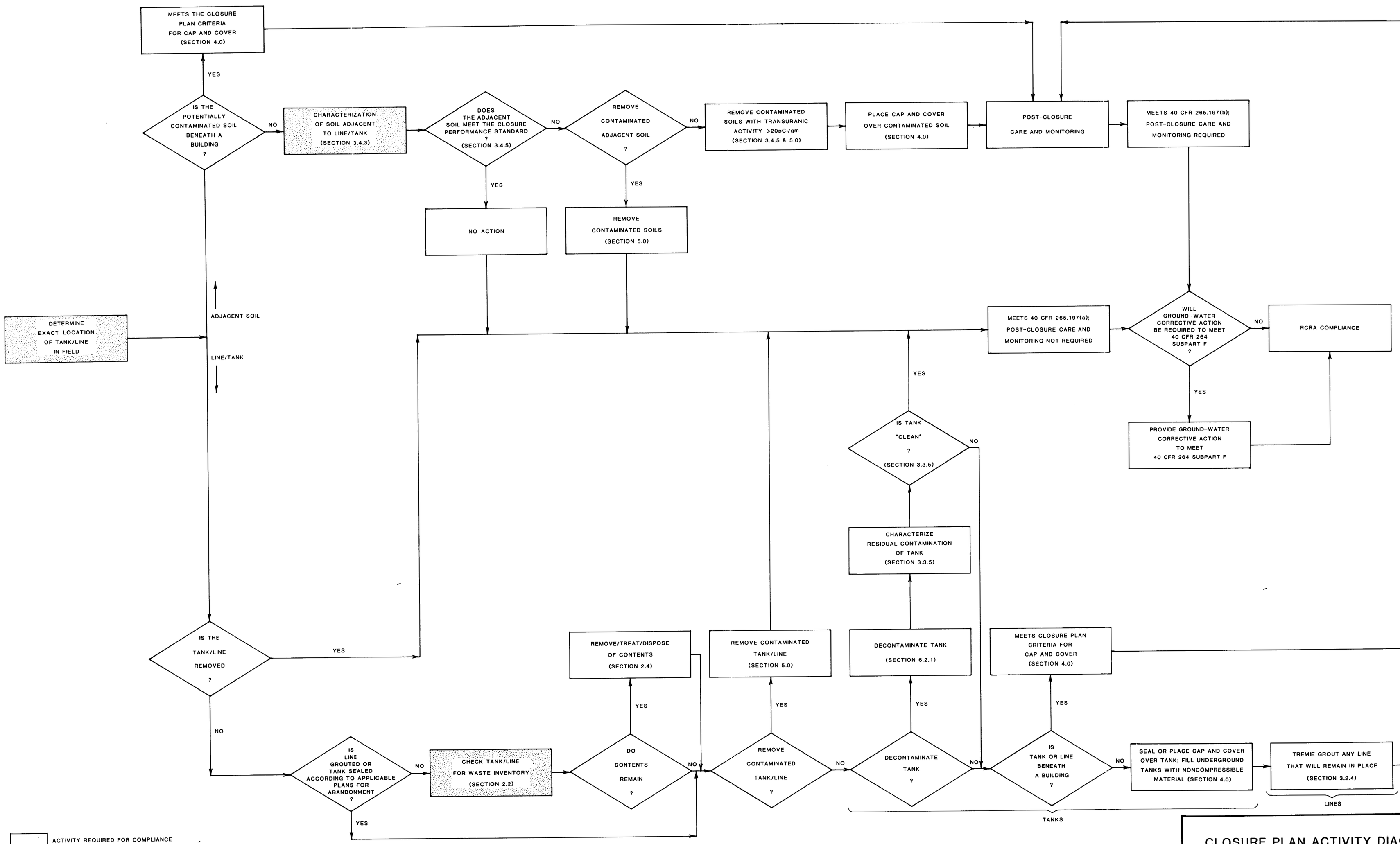

CLOSURE PLAN ACTIVITY DIAGRAM

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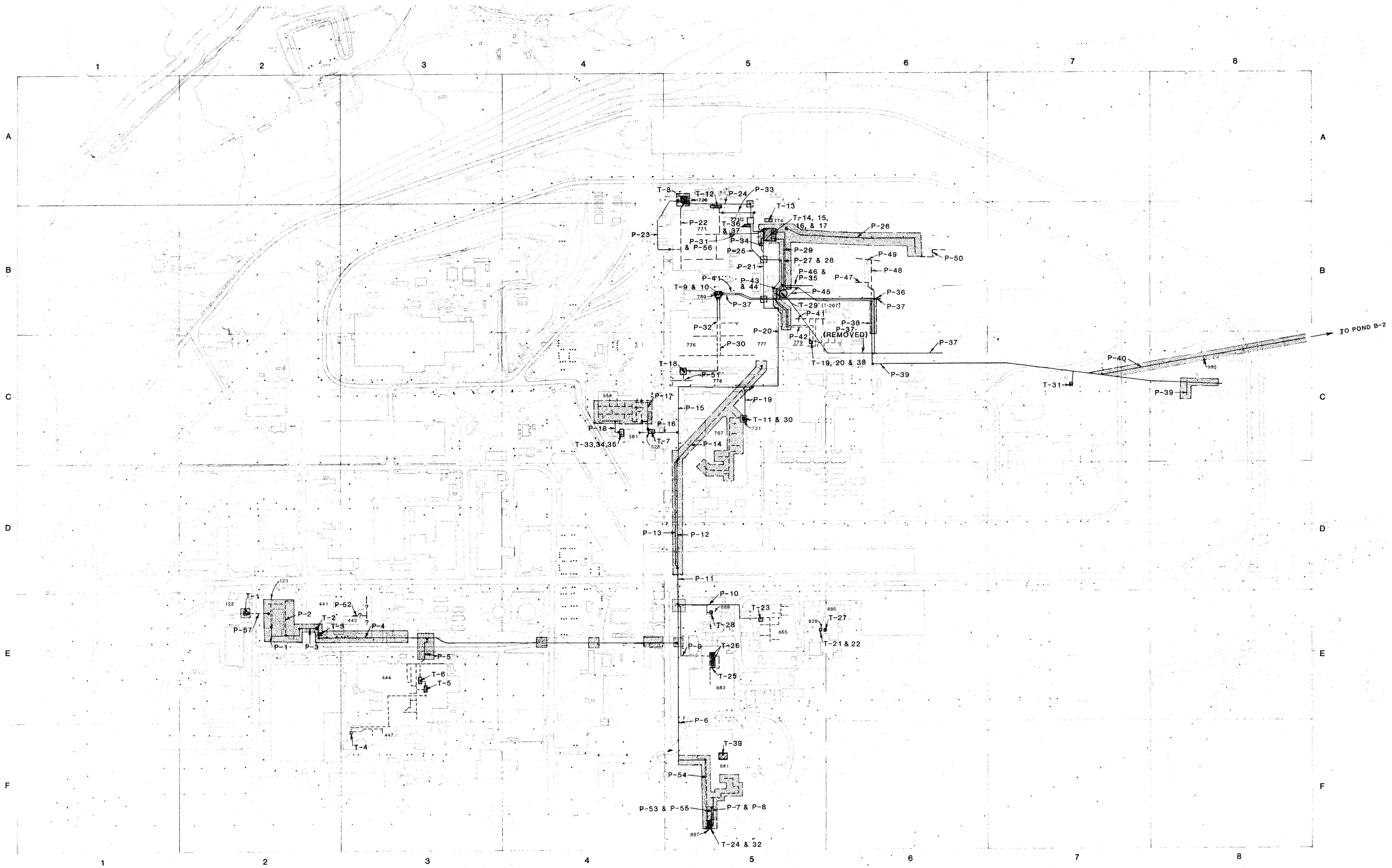
Drawn C.L. Check G.J.	Date OCT. 1, 1988	Plate II
Revised	Job Number 6 064 87	



APPROXIMATE SCALE 1"=200'

LEGEND

- Lines present underground
- Lines present beneath buildings
- Location of Tanks
- Starting or ending point of line segments
- P-1 Pipe Reference, see Table 1-1
- T-1 Tank Reference, see Table 1-2
- Area of reported release. Size is for presentation and does not represent the extent of release.

		A-3 15501-3	A-4 15501-4	A-5 15501-5	A-6 15501-6	A-7 15501-7	
	B-2 15501-10	B-3 15501-11	B-4 15501-12 A1-1	B-5 15501-13 A1-2	B-6 15501-14 A1-3	B-7 15501-15	B-8 15501-16
C-1 15501-17	C-2 15501-18	C-3 15501-19	C-4 15501-20 A1-4	C-5 15501-21 A1-5	C-6 15501-22 A1-6	C-7 15501-23 A1-7	C-8 15501-24 A1-8
D-1 15501-26	D-2 15501-27	D-3 15501-28	D-4 15501-29	D-5 15501-30 A1-9	D-6 15501-31	D-7 15501-32	D-8 15501-33
E-1 15501-39	E-2 15501-40 A1-10	E-3 15501-41 A1-11	E-4 15501-42 A1-12	E-5 15501-43 A1-13	E-6 15501-44	E-7 15501-45	E-8 15501-46
F-1 15501-50	F-2 15501-51	F-3 15501-52 A1-14	F-4 15501-53	F-5 15501-54 A1-15	F-6 15501-55	F-7 15501-56	F-8 15501-57

KEY TO ORIGINAL PROCESS WASTE LINES SITE UTILITY LOCATION MAPS (APPENDIX 1)

B-4 / 15501-12 / A1-1

- Key Location (row-column)
- Rockwell International Site Utility Plan drawing number
- Appendix 1 plate number

Shaded "KEYS" indicate drawings that cover the original process waste lines and are included in Appendix 1.

ORIGINAL PROCESS WASTE LINES LOCATION MAP

Chen & Associates
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96 South Zuni St. • Denver, Colorado 80223

Drawn L.D.M.	Check G.J.	Date Oct. 1, 1988	Plate I
Revised 1		Job Number 6-064-87	

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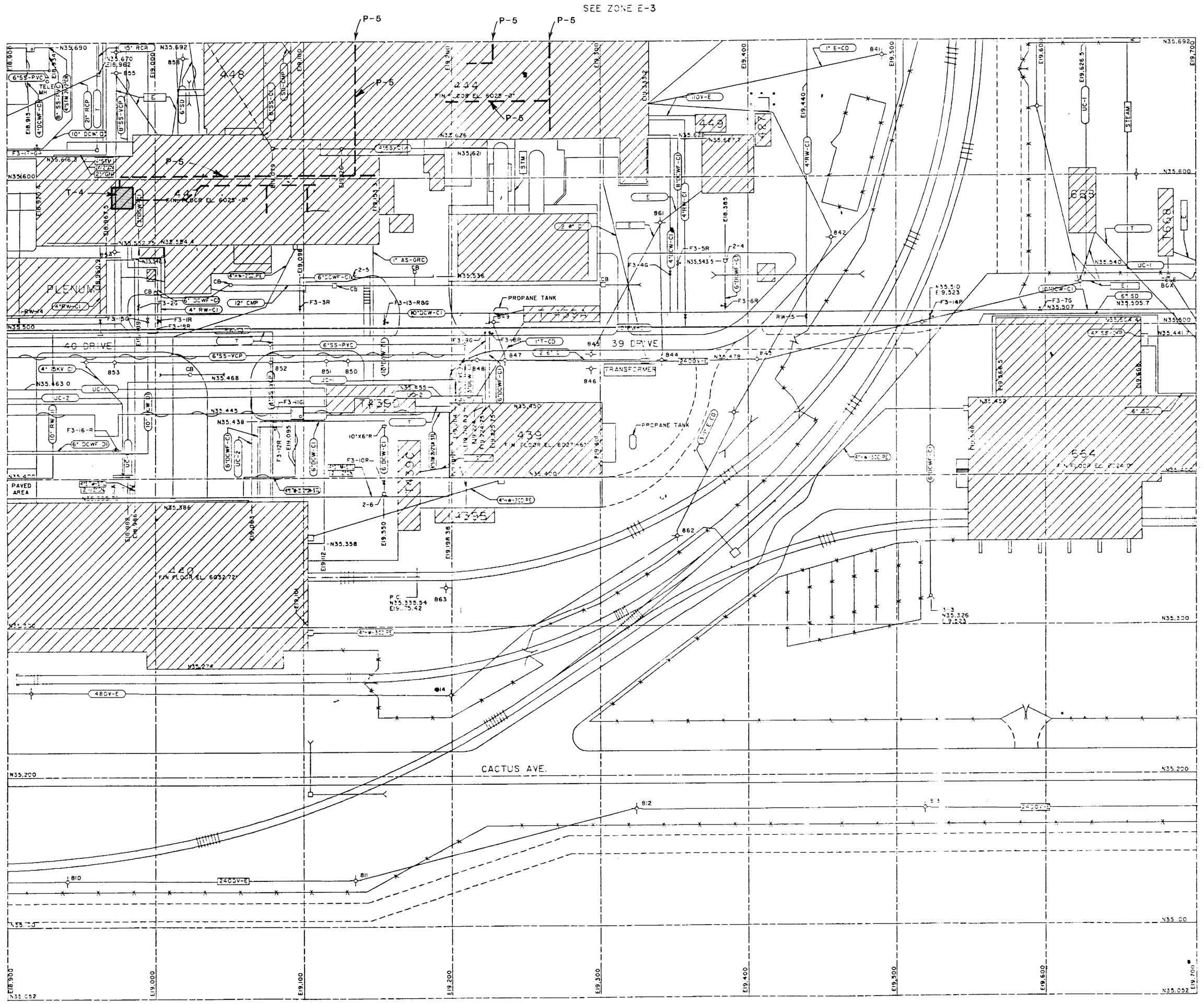

ABREVIATIONS

ABDN	ABANDONED
ABM	ALARM AND METERING
AR	ARGON
AS	ALARM SYSTEM--------2'-6" TO 3'-0" DEEP
BD	BLOW DOWN
BM	BENCH MARK (ALSO ABM)
B.O.D.	BOTTOM OF DUCT
B.O.P.	BOTTOM OF PIPE
BA	BREATHING AIR
CA OR CAP	CEMENT-ASBESTOS PIPE
CB	CATCH BASIN
CCL4	CARBON TETRACHLORIDE
CD	CONDUIT
CI	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CN	CONDENSATION STEAM
CNA	CONCENTRATED NITRIC ACID
CONC	CONCRETE
CWNP	COLD WATER NOT POTABLE
CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
CU	COPPER PIPE
CO	CLEAN OUT
DCW	DOMESTIC COLD WATER
DCWF	DOMESTIC COLD WATER-FIRE
DCW, DCWF	5'-0" TO 8'-0" DEEP
DI	DUCTILE IRON PIPE
DUCT	DUCT PLASTIC, TRANSITE OR STEEL IN CONC.
E	ELECTRICAL----------1'-6" TO 3'-0" DEEP
EL OR ELEV.	ELEVATION
EMH	ELECTRICAL MANHOLE
E-N	N_2 LOW PRESSURE ALARM
FD	FOUNDATION DRAIN
FG	FIBERGLASS PIPE
FH	FIRE HYDRANT
FO	FUEL OIL
G	GLASS LINED PIPE
GLP	GAS, LIQUID PETROLEUM
GN	GAS, NATURAL
HF	HYDROFLORIC ACID
HH	HAND HOLE
HW	HONEYWELL ALARM SYSTEM
G, GLP, GN	4'-0" DEEP
KV	KILOVOLT
KOH	POTASSIUM HYDROXIDE
IA	INSTRUMENT AIR
LW	LAUNDRY WASTE
MH	MANHOLE
N_2	NITROGEN
O_2	OXYGEN
OS	OUTFALL SEWER
N_2, O_2, OS	2'-0" TO 4'-0" DEEP
PA	PLANT AIR
PB	PULL BOX
PE	POLYETHYLENE PIPE
POW	PROCESS OIL WASTE
PVC	POLYVINYL CHLORIDE PIPE
PW	PROCESS WASTE
PWF	PROCESS WASTE-FORCED
PWR	PROCESS WASTE RETURN
PWS	PROCESS WASTE SUPPLY
PW, PWF, PWR, PWS	4'-0" TO 8'-0" DEEP
RCP	REINFORCED CONCRETE PIPE
RT	RIGID TEFLON PIPE
RW	RAW WATER
SD	STORM DRAIN
SS	SANITARY SEWER
SSF	SANITARY SEWER FORCED
SST	STAINLESS STEEL PIPE
STM	STEAM (5 P.S.I. & ABOVE)
STL	STEEL PIPE
SD, SS, SSF, SST, STM, STL	4'-0" TO 8'-0" DEEP
T	TELEPHONE--------1'-0" TO 8'-0" DEEP
TMH	TELEPHONE MANHOLE
TWR	TOWER WATER RETURN
TWS	TOWER WATER SUPPLY
UC-1	UNDERGROUND CABLE-CLASS 1
UC-2	UNDERGROUND CABLE-CLASS 2
UC-1, UC-2	2'-6" TO 3'-0" DEEP
VCP	VITRIFIED CLAY PIPE
VV	VALVE VAULT
SE	SEWAGE EFFLUENT
ROF	REVERSE OSMOSIS FEED
ROPW	REVERSE OSMOSIS PRODUCT WATER
PFBW	PRECOAT FILTER BACKWASH
PROB	PRIMARY REVERSE OSMOSIS BRINE
SROP	SECONDARY REVERSE OSMOSIS
DBF	DRYING BED FILTRATE

N

40 20 0 40 80 120

SCALE IN FEET (1" = 40')

LEGEND

- Lines present underground
- Lines present beneath buildings
- Location of Tanks
- Starting or ending point of line segments
- P-1 Pipe Reference, see Table 1-1
- T-1 Tank Reference, see Table 1-2
- Area of reported release. Size is for presentation and does not represent the extent of release.

UTILITY INDENTIFICATION

12" DCW A CU

SIZE OF PIPE OR CONDUIT
TYPE OF UTILITY
MATERIAL OF PIPE OR CONDUIT

3" PW-PE
4" PW-PE

GANGED SYMBOLS INDICATE 2 OR MORE UTILITIES IN THE SAME AREA

85 - 3 - R
- INDICATES FIRE LINE (RED)
- VALVE NO. WITHIN INDICATED ZONE
- ZONE NUMBER

85 - 3 - G
- INDICATES DOMESTIC WATER (GREEN)
- VALVE NO. WITHIN INDICATED ZONE
- ZONE NUMBER

6 - 10 INDICATES FIRE LINE (RED)

SYMBOLS

- UTILITY BELOW GRADE
- UTILITY ABOVE GRADE
- UTILITY LINE IN SERVICE
- UTILITY LINE ABANDONED
- VALVE
- POST INDICATOR VALVE
- FIRE HYDRANT
- POWER POLE
- POWER POLES WITH ANCHORS
- MANHOLE OR VALVE VAULT
- BENCH MARK MONUMENT
- CULVERT
- CLEAN OUT
- SLUICE GATE

BASE MAP: ROCKWELL INTERNATIONAL DRAWING 15501-52 N F-3

MAP F-3

ORIGINAL PROCESS WASTE LINES SITE LOCATION UTILITY MAP F-3

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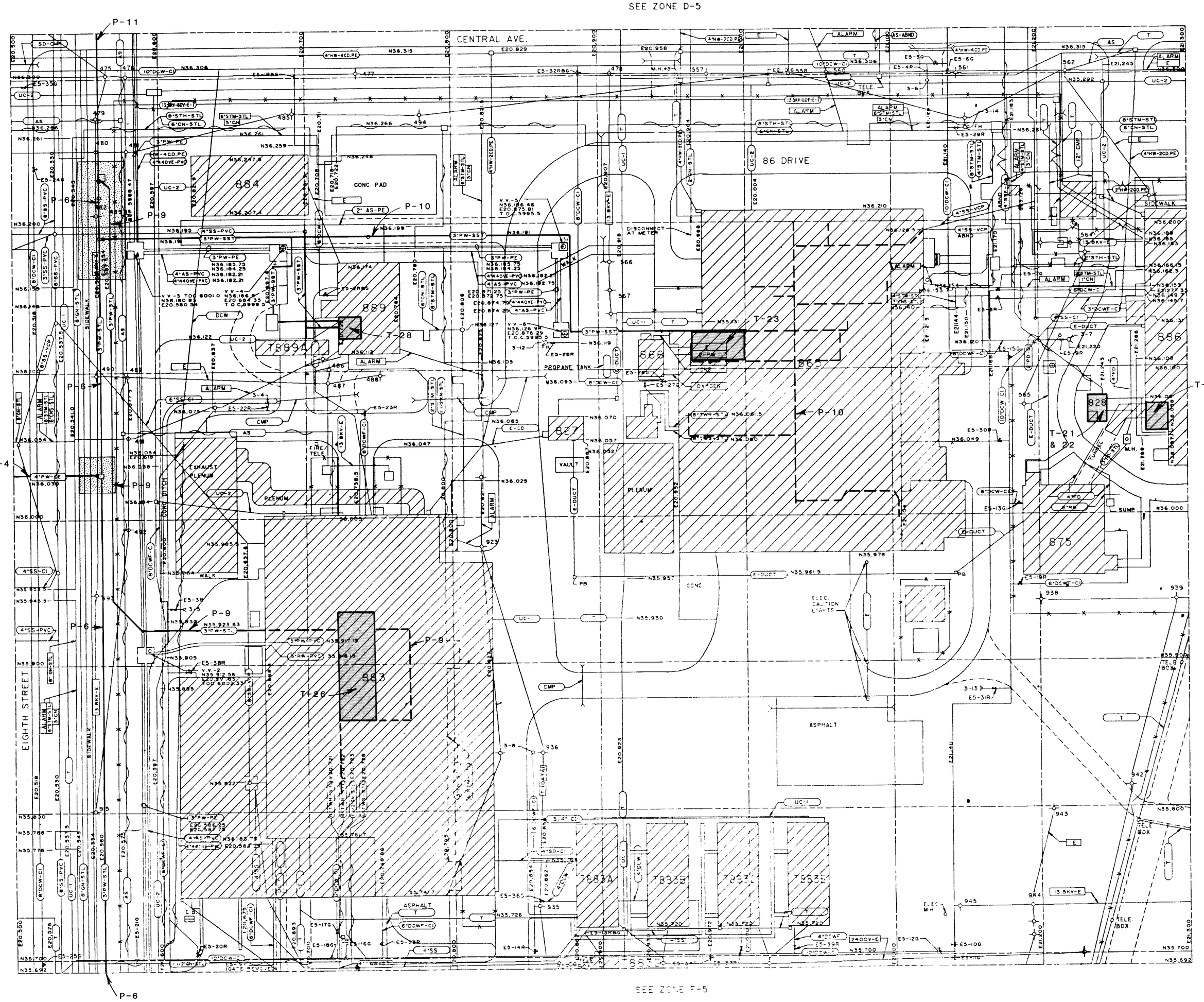

ABREVIATIONS

ABDN	ABANDONED
ABM	ALARM AND METERING
AR	ARGON
AS	ALARM SYSTEM--------2'-6" TO 3'-0" DEEP
BD	BLOW DOWN
BM	BENCH MARK (ALSO ABM)
B.O.P.	BOTTOM OF DUCT
B.O.D.	BOTTOM OF PIPE
BA	BREATHING AIR
CA OR CAP	CEMENT-ASBESTOS PIPE
CB	CATCH BASIN
CCL4	CARBON TETRACHLORIDE
CD	CONDUIT
CI	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CN	CONDENSATION STEAM
CNA	CONCENTRATED NITRIC ACID
CONC	CONCRETE
CWNP	COLD WATER NOT POTABLE
CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
CU	COPPER PIPE
CO	CLEAN OUT
DCW	DOMESTIC COLD WATER
DCWF	DOMESTIC COLD WATER-FIRE
D.I.	DUCTILE IRON PIPE
DUCT	DUCT PLASTIC, TRANSITE OR STEEL IN CONC.
E	ELECTRICAL---------1'-6" TO 3'-0" DEEP
EL OR ELEV.	ELEVATION
EMH	ELECTRICAL MANHOLE
E-N	N_2 LOW PRESSURE ALARM
FD	FOUNDATION DRAIN
FG	FIBERGLASS PIPE
FH	FIRE HYDRANT
FO	FUEL OIL
G	GLASS LINED PIPE
GLP	GAS, LIQUID PETROLEUM
GN	GAS, NATURAL
HF	HYDROFLORIC ACID
HH	HAND HOLE
HW	HONEYWELL ALARM SYSTEM
KV	KILOVOLT
KOH	POTASSIUM HYDROXIDE
IA	INSTRUMENT AIR
LW	LAUNDRY WASTE
MH	MANHOLE
N_2	NITROGEN
O_2	OXYGEN
OS	OUTFALL SEWER
PA	PLANT AIR
PB	PULL BOX
PE	POLYETHYLENE PIPE
POW	PROCESS OIL WASTE
PVC	POLYVINYL CHLORIDE PIPE
PW	PROCESS WASTE
PWF	PROCESS WASTE-FORCED
PWR	PROCESS WASTE RETURN
PWS	PROCESS WASTE SUPPLY
RCP	REINFORCED CONCRETE PIPE
RT	RIGID TEFLON PIPE
RW	RAW WATER
SD	STORM DRAIN
SS	SANITARY SEWER
SSF	SANITARY SEWER FORCED
SST	STAINLESS STEEL PIPE
STM	STEAM (5 P.S.I. & ABOVE)
STL	STEEL PIPE
T	TELEPHONE--------1'-0" TO 8'-0" DEEP
TMH	TELEPHONE MANHOLE
TWR	TOWER WATER RETURN
TWS	TOWER WATER SUPPLY
UC-1	UNDERGROUND CABLE-CLASS 1
UC-2	UNDERGROUND CABLE-CLASS 2
VCP	VITRIFIED CLAY PIPE
VV	VALVE VAULT
SE	SEWAGE EFFLUENT
ROF	REVERSE OSMOSIS FEED
ROPW	REVERSE OSMOSIS PRODUCT WATER
DFBW	PRECOAT FILTER BACKWASH
PROB	PRIMARY REVERSE OSMOSIS BRINE
SROP	SECONDARY REVERSE OSMOSIS
DBF	DRYING BED FILTRATE

SCALE IN FEET (1" = 40')

LEGEND

- Lines present underground
- Lines present beneath buildings
- Location of Tanks
- Starting or ending point of line segments
- P-1 Pipe Reference, see Table 1-1
- T-1 Tank Reference, see Table 1-2
- Area of reported release. Size is for presentation and does not represent the extent of release.

UTILITY INDENTIFICATION

SIZE OF PIPE OR CONDUIT
TYPE OF UTILITY
12" (K A C)
MATERIAL OF PIPE OR CONDUIT

3" PW-PE
4" PW-PE
GANGED SYMBOLS INDICATE 2 OR MORE UTILITIES IN THE SAME AREA

85 - 3 - R
INDICATES FIRE LINE (RED)
VALVE NO. WITHIN INDICATED ZONE
ZONE NUMBER

85 - 3 - G
INDICATES DOMESTIC WATER (GREEN)
VALVE NO. WITHIN INDICATED ZONE
ZONE NUMBER

6 - 10
INDICATES FIRE LINE (RED)

SYMBOLS

- UTILITY BELOW GRADE
- UTILITY ABOVE GRADE
- UTILITY LINE IN SERVICE
- UTILITY LINE ABANDONED
- VALVE
- POST INDICATOR VALVE
- FIRE HYDRANT
- POWER POLE
- POWER POLES WITH ANCHORS
- MANHOLE OR VALVE VAULT
- BENCH MARK MONUMENT
- CULVERT
- CLEAN OUT
- SLUICE GATE

BASE MAP: ROCKWELL INTERNATIONAL DRAWING 15501-43 N E-5

MAP E-5

ORIGINAL PROCESS WASTE LINES SITE UTILITY LOCATION MAP E-5

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Drawn L.D.M. Check G.J.	Date OCT. 1, 1988	Figure A1-13
Revised 1	Job Number 6 064 87	

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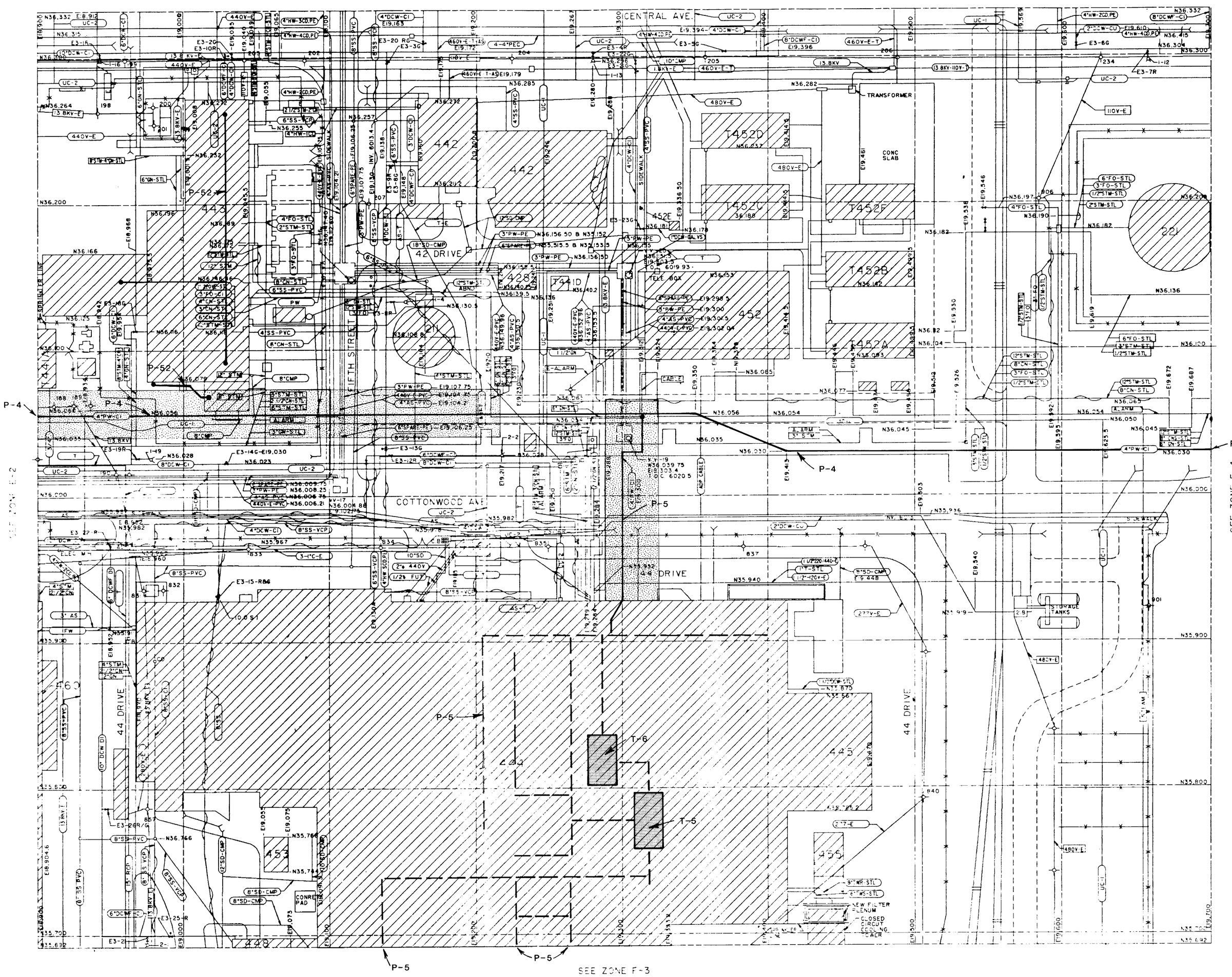


MAP E-3

ABREVIATIONS

ABDN	ABANDONED
ABM	ALARM AND METERING
AR	ARGON
AS	ALARM SYSTEM-------2'-6" TO 3'-0" DEEP
BD	BLOW DOWN
BM	BENCH MARK (ALSO ABM)
BOD	BOTTOM OF DUCT
BOP	BOTTOM OF PIPE
BA	BREATHING AIR
CA OR CAP	CEMENT-ASBESTOS PIPE
CB	CATCH BASIN
CCL4	CARBON TETRACHLORIDE
CD	CONDUIT
CI	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CN	CONDENSATION STEAM
CNA	CONCENTRATED NITRIC ACID
CONC	CONCRETE
CWNP	COLD WATER NOT POTABLE
CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
CU	COPPER PIPE
CO	CLEAN OUT
DCW	DOMESTIC COLD WATER
DCWF	DOMESTIC COLD WATER-FIRE — 5'-0" TO 8'-0" DEEP
DI	DUCTILE IRON PIPE
DUCT	DUCT PLASTIC, TRANSITE OR STEEL IN CONC.
E	ELECTRICAL---------1'-6" TO 3'-0" DEEP
EL OR ELEV.	ELEVATION
EMH	ELECTRICAL MANHOLE
E-N	N_2 LOW PRESSURE ALARM
FD	FOUNDATION DRAIN
FG	FIBERGLASS PIPE
FH	FIRE HYDRANT
FO	FUEL OIL
G	GLASS LINED PIPE
GLP	GAS, LIQUID PETROLEUM — 4'-0" DEEP
GN	GAS, NATURAL
HF	HYDROFLORIC ACID
HH	HAND HOLE
HW	HONEYWELL ALARM SYSTEM
KV	KILOVOLT
KOH	POTASSIUM HYDROXIDE
IA	INSTRUMENT AIR
LW	LAUNDRY WASTE
MH	MANHOLE
N_2	NITROGEN — 2'-0" TO 4'-0" DEEP
O_2	OXYGEN
OS	OUTFALL SEWER
PA	PLANT AIR
PB	PULL BOX
PE	POLYETHYLENE PIPE
POW	PROCESS OIL WASTE
PVC	POLYVINYL CHLORIDE PIPE
PW	PROCESS WASTE
PWF	PROCESS WASTE-FORCED
PWR	PROCESS WASTE RETURN — 4'-0" TO 8'-0" DEEP
PWS	PROCESS WASTE SUPPLY
RCP	REINFORCED CONCRETE PIPE
RT	RIGID TEFLON PIPE
RW	RAW WATER
SD	STORM DRAIN
SS	SANITARY SEWER
SSF	SANITARY SEWER FORCED — 4'-0" TO 8'-0" DEEP
SST	STAINLESS STEEL PIPE
STM	STEAM (5 P.S.I. & ABOVE)
STL	STEEL PIPE
T	TELEPHONE---------1'-0" TO 8'-0" DEEP
TMH	TELEPHONE MANHOLE
TWR	TOWER WATER RETURN
TWS	TOWER WATER SUPPLY
UC-1	UNDERGROUND CABLE-CLASS 1 — 2'-6" TO 3'-0" DEEP
UC-2	UNDERGROUND CABLE-CLASS 2
VCP	VITRIFIED CLAY PIPE
VV	VALVE VAULT
SE	SEWAGE EFFLUENT
ROF	REVERSE OSMOSIS FEED
ROPW	REVERSE OSMOSIS PRODUCT WATER
PFBW	PRECOAT FILTER BACKWASH
PROB	PRIMARY REVERSE OSMOSIS BRINE
SROP	SECONDARY REVERSE OSMOSIS
DBF	DRYING BED FILTRATE

N

40 20 0 40 80 120

SCALE IN FEET (1" = 40')

LEGEND

- Lines present underground
- Lines present beneath buildings
- Location of Tanks
- Starting or ending point of line segments
- P-1 Pipe Reference, see Table 1-1
- T-1 Tank Reference, see Table 1-2
- Area of reported release. Size is for presentation and does not represent the extent of release.

UTILITY INDENTIFICATION

12" ICA CI — SIZE OF PIPE OR CONDUIT; TYPE OF UTILITY

MATERIAL OF PIPE OR CONDUIT

3" PW-PE
4" PW-PE — GANGED SYMBOLS INDICATE 2 OR MORE UTILITIES IN THE SAME AREA

85 - 3 - R — INDICATES FIRE LINE (RED); VALVE NO. WITHIN INDICATED ZONE; ZONE NUMBER

85 - 3 - G — INDICATES DOMESTIC WATER (GREEN); VALVE NO. WITHIN INDICATED ZONE; ZONE NUMBER

6 - 10 — INDICATES FIRE LINE (RED)

SYMBOLS

- UTILITY BELOW GRADE
- UTILITY ABOVE GRADE
- UTILITY LINE IN SERVICE
- UTILITY LINE ABANDONED
- VALVE
- POST INDICATOR VALVE
- FIRE HYDRANT
- POWER POLE
- POWER POLES WITH ANCHORS
- MANHOLE OR VALVE VAULT
- BENCH MARK MONUMENT
- CULVERT
- CLEAN OUT
- SLUICE GATE

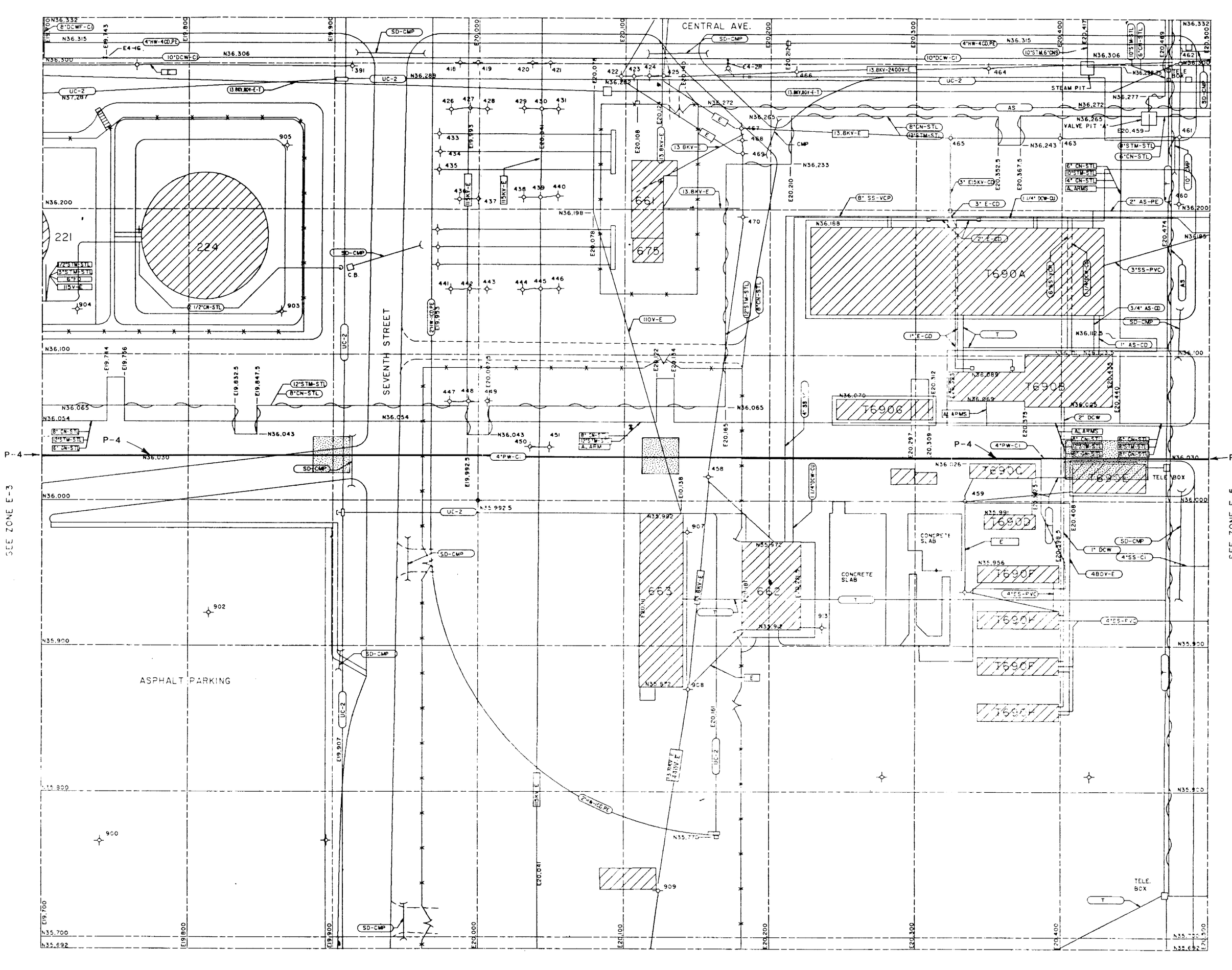
BASE MAP: ROCKWELL INTERNATIONAL DRAWING 15501-41 P E-3

ORIGINAL PROCESS WASTE LINES SITE UTILITY LOCATION MAP E-3

Chen & Associates
Consulting Geotechnical Engineers
96 South Zuni St. • Denver, Colorado 80223

Drawn L.D.M. Check G.J.	Date OCT. 1, 1988	Figure A1-11
Revised 1	Job Number 6 064 87	

88280



MAP E-4

ABREVIATIONS

ABDN	ABANDONED
ABM	ALARM AND METERING
AR	ARGON
AS	ALARM SYSTEM--------2'-6" TO 3'-0" DEEP
BD	BLOW DOWN
BM	BENCH MARK (ALSO ABM)
B.O.P.	BOTTOM OF DUCT
B.O.P.	BOTTOM OF PIPE
BA	BREATHING AIR
CA OR CAP	CEMENT-ASBESTOS PIPE
CB	CATCH BASIN
CCL4	CARBON TETRACHLORIDE
CD	CONDUIT
CI	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CN	CONDENSATION STEAM
CNA	CONCENTRATED NITRIC ACID
CONC	CONCRETE
CWNP	COLD WATER NON POTABLE
CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
CU	COPPER PIPE
CO	CLEAN OUT
DCW	DOMESTIC COLD WATER
DCWF	DOMESTIC COLD WATER-FIRE — 5'-0" TO 8'-0" DEEP
D.I.	DUCTILE IRON PIPE
DUCT	DUCT PLASTIC, TRANSITE OR STEEL IN CONC.
E	ELECTRICAL---------1'-6" TO 3'-0" DEEP
EL OR ELEV.	ELEVATION
EMH	ELECTRICAL MANHOLE
E-N	N_2 LOW PRESSURE ALARM
FD	FOUNDATION DRAIN
FG	FIBERGLASS PIPE
FH	FIRE HYDRANT
FO	FUEL OIL
G	GLASS LINED PIPE
GLP	GAS, LIQUID PETROLEUM
GN	GAS, NATURAL — 4'-0" DEEP
HF	HYDROFLORIC ACID
HH	HAND HOLE
HW	HONEYWELL ALARM SYSTEM
KV	KILOVOLT
KOH	POTASSIUM HYDROXIDE
IA	INSTRUMENT AIR
LW	LAUNDRY WASTE
MH	MANHOLE
N_2	NITROGEN
O_2	OXYGEN — 2'-0" TO 4'-0" DEEP
OS	OUTFALL SEWER
PA	PLANT AIR
PB	PULL BOX
PE	POLYETHYLENE PIPE
PDW	PROCESS OIL WASTE
PVC	POLYVINYL CHLORIDE PIPE
PW	PROCESS WASTE
PWF	PROCESS WASTE-FORCED
PWR	PROCESS WASTE RETURN — 4'-0" TO 8'-0" DEEP
PWS	PROCESS WASTE SUPPLY
RCP	REINFORCED CONCRETE PIPE
RT	RIGID TEFLON PIPE
RW	RAW WATER
SD	STORM DRAIN
SS	SANITARY SEWER
SSF	SANITARY SEWER FORCED — 4'-0" TO 8'-0" DEEP
SST	STAINLESS STEEL PIPE
STM	STEAM (5 P.S.I. & ABOVE)
STL	STEEL PIPE
T	TELEPHONE--------1'-0" TO 8'-0" DEEP
TMH	TELEPHONE MANHOLE
TWR	TOWER WATER RETURN
TWS	TOWER WATER SUPPLY
UC-1	UNDERGROUND CABLE-CLASS 1 — 2'-6" TO 3'-0" DEEP
UC-2	UNDERGROUND CABLE-CLASS 2
VCP	VITRIFIED CLAY PIPE
VV	VALVE VAULT
SE	SEWAGE EFFLUENT
ROF	REVERSE OSMOSIS FEED
ROPW	REVERSE OSMOSIS PRODUCT WATER
PBW	PRECOA FILTER BACKWASH
PROB	PRIMARY REVERSE OSMOSIS BRINE
SROP	SECONDARY REVERSE OSMOSIS
DBF	DRYING BED FILTRATE

SCALE IN FEET (1" = 40')

LEGEND

- Lines present underground
- Lines present beneath buildings
- Location of Tanks
- Starting or ending point of line segments
- P-1 Pipe Reference, see Table 1-1
- T-1 Tank Reference, see Table 1-2
- Area of reported release. Size is for presentation and does not represent the extent of release.

UTILITY INDENTIFICATION

SIZE OF PIPE OR CONDUIT
TYPE OF UTILITY
MATERIAL OF PIPE OR CONDUIT

3" PW-PE
4" PW-PE
GANGED SYMBOLS INDICATE 2 OR MORE UTILITIES IN THE SAME AREA

85 - 3 - R
INDICATES FIRE LINE (RED)
VALVE NO. WITHIN INDICATED ZONE
ZONE NUMBER

85 - 3 - G
INDICATES DOMESTIC WATER (GREEN)
VALVE NO. WITHIN INDICATED ZONE
ZONE NUMBER

6 - 10 INDICATES FIRE LINE (RED)

SYMBOLS

- UTILITY BELOW GRADE
- UTILITY ABOVE GRADE
- UTILITY LINE IN SERVICE
- UTILITY LINE ABANDONED
- VALVE
- POST INDICATOR VALVE
- FIRE HYDRANT
- POWER POLE
- POWER POLES WITH ANCHORS
- MANHOLE OR VALVE VAULT
- BENCH MARK MONUMENT
- CULVERT
- CLEAN OUT
- SLUICE GATE

BASE MAP : ROCKWELL INTERNATIONAL DRAWING 15501-42 N E-4

ORIGINAL PROCESS WASTE LINES SITE UTILITY LOCATION MAP E-4

Chen & Associates
Consulting Geotechnical Engineers
96 South Zuni St. • Denver, Colorado 80223

Drawn L.D.M. Check G.J.	Date OCT. 1, 1988	Figure A1-12
Revised 1	Job Number 6 064 87	

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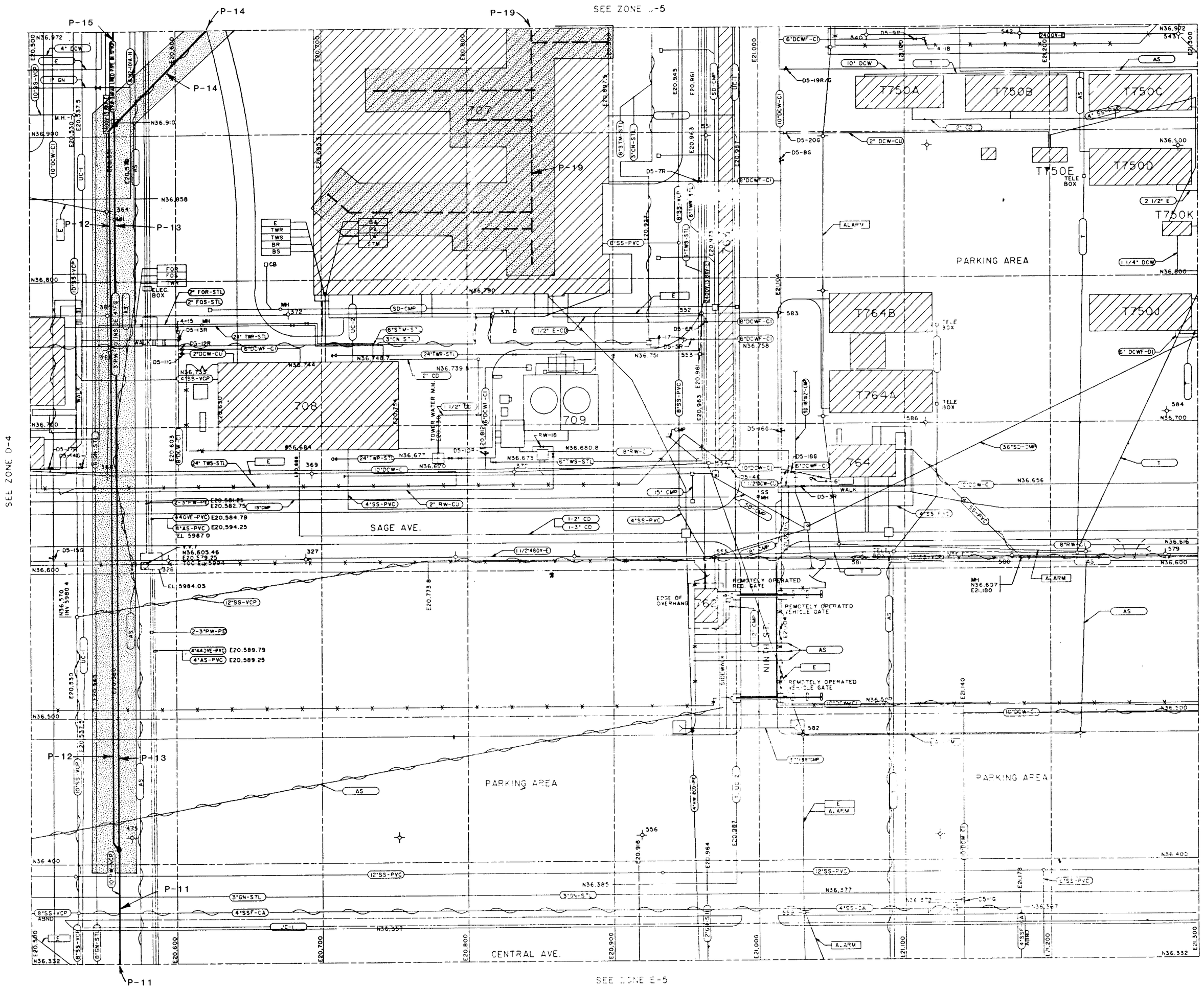

ABREVIATIONS

ABDN	ABANDONED
A&M	ALARM AND METERING
AR	ARGON
AS	ALARM SYSTEM--------2'-6" TO 3'-0" DEEP
BD	BLOW DOWN
BM	BENCH MARK (ALSO ABM)
B.O.P.	BOTTOM OF DUCT
B.O.P.	BOTTOM OF PIPE
BA	BREATHING AIR
CA OR CAP	CEMENT-ASBESTOS PIPE
CB	CATCH BASIN
CCL4	CARBON TETRACHLORIDE
CD	CONDUIT
CI	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CN	CONDENSATION STEAM
CNA	CONCENTRATED NITRIC ACID
CONC	CONCRETE
CWNP	COLD WATER NOT POTABLE
CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
CU	COPPER PIPE
CO	CLEAN OUT
DCW	DOMESTIC COLD WATER
DCWF	DOMESTIC COLD WATER-FIRE
D.I.	DUCTILE IRON PIPE
DUCT	DUCT PLASTIC, TRANSITE OR STEEL IN CONC
E	ELECTRICAL--------1'-6" TO 3'-0" DEEP
EL OR ELEV.	ELEVATION
EMH	ELECTRICAL MANHOLE
E-N	N_2 LOW PRESSURE ALARM
FD	FOUNDATION DRAIN
FG	FIBERGLASS PIPE
FH	FIRE HYDRANT
FO	FUEL OIL
G	GLASS LINED PIPE
GLP	GAS, LIQUID PETROLEUM
GN	GAS, NATURAL
HF	HYDROFLORIC ACID
HH	HAND HOLE
HW	HONEYWELL ALARM SYSTEM
KV	KILOVOLT
KOH	POTASSIUM HYDROXIDE
IA	INSTRUMENT AIR
LW	LAUNDRY WASTE
MH	MANHOLE
N_2	NITROGEN
O_2	OXYGEN
OS	OUTFALL SEWER
PA	PLANT AIR
PB	PULL BOX
PE	POLYETHYLENE PIPE
POW	PROCESS OIL WASTE
PVC	POLYVINYL CHLORIDE PIPE
PW	PROCESS WASTE
PWF	PROCESS WASTE-FORCED
PWR	PROCESS WASTE RETURN
PWS	PROCESS WASTE SUPPLY
RCP	REINFORCED CONCRETE PIPE
RT	RIGID TEFLON PIPE
RW	RAW WATER
SD	STORM DRAIN
SS	SANITARY SEWER
SSF	SANITARY SEWER FORCED
SST	STAINLESS STEEL PIPE
STM	STEAM (5 P.S.I. & ABOVE)
STL	STEEL PIPE
T	TELEPHONE--------1'-0" TO 8'-0" DEEP
TMH	TELEPHONE MANHOLE
TWR	TOWER WATER RETURN
TWS	TOWER WATER SUPPLY
UC-1	UNDERGROUND CABLE-CLASS 1
UC-2	UNDERGROUND CABLE-CLASS 2
VCP	VITRIFIED CLAY PIPE
VV	VALVE VAULT
SE	SEWAGE EFFLUENT
ROF	REVERSE OSMOSIS FEED
ROPW	REVERSE OSMOSIS PRODUCT WATER
PFBW	PRECOAT FILTER BACKWASH
PROB	PRIMARY REVERSE OSMOSIS BRINE
SROP	SECONDARY REVERSE OSMOSIS
DBF	DRYING BED FILTRATE

SCALE IN FEET (1" = 40')

LEGEND

- Lines present underground
- Lines present beneath buildings
- Location of Tanks
- Starting or ending point of line segments
- P-1 Pipe Reference, see Table 1-1
- T-1 Tank Reference, see Table 1-2
- Area of reported release. Size is for presentation and does not represent the extent of release.

UTILITY INDENTIFICATION

SIZE OF PIPE OR CONDUIT
TYPE OF UTILITY
MATERIAL OF PIPE OR CONDUIT

GANGED SYMBOLS INDICATE 2 OR MORE UTILITIES IN THE SAME AREA

85 - 3 - R: INDICATES FIRE LINE (RED); VALVE NO. WITHIN INDICATED ZONE; ZONE NUMBER

85 - 3 - G: INDICATES DOMESTIC WATER (GREEN); VALVE NO. WITHIN INDICATED ZONE; ZONE NUMBER

6 - 10: INDICATES FIRE LINE (RED)

SYMBOLS

- UTILITY BELOW GRADE
- UTILITY ABOVE GRADE
- UTILITY LINE IN SERVICE
- UTILITY LINE ABANDONED
- VALVE
- POST INDICATOR VALVE
- FIRE HYDRANT
- POWER POLE
- POWER POLES WITH ANCHORS
- MANHOLE OR VALVE VAULT
- BENCH MARK MONUMENT
- CULVERT
- CLEAN OUT
- SLUICE GATE

BASE MAP: ROCKWELL INTERNATIONAL DRAWING 15501-30 L D-5

MAP D-5

ORIGINAL PROCESS WASTE LINES SITE UTILITY LOCATION MAP D-5

Chen & Associates
Consulting Geotechnical Engineers
96 South Zuni St. • Denver, Colorado 80223

Drawn L.D.M. Check G.J.	Date OCT. 1, 1988	Figure A1-9
Revised 1	Job Number 6 064 87	

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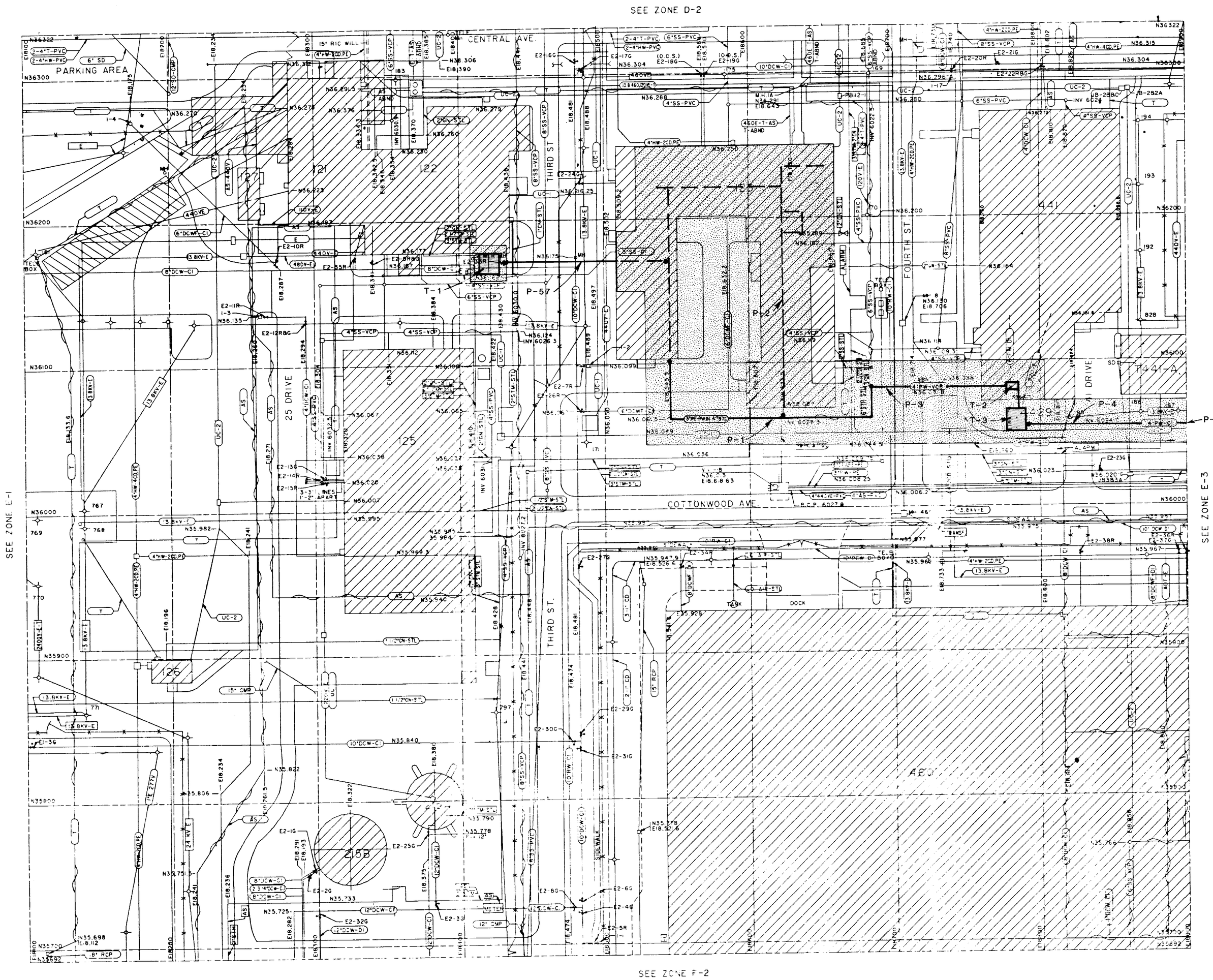

ABREVIATIONS

ABDN	ABANDONED
ABM	ALARM AND METERING
AR	ARGON
AS	ALARM SYSTEM--------2'-6" TO 3'-0" DEEP
BD	BLOW DOWN
BM	BENCH MARK (ALSO ABM)
B.O.P.	BOTTOM OF DUCT
B.O.P.	BOTTOM OF PIPE
BA	BREATHING AIR
CA OR CAP	CEMENT-ASBESTOS PIPE
CB	CATCH BASIN
CCL4	CARBON TETRACHLORIDE
CD	CONDUIT
CI	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CN	CONDENSATION, STEAM
CNA	CONCENTRATED NITRIC ACID
CONC	CONCRETE
CWNP	COLD WATER NOT POTABLE
CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
CU	COPPER PIPE
CO	CLEAN OUT
DCW	DOMESTIC COLD WATER
DCWF	DOMESTIC COLD WATER-FIRE
D.I.	DUCTILE IRON PIPE
DUCT	DUCT PLASTIC, TRANSITE OR STEEL IN CONC
	5'-0" TO 8'-0" DEEP
E	ELECTRICAL----------1'-6" TO 3'-0" DEEP
EL OR ELEV.	ELEVATION
EMH	ELECTRICAL MANHOLE
E-N	N_2 LOW PRESSURE ALARM
FD	FOUNDATION DRAIN
FG	FIBERGLASS PIPE
FH	FIRE HYDRANT
FO	FUEL OIL
G	GLASS LINED PIPE
GLP	GAS, LIQUID PETROLEUM
GN	GAS, NATURAL
	4'-0" DEEP
HF	HYDROFLORIC ACID
HH	HAND HOLE
HW	HONEYWELL ALARM SYSTEM
KV	KILOVOLT
KOH	POTASSIUM HYDROXIDE
IA	INSTRUMENT AIR
LW	LAUNDRY WASTE
MH	MANHOLE
N_2	NITROGEN
O_2	OXYGEN
OS	OUTFALL SEWER
	2'-0" TO 4'-0" DEEP
PA	PLANT AIR
PB	PULL BOX
PE	POLYETHYLENE PIPE
POW	PROCESS OIL WASTE
PVC	POLYVINYL CHLORIDE PIPE
PW	PROCESS WASTE
PWF	PROCESS WASTE-FORCED
PWR	PROCESS WASTE RETURN
PWS	PROCESS WASTE SUPPLY
	4'-0" TO 8'-0" DEEP
RCP	REINFORCED CONCRETE PIPE
RT	RIGID TEFLON PIPE
RW	RAW WATER
SD	STORM DRAIN
SS	SANITARY SEWER
SSF	SANITARY SEWER FORCED
SST	STAINLESS STEEL PIPE
STM	STEAM (5 P.S.I. & ABOVE)
STL	STEEL PIPE
	4'-0" TO 8'-0" DEEP
T	TELEPHONE----------1'-0" TO 8'-0" DEEP
TMH	TELEPHONE MANHOLE
TWR	TOWER WATER RETURN
TWS	TOWER WATER SUPPLY
UC-1	UNDERGROUND CABLE-CLASS 1
UC-2	UNDERGROUND CABLE-CLASS 2
	2'-6" TO 3'-0" DEEP
VCP	VITRIFIED CLAY PIPE
VV	VALVE VAULT
SE	SEWAGE EFFLUENT
ROF	REVERSE OSMOSIS FEED
ROPW	REVERSE OSMOSIS PRODUCT WATER
PFBW	PRECOAT FILTER BACKWASH
PROB	PRIMARY REVERSE OSMOSIS BRINE
SROP	SECONDARY REVERSE OSMOSIS
DBF	DRYING BED FILTRATE

40 20 0 40 80 120

SCALE IN FEET (1" = 40')

LEGEND

- Lines present underground
- Lines present beneath buildings
- Location of Tanks
- Starting or ending point of line segments
- P-1 Pipe Reference, see Table 1-1
- T-1 Tank Reference, see Table 1-2
- Area of reported release. Size is for presentation and does not represent the extent of release.

UTILITY INDENTIFICATION

SIZE OF PIPE OR CONDUIT
TYPE OF UTILITY
12" DCW CI
MATERIAL OF PIPE OR CONDUIT

3" PW-PE
4" PW-PE
GANGED SYMBOLS INDICATE 2 OR MORE UTILITIES IN THE SAME AREA

85 - 3 - R
INDICATES FIRE LINE (RED)
VALVE NO WITHIN INDICATED ZONE
ZONE NUMBER

85 - 3 - G
INDICATES DOMESTIC WATER (GREEN)
VALVE NO WITHIN INDICATED ZONE
ZONE NUMBER

6 - 10
INDICATES FIRE LINE (RED)

SYMBOLS

- UTILITY BELOW GRADE
- UTILITY ABOVE GRADE
- UTILITY LINE IN SERVICE
- UTILITY LINE ABANDONED
- VALVE
- POST INDICATOR VALVE
- FIRE HYDRANT
- POWER POLE
- POWER POLES WITH ANCHORS
- MANHOLE OR VALVE VAULT
- BENCH MARK MONUMENT
- CULVERT
- CLEAN OUT
- SLUICE GATE

BASE MAP: ROCKWELL INTERNATIONAL DRAWING 15501-40 N E-2

MAP E-2

ORIGINAL PROCESS WASTE LINES SITE UTILITY LOCATION MAP E-2

Chen & Associates
Consulting Geotechnical Engineers
96 South Zuni St. • Denver, Colorado 80223

Drawn L.D.M. Check G.J.	Date OCT. 1, 1988	Figure A1-10
Revised	Job Number 6 064 87	

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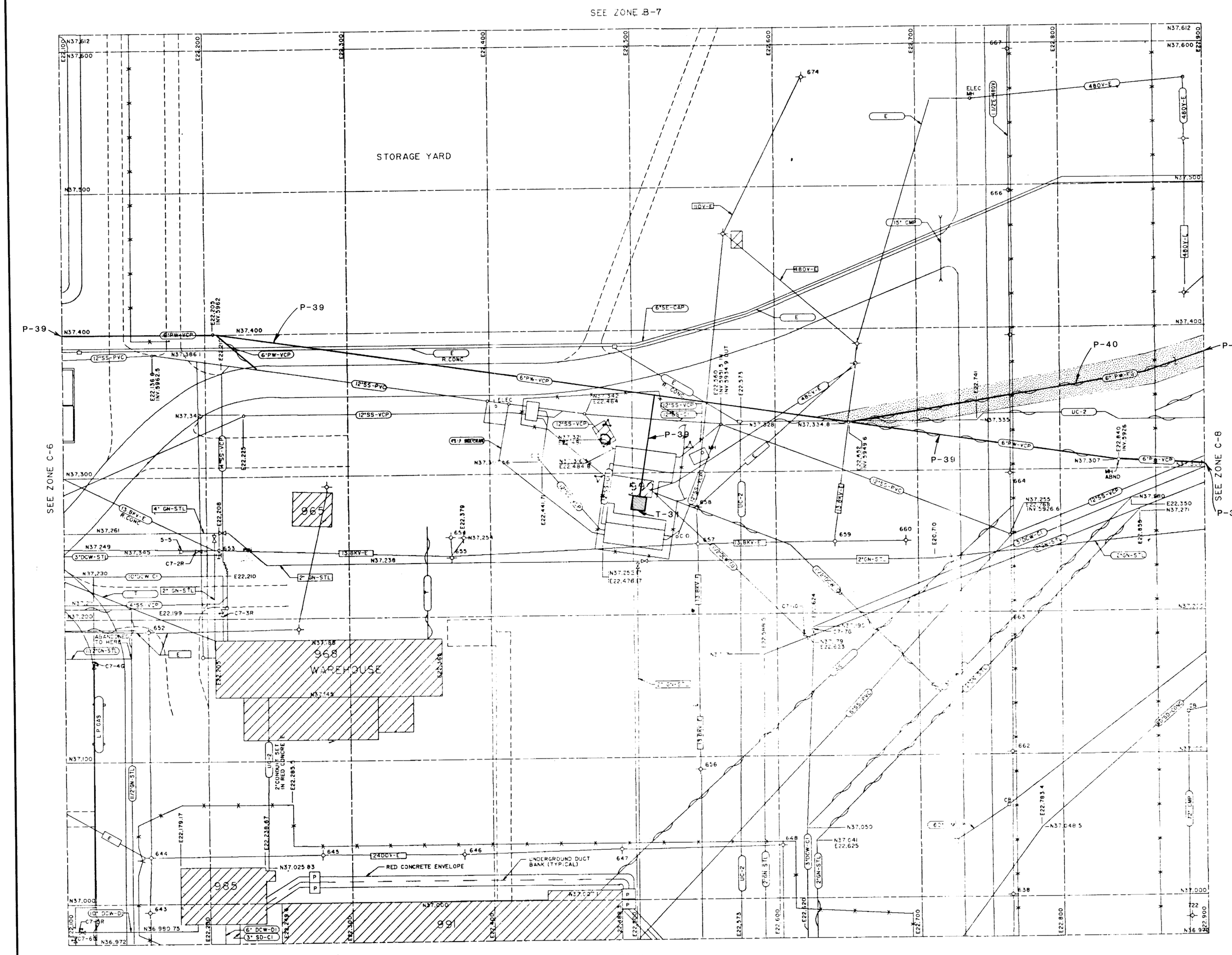


MAP C-7

ABREVIATIONS

ABDN	ABANDONED
ARM	ALARM AND METERING
AR	ARGON
AS	ALARM SYSTEM--------2'-6" TO 3'-0" DEEP
BD	BLOW DOWN
BM	BENCH MARK (ALSO ABM)
B.O.P.	BOTTOM OF DUCT
B.O.D.	BOTTOM OF PIPE
BA.	BREATHING AIR
CA OR CAP	CEMENT-ASBESTOS PIPE
CB	CATCH BASIN
CCL4	CARBON TETRACHLORIDE
CD	CONDUIT
CI	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CN	CONDENSATION, STEAM
CNA	CONCENTRATED NITRIC ACID
CONC	CONCRETE
CWNP	COLD WATER NOT POTABLE
CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
CU	COPPER PIPE
CO	CLEAN OUT
DCW	DOMESTIC COLD WATER
DCWF	DOMESTIC COLD WATER-FIRE
D.I.	DUCTILE IRON PIPE
DUCT	DUCT PLASTIC, TRANSITE OR STEEL IN CONC.
	(DCW, DCWF: 5'-0" TO 8'-0" DEEP)
E	ELECTRICAL----------1'-6" TO 3'-0" DEEP
EL OR ELEV.	ELEVATION
EMH	ELECTRICAL MANHOLE
E-N	N_2 LOW PRESSURE ALARM
FD	FOUNDATION DRAIN
FG	FIBERGLASS PIPE
FH	FIRE HYDRANT
FO	FUEL OIL
G	GLASS LINED PIPE
GLP	GAS, LIQUID PETROLEUM
GN	GAS, NATURAL
HF	HYDROFLORIC ACID
HH	HAND HOLE
HW	HONEYWELL ALARM SYSTEM
	(G, GLP, GN, HF, HH, HW: 4'-0" DEEP)
KV	KILOVOLT
KOH	POTASSIUM HYDROXIDE
IA	INSTRUMENT AIR
LW	LAUNDRY WASTE
MH	MANHOLE
N_2	NITROGEN
O_2	OXYGEN
OS	OUTFALL SEWER
	(N_2, O_2, OS: 2'-0" TO 4'-0" DEEP)
PA	PLANT AIR
PB	PULL BOX
PE	POLYETHYLENE PIPE
POW	PROCESS OIL WASTE
PVC	POLYVINYL CHLORIDE PIPE
PW	PROCESS WASTE
PWF	PROCESS WASTE-FORCED
PWR	PROCESS WASTE RETURN
PWS	PROCESS WASTE SUPPLY
	(PW, PWF, PWR, PWS: 4'-0" TO 8'-0" DEEP)
RCP	REINFORCED CONCRETE PIPE
RT	RIGID TEFLON PIPE
RW	RAW WATER
SD	STORM DRAIN
SS	SANITARY SEWER
SSF	SANITARY SEWER FORCED
SST	STAINLESS STEEL PIPE
STM	STEAM (5 P.S.I. & ABOVE)
STL	STEEL PIPE
	(SD, SS, SSF, SST, STM, STL: 4'-0" TO 8'-0" DEEP)
T	TELEPHONE--------1'-0" TO 8'-0" DEEP
TMH	TELEPHONE MANHOLE
TWR	TOWER WATER RETURN
TWS	TOWER WATER SUPPLY
UC-1	UNDERGROUND CABLE CLASS 1
UC-2	UNDERGROUND CABLE-CLASS 2
	(UC-1, UC-2: 2'-6" TO 3'-0" DEEP)
VCP	VITRIFIED CLAY PIPE
VV	VALVE VAULT
SE	SEWAGE EFFLUENT
ROF	REVERSE OSMOSIS FEED
ROPW	REVERSE OSMOSIS PRODUCT WATER
PFBW	PRECOAT FILTER BACKWASH
PROB	PRIMARY REVERSE OSMOSIS BRINE
SROP	SECONDARY REVERSE OSMOSIS
DBF	DRYING BED FILTRATE

SCALE IN FEET (1" = 40')

LEGEND

- Lines present underground
- Lines present beneath buildings
- Location of Tanks
- Starting or ending point of line segments
- P-1 Pipe Reference, see Table 1-1
- T-1 Tank Reference, see Table 1-2
- Area of reported release. Size is for presentation and does not represent the extent of release.

UTILITY INDENTIFICATION

- SIZE OF PIPE OR CONDUIT
- TYPE OF UTILITY
- MATERIAL OF PIPE OR CONDUIT
- 3" PW-PE, 4" PW-PE — GANGED SYMBOLS INDICATE 2 OR MORE UTILITIES IN THE SAME AREA
- 85 - 3 - R — INDICATES FIRE LINE (RED); VALVE NO. WITHIN INDICATED ZONE; ZONE NUMBER
- 85 - 3 - G — INDICATES DOMESTIC WATER (GREEN); VALVE NO. WITHIN INDICATED ZONE; ZONE NUMBER
- 6 - 10 — INDICATES FIRE LINE (RED)

SYMBOLS

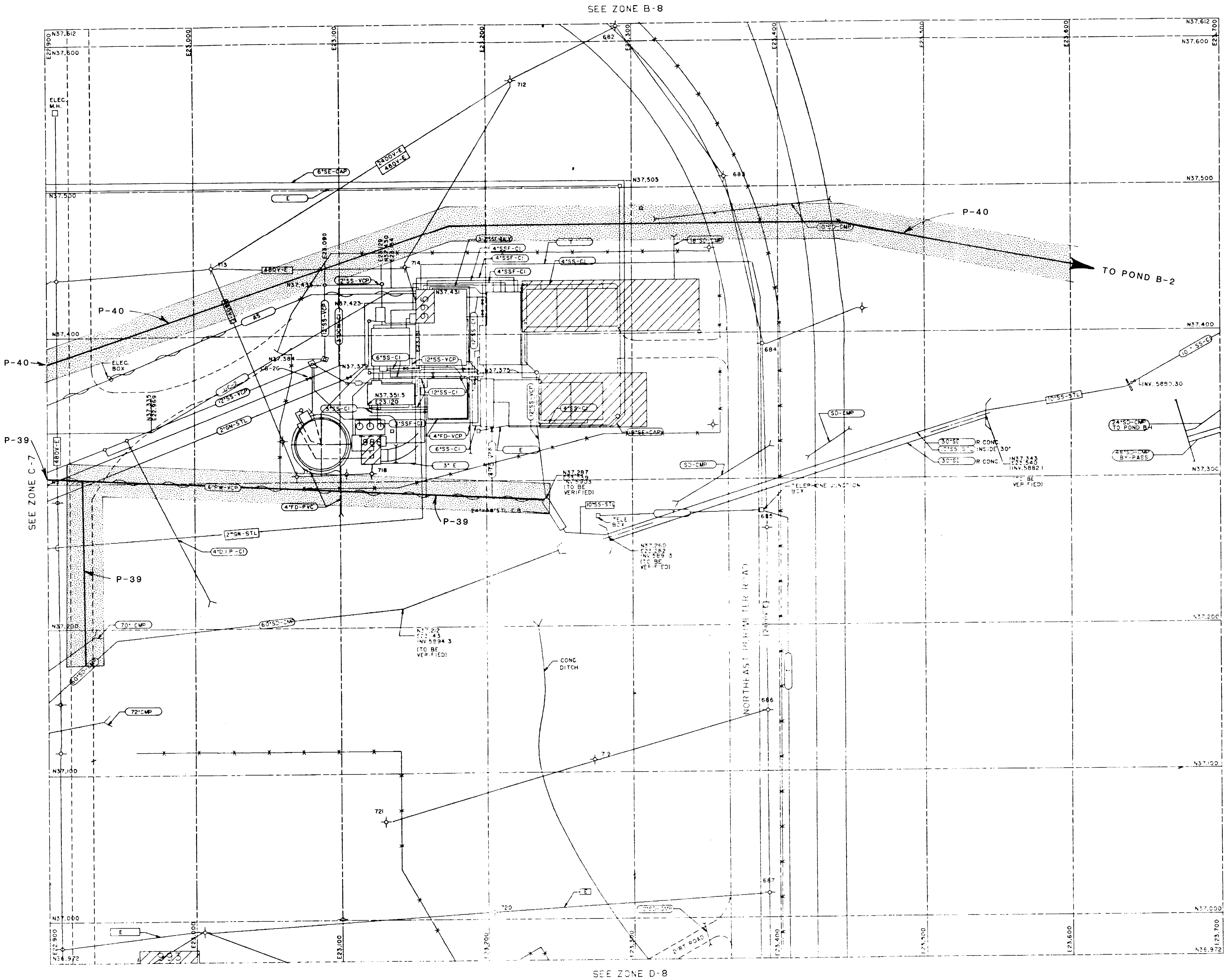
- UTILITY BELOW GRADE
- UTILITY ABOVE GRADE
- UTILITY LINE IN SERVICE
- UTILITY LINE ABANDONED
- VALVE
- POST INDICATOR VALVE
- FIRE HYDRANT
- POWER POLE
- POWER POLES WITH ANCHORS
- MANHOLE OR VALVE VAULT
- BENCH MARK MONUMENT
- CULVERT
- CLEAN OUT
- SLUICE GATE

BASE MAP: ROCKWELL INTERNATIONAL DRAWING 15501-23 L C-7

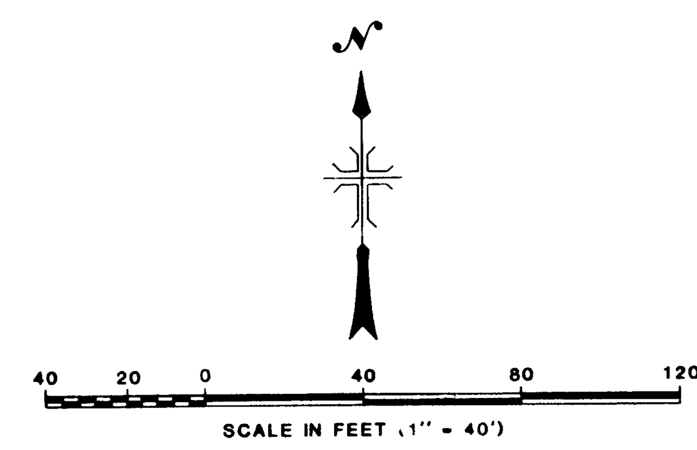
ORIGINAL PROCESS WASTE LINES SITE UTILITY LOCATION MAP C-7

Chen & Associates
Consulting Geotechnical Engineers
96 South Zuni St. • Denver, Colorado 80223

Drawn L.D.M. Check G.J.	Date OCT. 1, 1988	Figure A1-7
Revised 1	Job Number 6 064 87	



MAP C-8



LEGEND

- Lines present underground
- Lines present beneath buildings
- Location of Tanks
- Starting or ending point of line segments
- P-1 Pipe Reference, see Table 1-1
- T-1 Tank Reference, see Table 1-2
- Area of reported release. Size is for presentation and does not represent the extent of release.

UTILITY INDENTIFICATION

- SIZE OF PIPE OR CONDUIT
- TYPE OF UTILITY
- WATER AL OF PIPE OR CONDUIT
- GANGED SYMBOLS INDICATE 2 OR MORE UTILITIES IN THE SAME AREA (3" PW-PE, 4" PW-PE)
- 85 - 3 - R: INDICATES FIRE LINE (RED); VALVE NO WITHIN INDICATED ZONE; ZONE NUMBER
- 85 - 3 - G: INDICATES DOMESTIC WATER (GREEN); VALVE NO WITHIN INDICATED ZONE; ZONE NUMBER
- 6 - 10: INDICATES FIRE LINE (RED)

ABREVIATIONS

ABDN	ABANDONED
ABM	ALARM AND METERING
AR	ARGON
AS	ALARM SYSTEM-------2'6" TO 3'0" DEEP
BD	BLOW DOWN
BM	BENCH MARK (ALSO ABM)
B.O.P.	BOTTOM OF DUCT
B.O.D.	BOTTOM OF PIPE
BA.	BREATHING AIR
CA OR CAP	CEMENT-ASBESTOS PIPE
CB	CATCH BASIN
CCL4	CARBON TETRACHLORIDE
CD	CONDUIT
CI	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CN	CONDENSATION, STEAM
CNA	CONCENTRATED NITRIC ACID
CONC	CONCRETE
CWNP	COLD WATER NOT POTABLE
CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
CU	COPPER PIPE
CO	CLEAN OUT
DCW	DOMESTIC COLD WATER (5'-0" TO 8'-0" DEEP)
DCWF	DOMESTIC COLD WATER-FIRE (5'-0" TO 8'-0" DEEP)
D.I.	DUCTILE IRON PIPE
DUCT	DUCT PLASTIC, TRANSITE OR STEEL IN CONC.
E	ELECTRICAL----------1'-6" TO 3'-0" DEEP
EL OR ELEV.	ELEVATION
EMH	ELECTRICAL MANHOLE
E-N	N_2 LOW PRESSURE ALARM
FD	FOUNDATION DRAIN
FG	FIBERGLASS PIPE
FH	FIRE HYDRANT
FO	FUEL OIL
G	GLASS LINED PIPE (4'-0" DEEP)
GLP	GAS, LIQUID PETROLEUM (4'-0" DEEP)
GN	GAS, NATURAL (4'-0" DEEP)
HF	HYDROFLORIC ACID (4'-0" DEEP)
HH	HAND HOLE
HW	HONEYWELL ALARM SYSTEM
KV	KILOVOLT
KOH	POTASSIUM HYDROXIDE
IA	INSTRUMENT AIR
LW	LAUNDRY WASTE
MH	MANHOLE
N_2	NITROGEN (2'-0" TO 4'-0" DEEP)
O_2	OXYGEN (2'-0" TO 4'-0" DEEP)
OS	OUTFALL SEWER (2'-0" TO 4'-0" DEEP)
PA	PLANT AIR
PB	PULL BOX
PE	POLYETHYLENE PIPE
POW	PROCESS OIL WASTE
PVC	POLYVINYL CHLORIDE PIPE
PW	PROCESS WASTE (4'-0" TO 8'-0" DEEP)
PWF	PROCESS WASTE-FORCED (4'-0" TO 8'-0" DEEP)
PWR	PROCESS WASTE RETURN (4'-0" TO 8'-0" DEEP)
PWS	PROCESS WASTE SUPPLY (4'-0" TO 8'-0" DEEP)
RCP	REINFORCED CONCRETE PIPE
RT	RIGID TEFLON PIPE
RW	RAW WATER
SD	STORM DRAIN (4'-0" TO 8'-0" DEEP)
SS	SANITARY SEWER (4'-0" TO 8'-0" DEEP)
SSF	SANITARY SEWER FORCED (4'-0" TO 8'-0" DEEP)
SST	STAINLESS STEEL PIPE (4'-0" TO 8'-0" DEEP)
STM	STEAM (5 P.S.I. & ABOVE) (4'-0" TO 8'-0" DEEP)
STL	STEEL PIPE
T	TELEPHONE--------1'-0" TO 8'-0" DEEP
TMH	TELEPHONE MANHOLE
TWR	TOWER WATER RETURN
TWS	TOWER WATER SUPPLY
UC-1	UNDERGROUND CABLE-CLASS 1 (2'-6" TO 3'-0" DEEP)
UC-2	UNDERGROUND CABLE-CLASS 2 (2'-6" TO 3'-0" DEEP)
VCP	VITRIFIED CLAY PIPE
VV	VALVE VAULT
SE	SEWAGE EFFLUENT
ROF	REVERSE OSMOSIS FEED
ROPW	REVERSE OSMOSIS PRODUCT WATER
PFBW	PRECOAT FILTER BACKWASH
PROB	PRIMARY REVERSE OSMOSIS BRINE
SROP	SECONDARY REVERSE OSMOSIS
DBF	DRYING BED FILTRATE

SYMBOLS

- UTILITY BELOW GRADE
- UTILITY ABOVE GRADE
- UTILITY LINE IN SERVICE
- UTILITY LINE ABANDONED
- VALVE
- POST INDICATOR VALVE
- FIRE HYDRANT
- POWER POLE
- POWER POLES WITH ANCHORS
- MANHOLE OR VALVE VAULT
- BENCH MARK MONUMENT
- CULVERT
- CLEAN OUT
- SLUICE GATE

BASE MAP: ROCKWELL INTERNATIONAL DRAWING 15501-24 L C-8

ORIGINAL PROCESS WASTE LINES SITE UTILITY LOCATION MAP C-8

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Drawn L.D.M. Check G.J.	Date OCT. 1, 1988	Figure A1-8
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