1979 C.B. ANNUAL REPORT

VOLUME I

SUMMARY OF DEVELOPMENT ACTIVITIES, COSTS AND ENVIRONMENTAL MONITORING

CATHEDRAL BLUFFS SHALE OIL COMPANY

TENNECO SHALE OIL COMPANY

OCCIDENTAL OIL SHALE INC., OPERATOR

751 HORIZON COURT

GRAND JUNCTION, COLORADO 81501

APRIL 30, 1980

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VOLUME 1

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April 30, 1980

Submitted by:

CATHEDRAL BLUFFS SHALE OIL COMPANY
TENNECO SHALE OIL COMPANY
OCCIDENTAL OIL SHALE, INC., OPERATOR
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to:

Mr. Peter A. Rutledge
Area Oil Shale Supervisor
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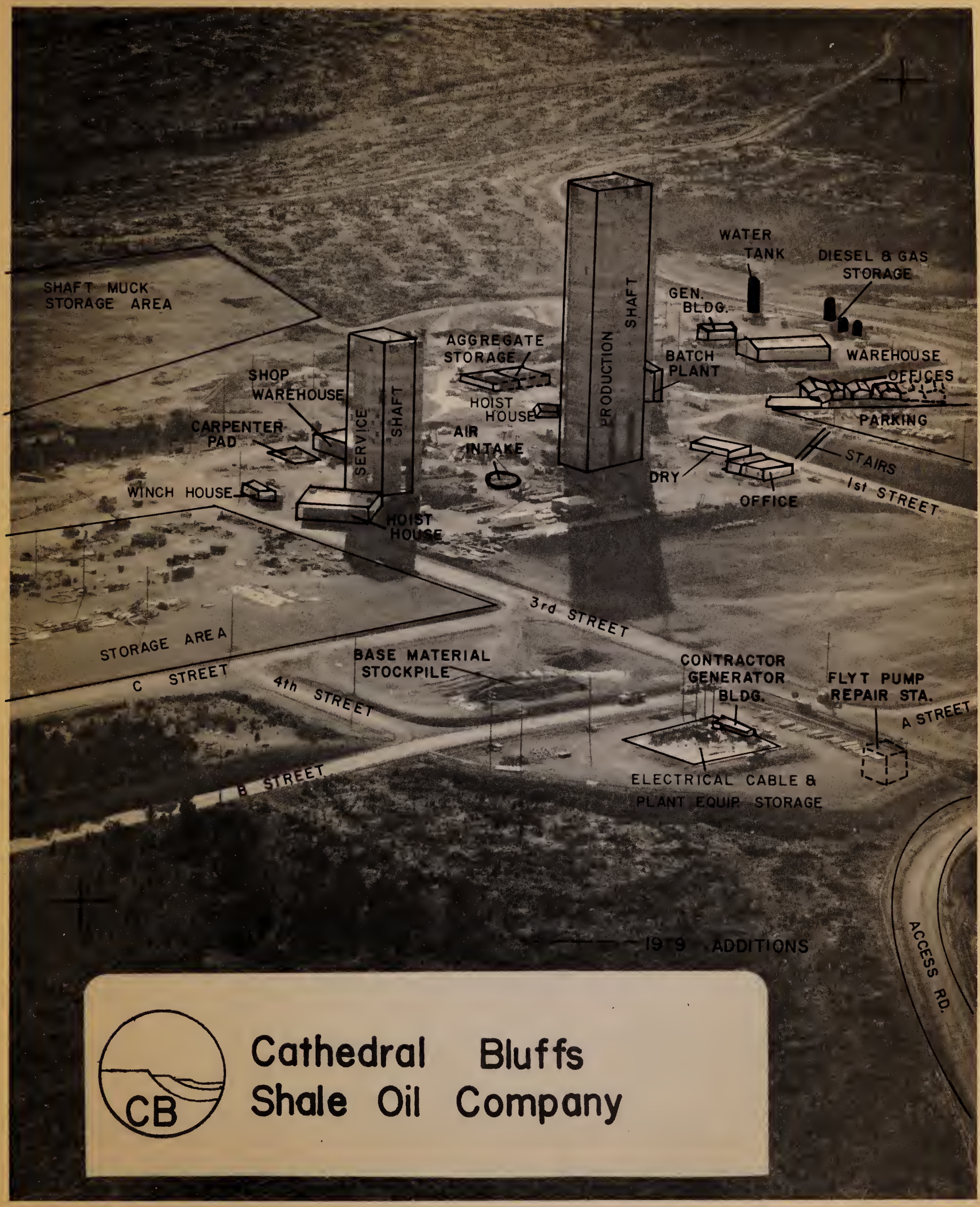
Grand Junction, Colorado 81501


SHAFT MUCK
STORAGE AREA
SHOP
WAREHOUSE
CARPENTER
PAD
WINCH HOUSE
SERVICE SHAFT
HOIST
HOUSE
AGGREGATE
STORAGE
HOIST
HOUSE
AIR
INTAKE
PRODUCTION SHAFT
WATER
TANK
DIESEL & GAS
STORAGE
GEN.
BLDG.
BATCH
PLANT
WAREHOUSE
OFFICES
PARKING
STAIRS
1st STREET
DRY
OFFICE
3rd STREET
STORAGE AREA
C STREET
41h STREET
BASE MATERIAL
STOCKPILE
B STREET
CONTRACTOR
GENERATOR
BLDG.
ELECTRICAL CABLE &
PLANT EQUIP STORAGE
FLYT PUMP
REPAIR STA.
A STREET
ACCESS RD.
1979 ADDITIONS
CB
Cathedral Bluffs
Shale Oil Company

ACCESS RD.

EXISTING ADDITIONS

PLANT EQUIP STORAGE

ELECTRICAL CABLE &

B STREET

BLDG.
GENERATOR
CONTRACTOR

REPAIR STA.
FLAT BUMS

A STREET

4th STREET

STOCKPILE
BASE MATERIAL

C STREET

3rd STREET

STORAGE AREA

HOUSE
HOIST

WINCH HOUSE

PAD
CARPENTER

WAREHOUSE
SHOP

SCRAPER

TRANS

INTAKE
AIR

HOUSE
HOIST

STORAGE
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CONCRETE BATCH PLANT

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DRY

OFFICE

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GEN.

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STORAGE AREA
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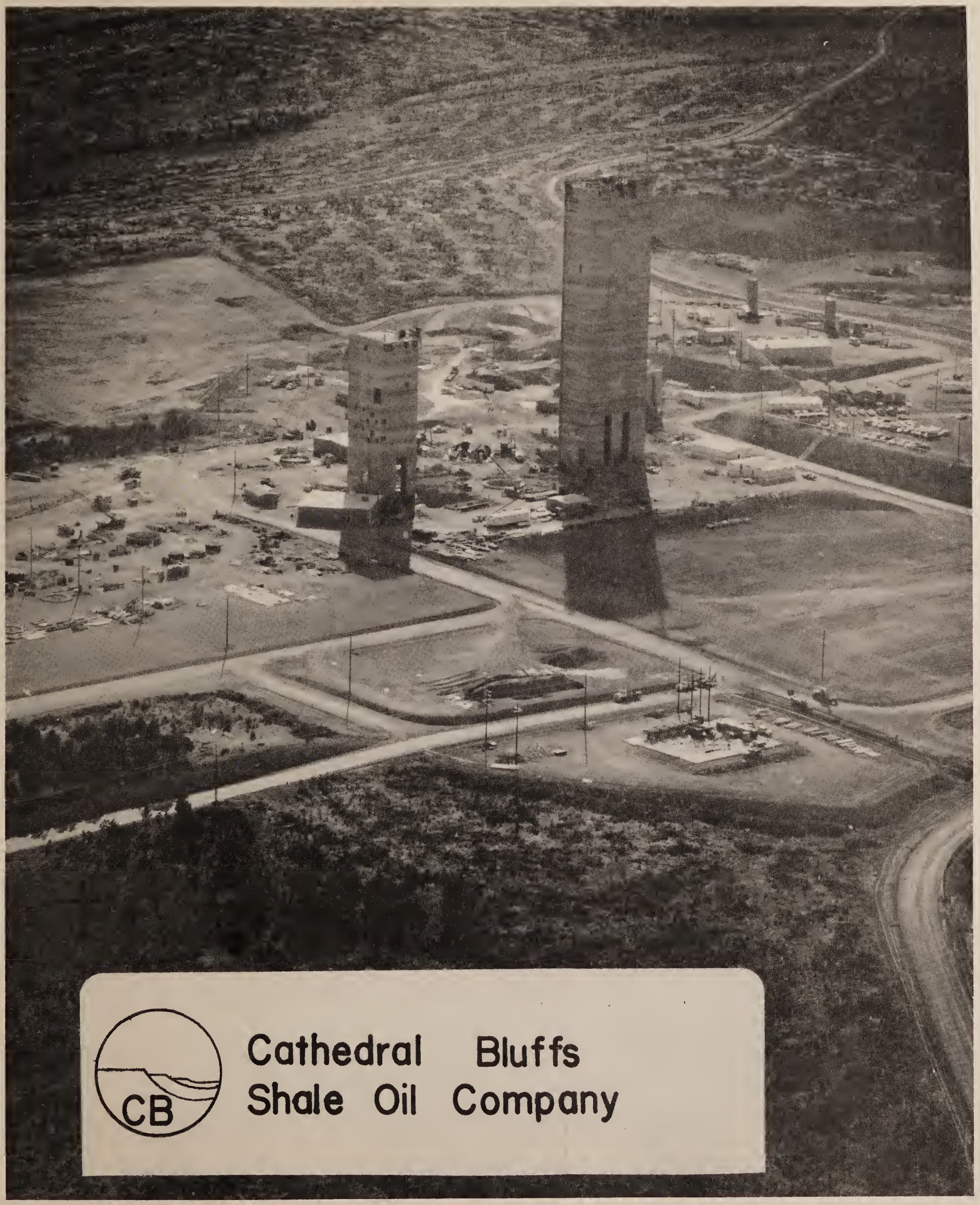
CB
Cathedral Bluffs
Shale Oil Company

FOREWORD

The 1979 C.B. ANNUAL REPORT is submitted to fulfill the requirements of Oil Shale Lease Number C-20341 as stated in Section 16(b) of the Lease, Section 1.(C)(4) of the Lease Environmental Stipulations, and Condition of Approval (No. 3) of the Detailed Development Plan. This report consists of the following volumes:

Volume 1 - Summary of Development Activities, Costs and Environmental Monitoring

Volume 2 - Environmental Analysis

Appendix 2A - Volume 2 Supporting Data

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VOLUME 1 - Summary of Development Activities, Cost, and Environmental Monitoring

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VOLUME 1

SUMMARY OF DEVELOPMENT ACTIVITIES, COSTS AND ENVIRONMENTAL MONITORING

1.0 INTRODUCTION AND SUMMARY

This report summarizes the development activities, costs, and environmental monitoring on the Federal Oil Shale Lease Tract C-b during calendar year 1979 under U. S. Department of Interior Lease Number C-20341. The Tract is located in Rio Blanco County in the Piceance Creek basin of northwestern Colorado.

Principal activity this year consisted of the sinking of three shafts with construction of attendant support facilities to dispose of mine water, shaft rock and muck. The shaft-sinking for a 15-foot diameter Ventilation/Escape Shaft was initiated in January, reaching an approximate depth of 1,031 feet by year-end. A 34-foot diameter Service Shaft was initially started in February, reaching a depth of approximately 790 feet by year-end. A 29-foot diameter Production Shaft was initiated in April reaching a depth of 850 feet below the surface by year-end. Water make for each of these shafts was as follows:

Shaft	Average Water Make (gpm)	Year-End Water Make (gpm)	Total for Year (10^6 gallon)
V/E	81	167	42.7
Service	17	35	9.1
Production	17	45	9.0
TOTAL	115	247	60.8

These values were obtained from Table 4-3, which also presents water used for potable use, construction and dust control. In sinking these shafts 56,500 cubic yards of shaft rock and 300 cubic yards of shale were mined requiring the use of 98 tons of explosives.

As of July, water pumped from the shafts exceeded that used on-Tract so that a water management system was pressed into service. This system utilizes two holding ponds, designated "A" and "B", each of 5 acre-feet capacity for temporary storage. As currently under design, water may either be discharged from Pond B or pumped via pipeline in the future to either sprinkler-irrigate on-Tract or reinject (on-Tract) into the groundwater system. As of year-end, no waters were pumped to Pond "C"; discharges were accomplished from Pond B under a valid NPDES (National Pollutant Discharge Elimination System) discharge permit. A total of 28 million gallons were discharged into East No Name Gulch for an average rate of 126 gpm over 154 days of full operation.

Six buildings were added to the Tract in 1979, in addition to a backwash pond, Pond "C", the sprinkler system, test reinjection well, a pipeline to handle mine water on-Tract and minor road improvements. Total project expenditures in 1979 were approximately $30 million.

Chapter 6 details the disturbed and reclaimed areas. A total of about 30 acres was disturbed during the year, consisting primarily of lands used for irrigation system pipelines. Twelve acres were reclaimed and revegetated; these consist of stockpiled soil south of the support area, temporary soil stockpile, irrigation system pipelines, and the East No Name dam site and barrow area.

At the year-end the on-Tract workforce approached 270. The associated population was distributed as follows: Rifle 66%, Colorado River Valley 20%, Meeker 11%, and miscellaneous 3%. A fleet of five buses provided transportation from Rifle and Meeker to the Tract by year-end. C.B. personnel and consultants are continuing to play an active role in the Mitigation Task Forces relative to the towns of Meeker, Rifle, and Rangely.

Environmental monitoring has continued as an on-going activity at the Tract since the completion of the two-year Baseline period (1974-1976). It encompasses air, water, noise, photography, and biology as well as studies of ecosystem interrelationships, toxicology, and health and safety. Results are briefly summarized in Section 9 of this volume and extensively analyzed in Volume 2 of this Annual Report. No substantial environmental impacts have been noted to-date.

For purposes of demonstrating compliance with this Annual Report with the Detailed Development Plan (DDP), the Development Monitoring Plan (DMP), and the Water Court Decree (leading to the Water Augmentation Plan (WAP)), a Requirements Compliance Matrix is presented on Table 1-1 showing where sections of these controlling documents are addressed in Volumes 1 and 2 of this Annual Report.

The following abbreviations appear in this report:

C.B. - for Cathedral Bluffs, and
C-b - for Colorado-b Oil Shale Federal Lease Tract.

TABLE 1-1 REQUIREMENTS COMPLIANCE MATRIX

Controlling Document	Document Section	Section Subject	Annual Report Volume I Section	Annual Report Volume II Section	Comments
DDP	Volume 1				
	I	General Information and Summary	1,2,4,7.13	1.1	
	II	Phase I - Mine Development			
	A.	Schedule & Summary	3,4	2.1	
	B.	Manpower	1,8		
	C.	Engineering Design & Procurement	3.2,4,5		
	D.	Mine Surface Facilities	1,3,4		
	E.	Mine Shaft Sinking	1,3,4,7.2		
	F.	Development Mine			
	G.	Utilities and Fuel	4		
	H.	Crushing and Conveying			
	I.	Alternate Mining Methods			
	J.	Access and Service Roads	4,7.10.2		
	K.	Dams		5.2.6, 5.3.6	
	L.	Coarse-ore Conveyor & Stockpile			
	M.	Shaft Dewatering, Treatment & Disposal	4	5.2.6,5.2.7,5.3.6,5.3.7	
III		Phase II - Plant Construction	5		
	A.	Summary	4		
	B.	Schedule & Manpower	3,8	2.1	
	C.	On-Tract Surface Facilities	4		
	D.	Off-Tract Facilities	4		
IV		Phase III & Phase IV			Not at this Phase of Development yet.
	A.	Summary - Phase III			" " " " " " "
	B.	Schedules and Manpower			" " " " " " "
	C.	Mine Operations			" " " " " " "
	D.	Crushing and Conveying			" " " " " " "
	E.	Retorting and Upgrading			" " " " " " "
	F.	Waste Disposal			" " " " " " "
	G.	Water Use			" " " " " " "
	H.	Electric Power Use			" " " " " " "

Controlling Document	Document Section		Section Subject	Annual Report Volume I Section	Annual Report Volume II Section	Comments
DDP	V	I	Utility Systems			Not at this Phase of Development yet.
		J	Pipelines			" " " " " " "
		K	Phase IV - Post Operations Environmental Control Plans	7.12 9		" " " " " " "
		A.	Air Pollution Control	7.1,9.3.5	1.2.5,1.2.6,4.2.3,6.0	
		B.	Water Pollution Control	1, 7.2	1.2.3,4.2.2,5.1,5.2.6,5.3.6	
		C.	Noise Control	7.8,9.3.7	1.2.7, 4.2.4, 7.0	
		D.	Protection of Historic, Scientific & Aesthetic Values	7.7,9.3.11	1.2.11	
		E.	Fire Prevention and Control	1,7.9.3		
		F.	Health and Safety	1,7.9.9.3.12,9.3.13	1.2.12, 1.2.13	
		G.	Overburden Management	6	1.2.9	
		H.	Processed - Shale Disposal	6		
		I.	Disposal of Other Wastes	4,6,7.5	1.2.13	
		J.	Fish and Wildlife Management	7.10,9.3.4,9.3.8	1.2.4,1.2.8,4.2.5,8.0	
		K.	Erosion Control and Surface Rehabilitation and Revegetation	6, 7.6, 9.3.9	1.2.9, 5.3.8	
		L.	SPCC Plan	7.4		
		M.	Off-Tract Corridors	7.11		
	VI		Environmental Monitoring	1	1.1	
		A.	Introduction	1	1	
		B.	Soils Survey and Productivity Assessment	1	5.3.8	
		C.	Surface Water	1, 4, 7.2	1.2.3,2.2,4.2.2,5.2.1,5.2.2,5.2.6,5.2.8,5.2.9,5.3.1,5.3.2,5.3.6,5.3.9	
		D.	Sub-surface Water	1, 4	1.2.3,2.2,4.2.2,5.2.3,5.2.4,5.2.5,5.2.8,5.2.9,5.3.2,5.3.4,5.3.5,5.3.9	
		E.	Meteorology and Air Quality	1, 7.1, 9.3.5, 9.3.6	1.2.5,1.2.6,4.2.3,6.0	
		F.	Biological	1, 9.3.4, 9.3.8, 9.3.9	1.2.4,1.2.8,1.2.9,4.2.5,8.0	
		G.	Noise	7.8, 9.3.7	1.2.7, 4.2.4	
DMP	1		Introduction	2, 9.1, 9.2	2.1	
	2		Milestones and Maps	9.2, 9.3	2.1	
	3		Photography	1, 9.3.1	1.2.1, 3.0, 4.2.1	
		.1	Surface	1	3.1	
		.2	Aerial	1	3.2	
	4		Indicator Variables	1, 9.3.2, 9.3.10	1.2.2, 1.2.10, 4.0	
	5		Hydrology	1, 7.2, 9.3.3	1.2.3, 2.2, 4.2.2, 5.1	
		.2	Surface	1, 4.7.2	5.2.1,5.2.2,5.2.8,5.2.9,5.3.1,5.3.2,5.3.9	
		.3	Sub-surface	1, 7.2	5.2.3,5.2.4,5.2.5,5.2.9,5.3.3,5.3.4,5.3.5,5.3.9	
		.4	Development	1,4	5.2.6,5.2.7,5.3.6,5.3.7	

Controlling Document	Document Section	Section Subject	Annual Report Volume I Section	Annual Report Volume II Section	Comments
DMP	.5	Systems Dependent	1,4		
	.6	Quality Assurance	1		
	6	Air Quality and Meteorology	1,7.1,9.3.5,9.3.6	1.2.5,1.2.6,4.2.3,6.0	
	.2	Ambient Air Quality	1,7.1	6.2	
	.3	Meteorlogy	1,7.1	6.3	
	.4	Development - Related	1,7.1		
	.5	Systems Dependent	1		
	7	Noise	1,7.8,9.3.7	1.2.7, 4.2.4, 7.0	
	8	Biology	1,9.3.8,9.3.9	1.2.4,1.2.8,1.2.9,4.2.5,8.0	
	.2	Big - Game Deer	1	1.2.8, 8.2	
	.3	Medium Sized Mammals	1	1.2.8, 8.3	
	.4	Small Mammals	1	8.4	
	.5	Avifauna	1	1.2.8, 8.5	
	.6	Aquatic	1,9.3.4	1.2.4, 8.6	
	.7	Terrestrial	1	8.7	
	.8	Threatened and Endangered	1	8.8	
	.9	Revegetation	1,6	8.9	
	.10	Systems Dependent	1	8.10	
	9	Items of Historic, Prehistoric or Scientific Interest	1,9.3.11	1.2.11, 9.0	
	10	Industrial Health and Safety	1,7.9,9.3.12,9.3.13	1.2.12, 1.2.13, 10.0	
	11	Subsidence Monitoring		11.0	
	12	Ecosystem Interrelationships	9.3.10	12.0	
	13	Data Management and Reporting	9.1,9.3.14,9.3.15	1.2.14,1.2.15,1.2.16,1.3	
Water Court Decree W-3493	7	Legal Description of Site	2,7.3	2.2	
	8	Sources of Water Supply		5.2.1,5.2.2,5.2.3,5.2.8,5.2.9	
	9,10,11	Dewatering and Augmentation	9.3.3	5.2.2,5.2.3,5.2.8,5.2.9	
	13	Assignment of Upper and Lower Aquifer		5.2.4,5.2.5,5.3.4,5.3.5	
	19	Evidence of Depletion Effects	9.3.3	5.2.1,5.2.2,5.2.3,5.2.4,5.2.8,5.2.9	
	24	Monitoring Program	7.2	1.2.3,2.2,4.2.2,5.1	
	25	Parameters		4.2.2,5.2.6,5.3.6	Exhibit A, wells, springs, seeps, streams precip. sites. Exhibit B, Development Monitoring program.
	26	Timely Implementation Requirement		5.1	
	27	Following Cone of Depression		4.2.2,5.2.3,5.2.4,5.2.5	
	28	Monitoring Plan Modifications Provision		1.3,5.2.9,5.3.9,13.0	
	29	Cone of Depression Determination and Monitoring	9.3.3	4.2.2, 5.2.8	
	30	Water Replacement		5.2.8	
	31	Colony, Union, Agreement		5.2.8	

Controlling Document	Document Section	Section Subject	Annual Report Volume I Section	Annual Report Volume II Section	Comments
	32 - 38	Compensation for Depletions		5.2.8	
	39 - 46	Protection of Objectors Water Rights		5.2.8	
	47 - 50	Court Retention of Jurisdiction	7.3		
	51 - 59	Conclusions of Law	7.3		
	60 - 79	Judgement and Decree	7.3		
	62	Replacement Water		5.2.8	
	63	Compensations to Well Water Right		5.2.8	
	71	Replacement Water Quality			
	73	State Water Engineer - Conditions		5.2.2,5.2.4,5.2.9	
	75	Term Day Hearing Requirement			
	76	Augmentation Modification Provision		1.3	

2.0 DESCRIPTION OF PROJECT AREA

2.1 Location

Federal Oil Shale Tract C-b is located in the Piceance Creek structural basin between the Colorado River on the south and the White River on the north. The basin is dominated by a large central plateau which represents more than 75 percent of the basin's land surface. The area represents a sparsely populated portion of the Rio Blanco County in northwestern Colorado. Terrain on the Tract consists primarily of undulating valleys and ridges trending in a northeasterly direction and draining into Piceance Creek. The northern edge of the Tract is approximately one-half mile south of Piceance Creek between Willow Creek and Stewart Gulch. Piceance Creek then flows northwesterly approximately 24 miles to its confluence with the White River. Irrigated-grassland ranching predominates along Piceance Creek. The towns nearest to the Tract are Meeker (40 miles), Rifle (40 miles), and Rangely (65 miles).

Elevations on the Tract vary from 6,400 feet in the lowest valley bottoms to 7,100 feet on the ridges at the southern edge of the Tract. The climate is semiarid with snow cover occurring variably from October to May. The climate supports sparse vegetation, with sagebrush and pinyon-juniper communities being dominant. Historically, the Tract has been used primarily for cattle grazing and providing winter range for mule deer. As part of a BLM range improvement program, approximately 45 percent of the Tract (primarily the flat ridgetops) was chained in 1967. The technique was intended to improve range production by removing sage and pinyon-juniper.

A view of the Tract as it existed in October, 1979 is presented on Figure 2-1.

2.2 Legal Description of the Leased Land

The Tract, as legally described in U. S. Department of the Interior Oil Shale Lease C-20341, consists of 5,093.9 acres, more or less, which is shown in Figure 2-2 and is located in Rio Blanco County, Colorado, as follows:

T3S, R96W, 6th P.M.

Section 5, W½ SE¼, and SW¼;
Section 6, lots 6 and 7, E½ SW¼, and SE½;
Section 7, lots 1, 2, 3 and 4, E½ W½, and E½;
Section 8, W½ NE¼, NW¼, and S½;
Section 9, SW¼;
Section 16, NW¼, and W½ SW¼;
Section 17;
Section 18, lots 1, 2, 3, and 4, E½ W½, and E½;

T3S, R97W, 6th P.M.

Section 1, S½;
Section 2, SE¼;
Section 11, E½;
Section 12;
Section 13, N½;
Section 14, N½ NE¼.

Figure 2-1

View of Tract from Upper Pond Area - October 1979

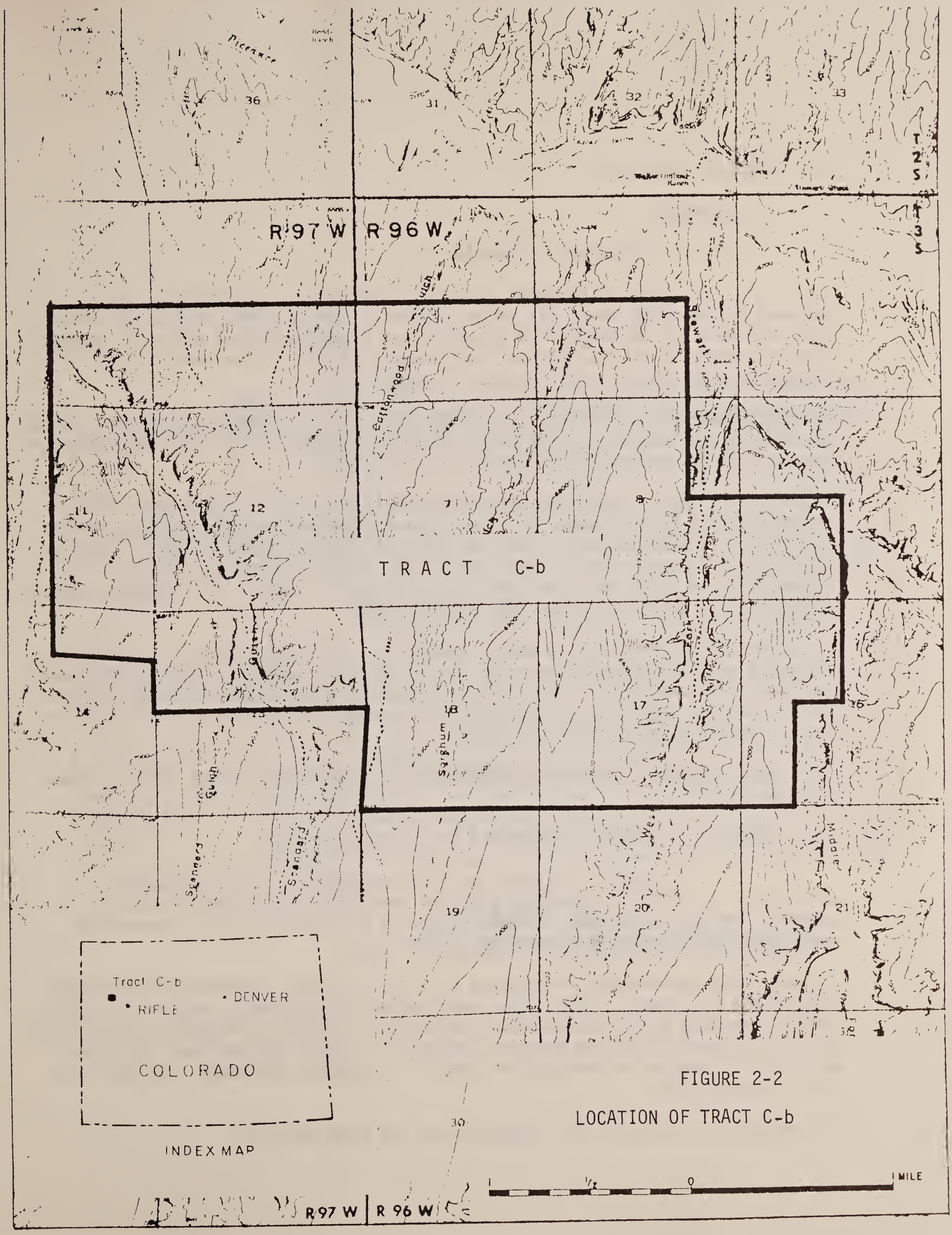

FIGURE 2-2

LOCATION OF TRACT C-b

3.0 SCHEDULE AND COSTS

3.1 Schedule

3.1.1 "Milestone" Schedule

The "Milestone" schedule (Figure 3-1) submitted to and approved by the AOSO (Area Oil Shale Office) in early 1978, depicts 25 activities, grouped as follows: site preparation, preconstruction activity, preproduction mining, shaft facilities, and commercial-facilities-construction encompassing the time span from 1977 through 1987.

The site preparation activity consisted mainly of road construction and grading and fencing activities in late 1977 continuing through 1978. The dam construction originally projected for 1979 has been delayed.

Preproduction mining activity consisted mainly of collaring the head frames and erection of hoist houses for the 15-foot diameter Ventilation/Escape Shaft, the 29-foot Production Shaft, and the 34-foot Service Shaft in 1978. Sinking these shafts is projected through 1982-1984, variable with each shaft. The 34-foot Off-gas Shaft is scheduled to be collared in 1982. The predevelopment mining span is shown covering 1982 through 1986.

According to the milestone schedule Commerical Facility construction will be initiated in mid-1983 with start of retort mining. General construction covers the span from mid-1985 to late 1986 with commercial MIS operations projected in mid-1987. At capacity, production will approach 57,000 bbls/day. Revision of this schedule is currently underway.

A near-term update of projected construction activities through 1982 is shown in Figure 3-2.

3.1.2 Schedule vs. Actual Activities in 1979

Figure 3-3 shows how site-preparation and construction activities in 1977-1979 compared with the previously developed milestone schedule for this time span. Even though due diligence has been exercised some schedule slippage has occurred.

The year 1979 represented the second full year of major construction development at the C-b Tract. This large scale effort, principally related to shaft-sinking involved many construction contractors. Project contractors and their area of responsibility are shown on Table 3-1. Shaft sinking was initiated on the V/E, Service and Production Shafts in January, February, and April of 1979, respectively.

As previously mentioned, dam construction has been delayed.

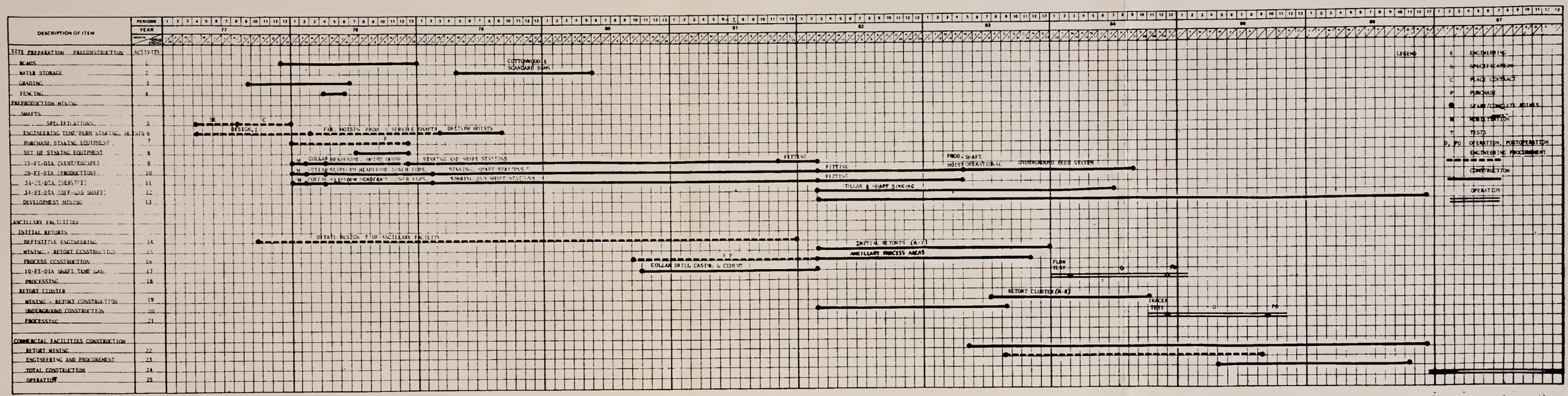

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FIGURE 3-1
OVERALL PROJECT GUIDE SCHEDULE

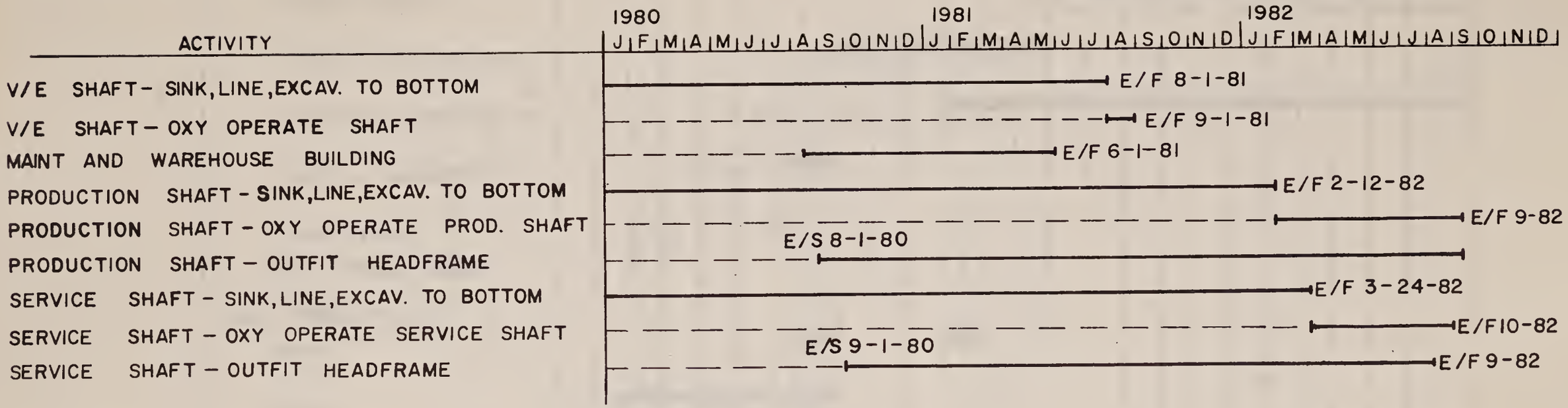

FIGURE 3-2
NEAR TERM PROJECTED C.B. PROJECT CONSTRUCTION ACTIVITIES

1. ALL SINKING RATES AT 40 ft/wk
2. ALL GROUT CYCLES ASSUMED TO BE 60 DAYS
3. E/S = ESTIMATED TO START
   E/F = ESTIMATED TO FINISH

FIGURE 3-3
C-b PREPARATION AND CONSTRUCTION
ACTIVITIES IN 1977, 1978 AND 1979

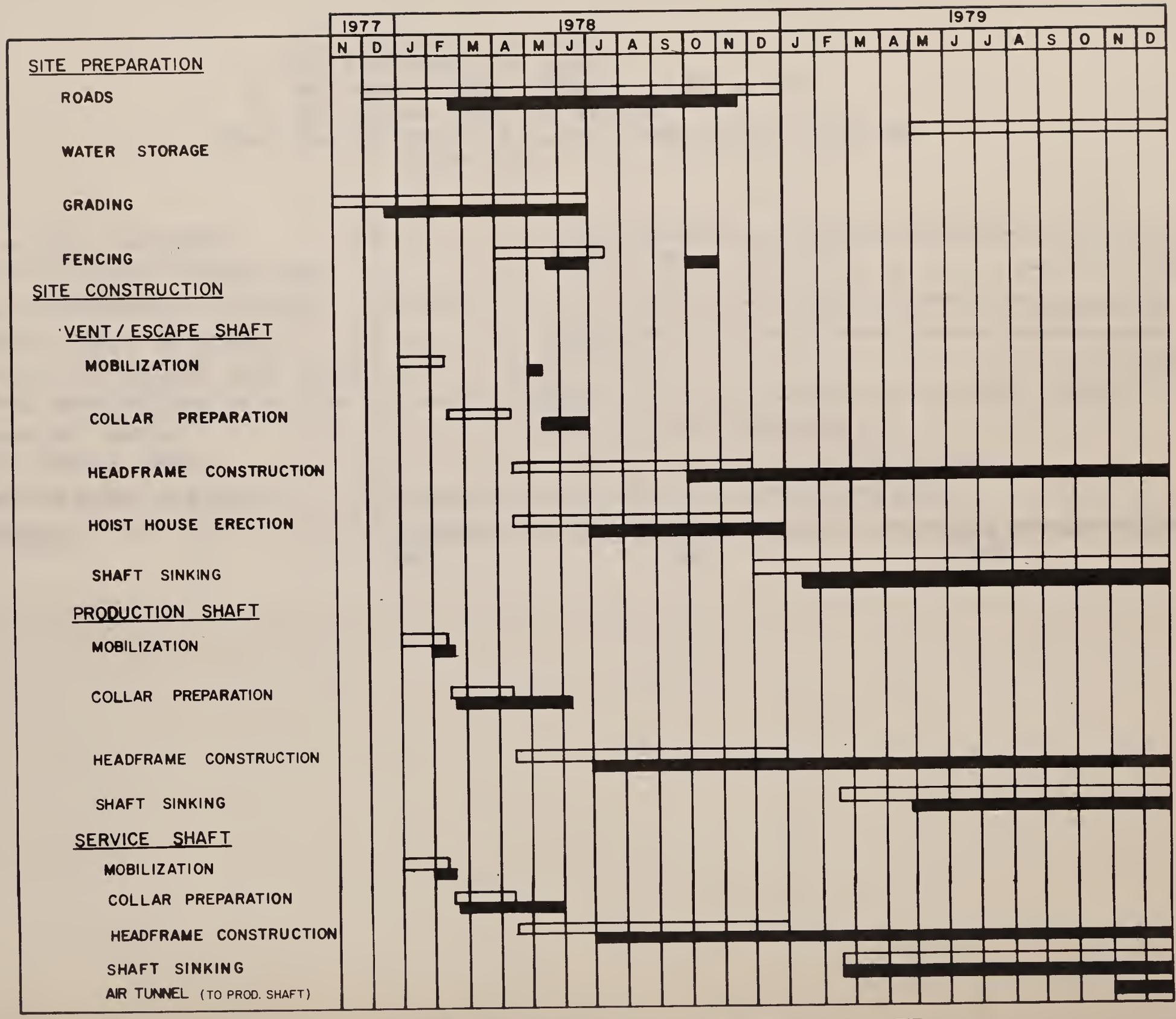

TABLE 3-1

Tract C-b Major Contractors and Responsibilities, 1979

Contractor	
Gilbert Corporation	Sink Production, Service & V/E Shafts
MACCO	Support Operations Labor, Minor Const & MSA
White & Sons	Operate Concrete Batch Plant
AMPCO	Flyte Pump Repair
KKBNA	Surveying
Lang Electric	Electrical Construction
Colorado Well Service	Reinjection Well and Test Well Rework
Armstrong Engineering	Pond "A" Enbankment Redesign and Soil Testing
Dravo	Mine Design, Schedule, and Estimating
Fluor	Process Engineering
Ralph M. Parsons	Construction Management, Design Engineering and Administrative Functions
Colorado Ute	Off-site Electrical Transmission & Sub-station Design & Procurement
ECA	Hydrologic Monitoring Programs and Sub-surface Reinjection Planning
Stoecker & Keammerer	Wildlife and Vegetation Studies
Colorado River Water Control District	USGS Surface-Stream Monitoring Program
Tipton & Kalmbach	Irrigation System Design
ERT	Bird and Aquatic Biology
AeroVironment	Air Diffusion Modeling

3.2 Costs

Financial information for 1979 is presented on Table 3-2 for the following categories: engineering, design and construction, operating costs, environmental, off-site development, and general administrative. Total project costs for 1979 are $29,971,400, down about $11.1 million from the 1978 costs of $41,045,000.

Additional detail in the reclamation and revegetation areas is provided in Chapter 6.

TABLE 3-2

C.B. SHALE OIL PROJECT

1979 FINANCIAL INFORMATION EXPENDITURES

(IN THOUSANDS)

Engineering, Design & Construction		
Preliminary & Engineering Design	$ 4,818.8	
Headframe Construction	1,100.2	
Shaft Construction	12,521.4	
Site Preparation	143.6	
Engineering Services & Fees	462.4	
Dewatering & Irrigation System	1,465.9	
Mining Services	1,103.1	
Busing	526.7	
Miscellaneous Costs	839.3	
		$22,981.4
Operating Costs		
C-b Tract Operations & Maintenance	190.2	190.2
Environmental		
Monitoring:		
Air	114.0	
Water	380.0	
Noise	5.0	
Geology	.9	
Biology	65.2	
Photography	4.3	
Reporting	29.2	
Permits	35.5	
Water Resource Development	100.9	
Toxological Studies	3.6	
Reclamation	10.5	
Miscellaneous Costs	.7	
		749.8
Off-site Development		
Housing	(158.7)*	
Community Development	279.7	
		121.0
General Administrative		
Staff Costs	2,978.6	
Office Expense	404.8	
Overhead	534.4	
Legal & Professional Fees	197.8	
Insurance	429.2	
Safety & Security	79.3	
Other General & Administrative	1,304.9	
		5,929.0
TOTAL C.B. Project		$29,971.4

*This represents net income over expenses received in 1979 from the Rifle Apartments, King's Crown Trailer Court, and the Meeker Apartments. Associated leases were prepaid in 1978.

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4.0 DEVELOPMENT ACTIVITIES

This chapter describes 1979 development activities relative to on-Tract facilities in Section 4.1, off-Tract facilities in Section 4.2, access/service and support in Section 4.3 and mining in Section 4.4.

4.1 On-Tract Facilities Description

4.1.1 General Arrangement

Construction works during 1979 consisted primarily of shaft sinking and installation of support facilities to dispose of mine water and muck. As a general locator, the frontispiece of the 1978 report is again repeated in this report, with building and street identification and 1979 additions shown as dotted. The general plot plan of existing surface facilities for 1979 is shown on Figure 4-1; this may be compared to the aircraft photo of September 9, 1979 shown on Figure 4-2 and the location of facilities in the mine support area and V/E shaft area on Figures 4-3 and 4-4. The existing plot plan that appeared in the 1978 Annual Report (as Figure 4-1) is shown for reference here as Figure 4-5. For easy reference a tabulation of surface facilities added in 1979 along with their approximate sizes and identifying figure cross-reference is presented on Table 4-1; disturbed, reclaimed and revegetated acreages are presented in Chapter 6.

It can be observed from the above illustrations, that major surface development in 1979 was associated with collection, treatment and disposition of mine water from the shafts; this involves settling ponds A, B, and C, a mine water sprinkling system and a test reinjection well as further detailed in Sections 4.1.10 and 7.2.

4.1.2 Production Shaft

Construction of the 29-foot diameter Production Shaft was begun in February 1978 when it was "collared in" to approximately 70-foot depth by conventional excavation methods. The 313 foot headframe was "slipformed" in just 26 days during September and early October 1978. Slipforming is a method of continuous construction in which the form is slipped or jacked-up as the concrete is poured in place. The rebar is placed ahead of the advancing form. Steel beams and floors were installed as feeder and collar floors were completed. The roof and lower power floor beams were set and the sinking and service hoists were installed in 1978. Both are housed in temporary metal buildings which were erected near the shaft. They are used during shaft-sinking activities only. Mechanical and electrical facilities were completed in 1979. The Production Shaft will serve as the main "muck"-hoisting facility during commercial operation.

Headframe cross-sections are shown on Figure 4-6 depicting the upper and lower power floors, the dump floor, and the collar floor. It is to be re-emphasized that ground-mounted temporary hoists in separate buildings are currently in use;

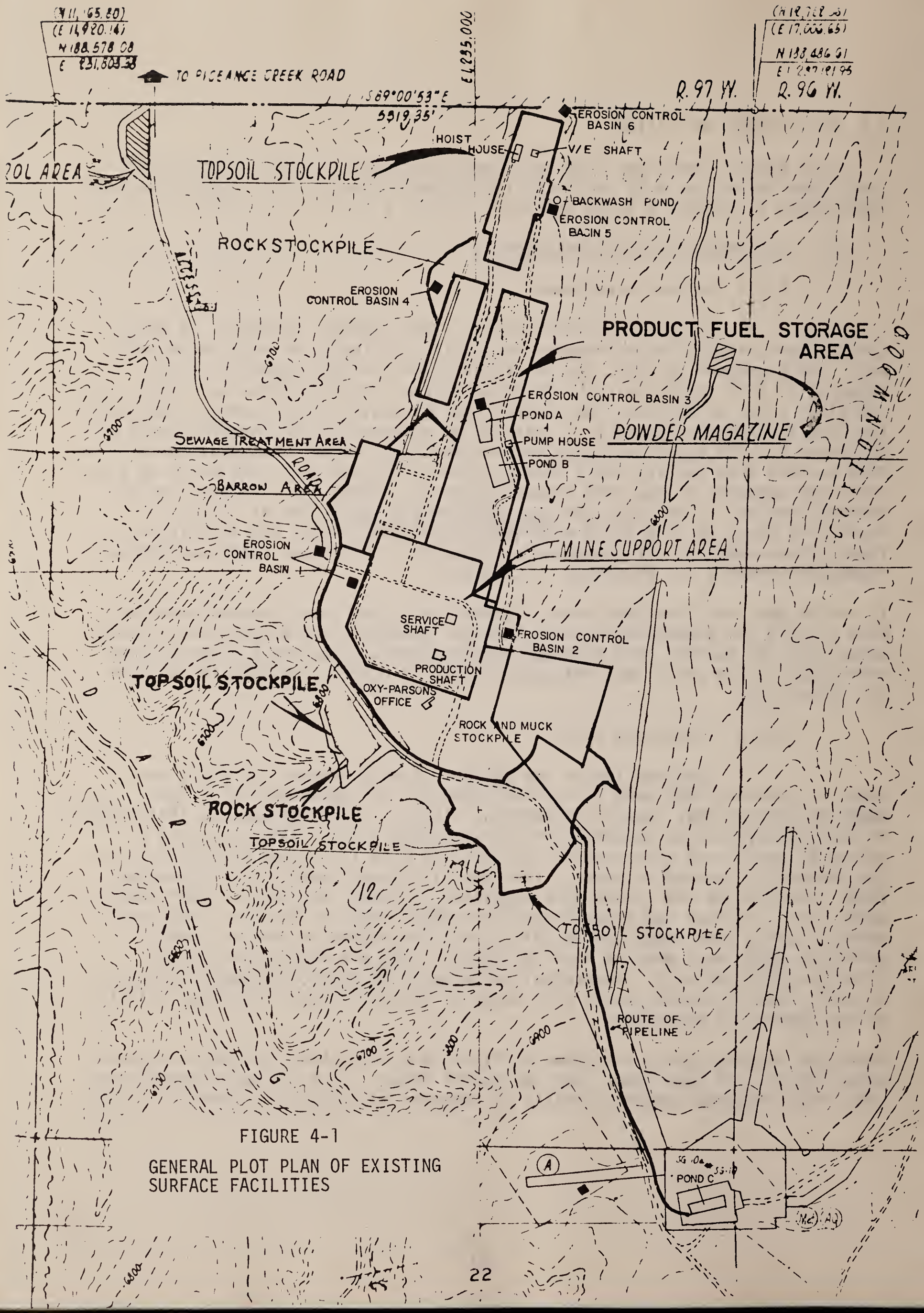


FIGURE 4-1

GENERAL PLOT PLAN OF EXISTING SURFACE FACILITIES

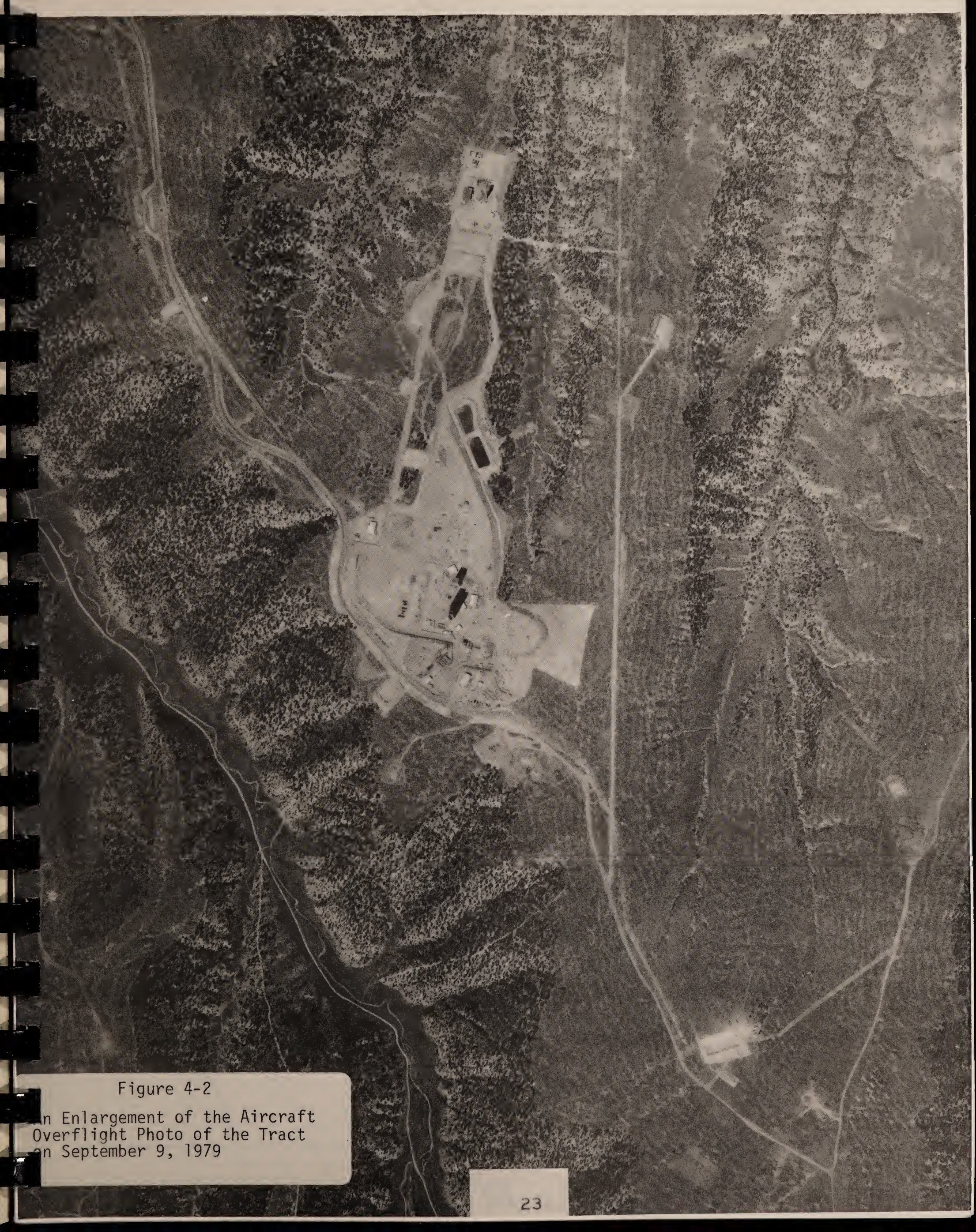


Figure 4-2

An Enlargement of the Aircraft Overflight Photo of the Tract on September 9, 1979

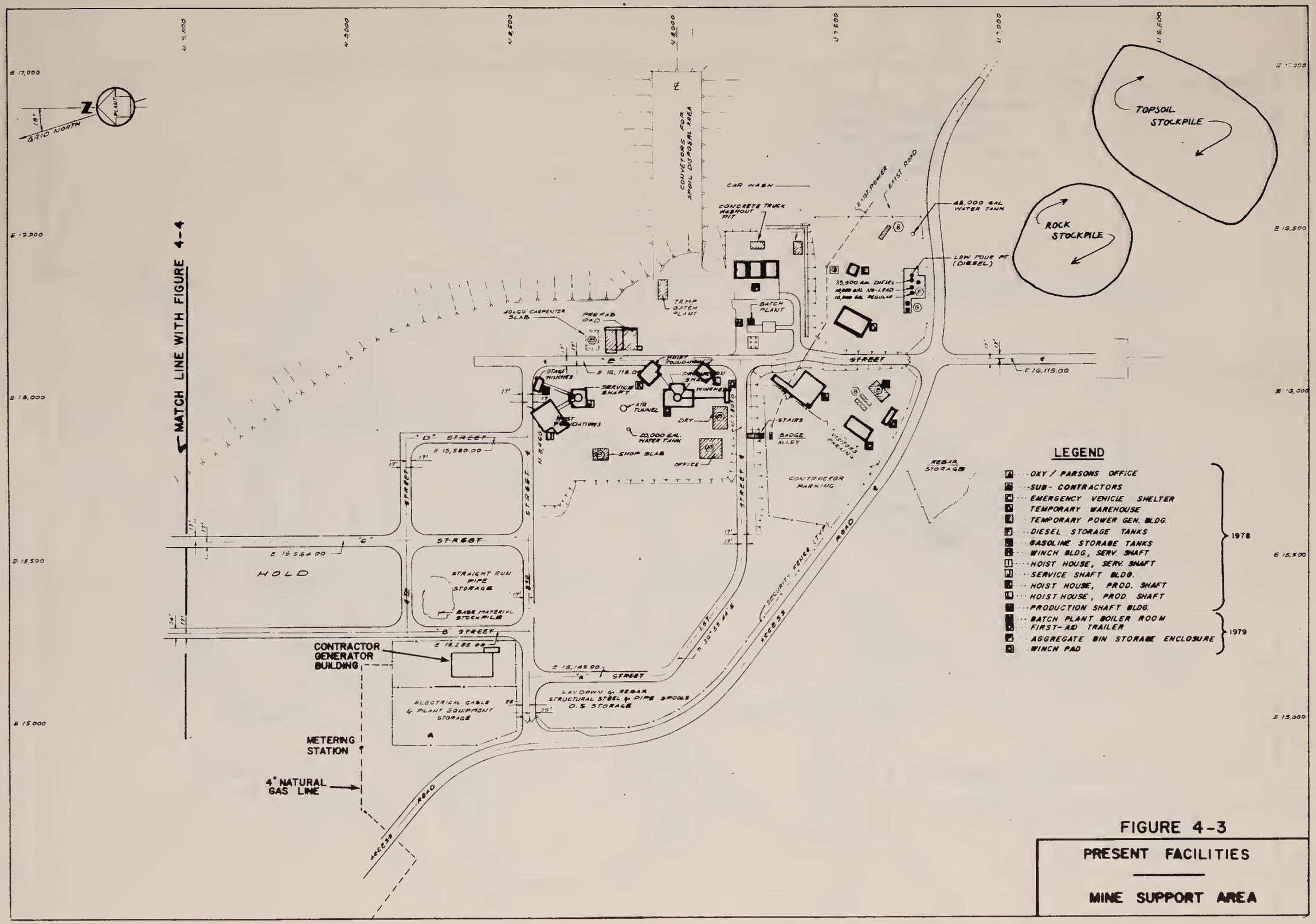
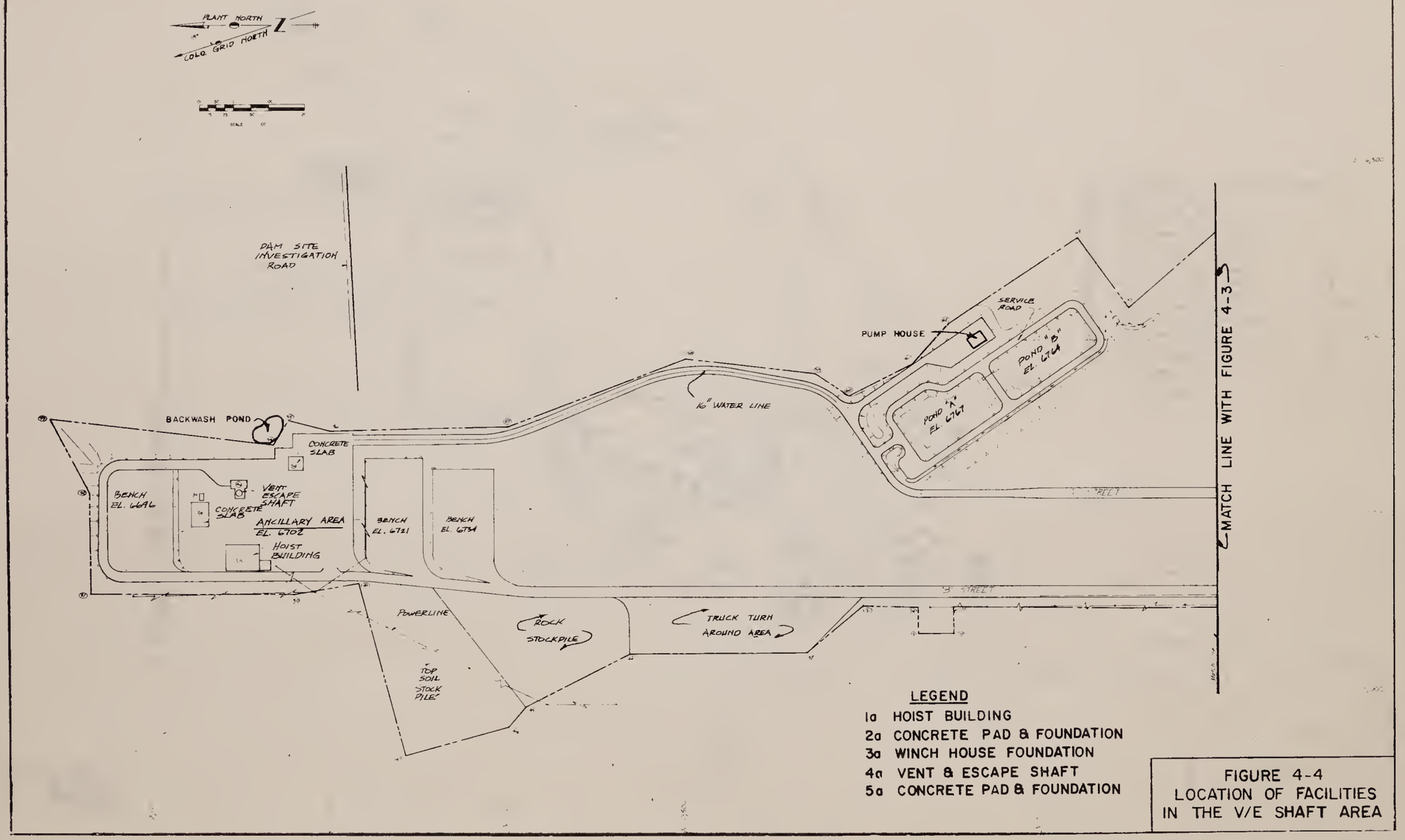


FIGURE 4-3

PRESENT FACILITIES

MINE SUPPORT AREA



LEGEND

1a HOIST BUILDING
2a CONCRETE PAD & FOUNDATION
3a WINCH HOUSE FOUNDATION
4a VENT & ESCAPE SHAFT
5a CONCRETE PAD & FOUNDATION

FIGURE 4-4
LOCATION OF FACILITIES
IN THE V/E SHAFT AREA

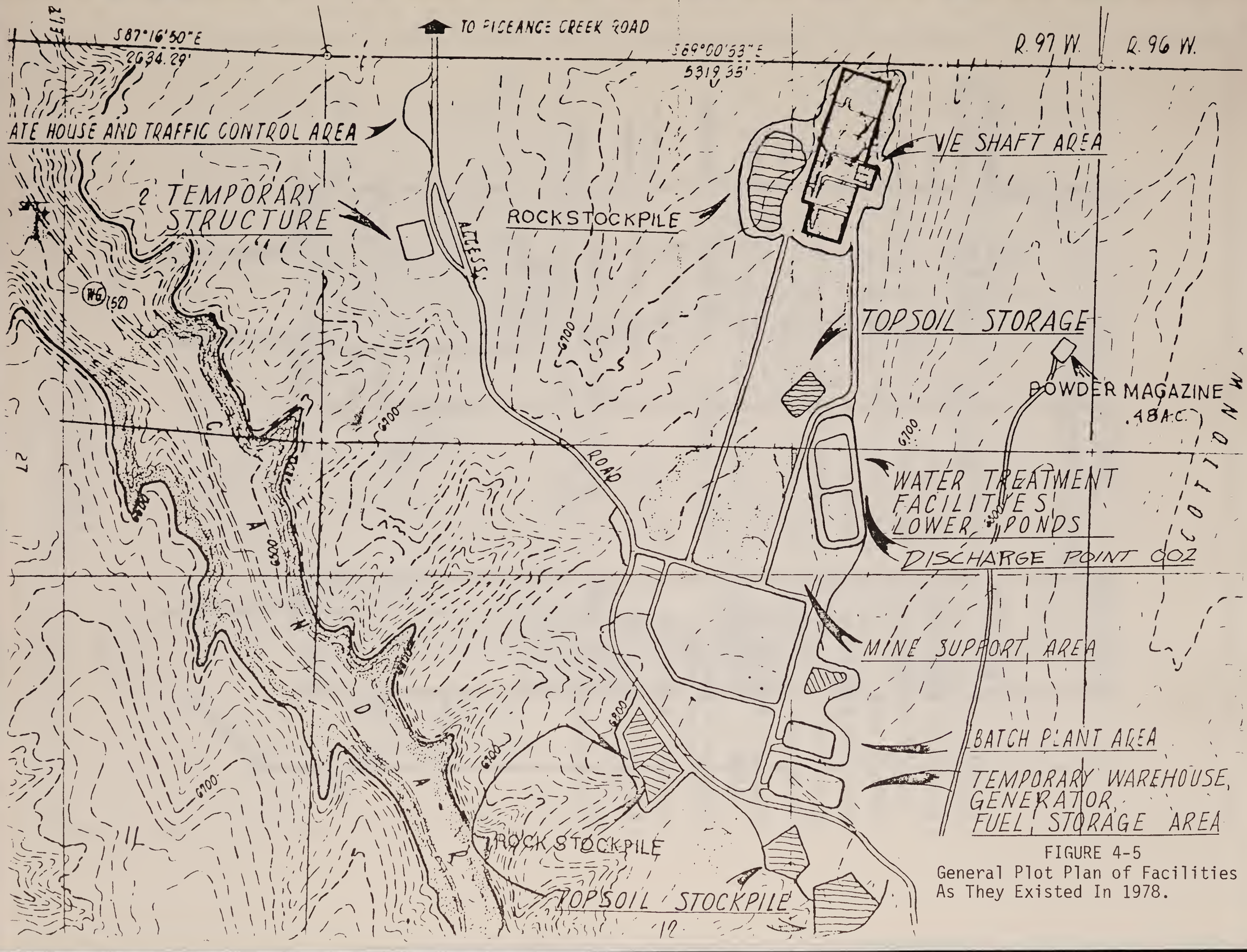


FIGURE 4-5
General Plot Plan of Facilities
As They Existed In 1978.

TABLE 4-1

FACILITIES ADDED IN 1979

Facility	Approximate Size	Location (Figure No.)	Completion Date
Batch Plant Boiler Room	30' x 20'	4-3	March
First Aid Trailer	40' x 10'	4-3	April
Backwash Pond	40' x 24' x 5' D	4-4	June
Lower Pond Pump House	40' x 24'	4-4	June
Upper Pond C	320'x 120'x 10'D	4-16, 4-17	July
Guard House	20' x 12'	4-1	August
Mine Water Pipeline (Lower to Upper Ponds)	14" D	4-1	August
Land Application (Sprinkler) System	Approx. 20 acres	4-16, 6-1	September
Upper Pond Pump House	40' x 24'	4-17	September
Aggregate Bin Storage Enclosure	136'x 56'	4-3	November
Test Reinjection Well	7 5/8" Casing, 1771' D	4-16	December

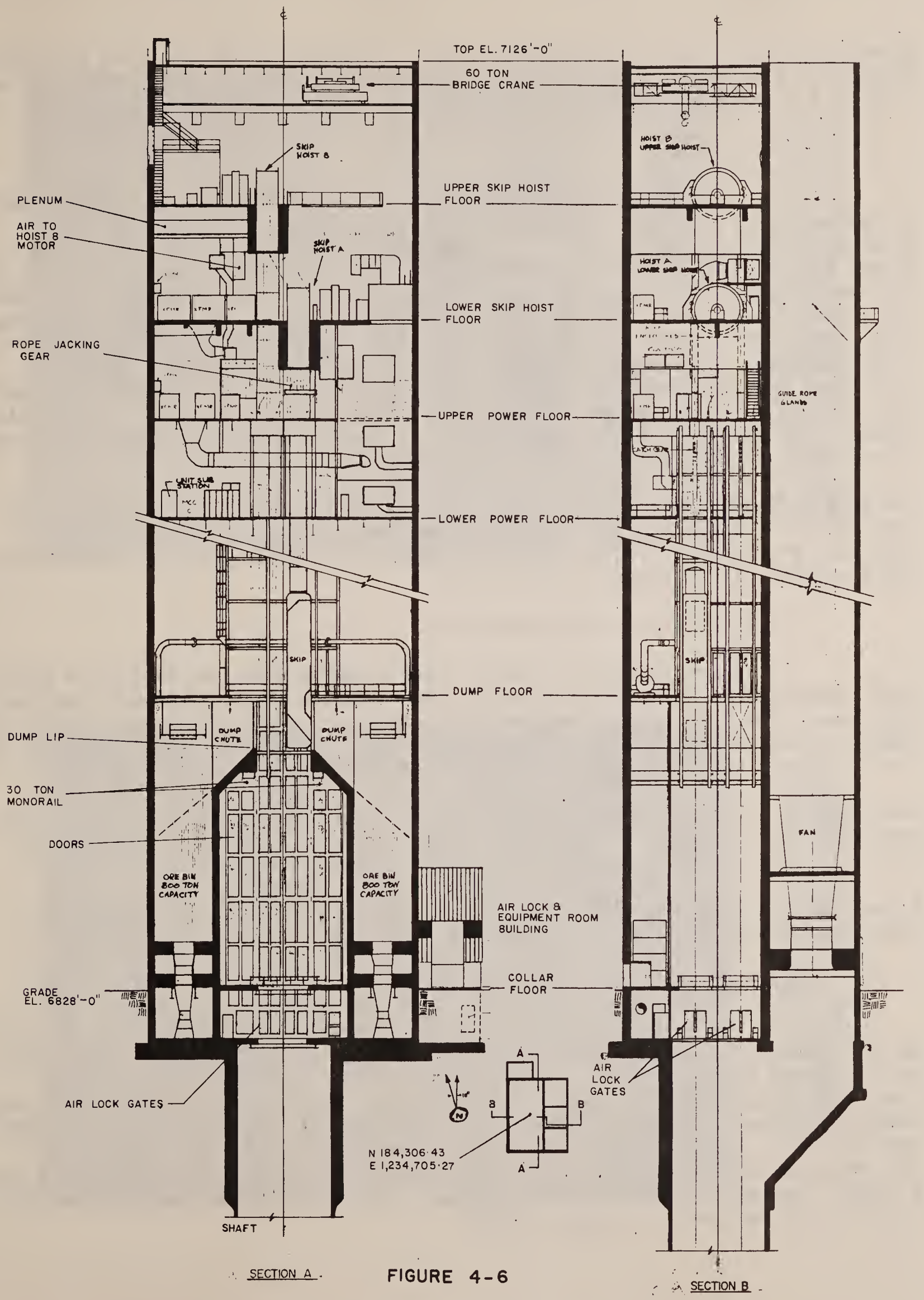


FIGURE 4-6

PRODUCTION SHAFT
HEADFRAME CROSS SECTIONS

permanent hoists are to be installed later. Pictures of the existing Production Shaft bucket above and through the open collar doors are shown on the photos of Figures 4-7 and 4-8 respectively.

4.1.3 Service Shaft

Construction of the 34-foot diameter Service Shaft was commenced in February 1978. The collar and headframe foundations were completed at a depth of 65 feet in May. The slipforming of the headframe tower took place in a 10-day period during August 1978 with installation of steel beams and floors in progress at year end. The manloading and collar floor was completed with beams set in the roof, upper power floor, lower power floor and dump chute. The dump chute and collar door has been installed. The sinking and service hoists were installed and a metal building erected to enclose them. The shaft-sinking mechanical and electrical facilities were completed in 1979. The Service Shaft will be used for both men and equipment hoisting and as a fresh-air ventilation intake. The air inlet or "air tunnel" to the Service Shaft was completed during August 1978; it enters the Service Shaft some 100' below grade.

The Service Shaft headframe cross-sections showing equipment ultimately to be installed, the hoist floor, upper and lower power floors and the manloading floor are presented in Figure 4-9. A photo of the sheave deck in the temporary hoist building is presented in Figure 4-10.

4.1.4 Ventilation/Escape Shaft

Construction of the 15-foot diameter Ventilation/Escape (V/E) Shaft commenced in May 1978; the collar and headframe foundation was completed that June. The structural steel headframe has been erected and the siding and dump-chute installation have now been completed. A metal building to house the shaft sinker's shop and dry room was erected in 1978.

Construction of the V/E Shaft hoist house was begun during July 1978; the building itself was completed in December. Installation of mechanical/electrical facilities were completed in 1979.

A photo of the exterior of the V/E Shaft and its hoist house is shown in Figure 4-11; views of the hoist mechanism are shown in Figures 4-12a and b.

4.1.5 Electric Power Facilities

Five 250-KW 440 volt diesel-driven generators were in operation during January for concrete batch-plant power. A 13.8KV overhead power distribution system from the power plant to the Ventilation/Escape Shaft, Service Shaft, and Production Shaft was completed in January; two more feeder lines were added in February. One additional generator was ordered in September for early 1980 delivery. White River Electric continues to provide Tract power. Two skid-mounted 250KW, 440 volt diesel generators are maintained for emergency use. A 1000KV station is maintained on standby. The average power load during sinking of all three shafts is about 5000KV.

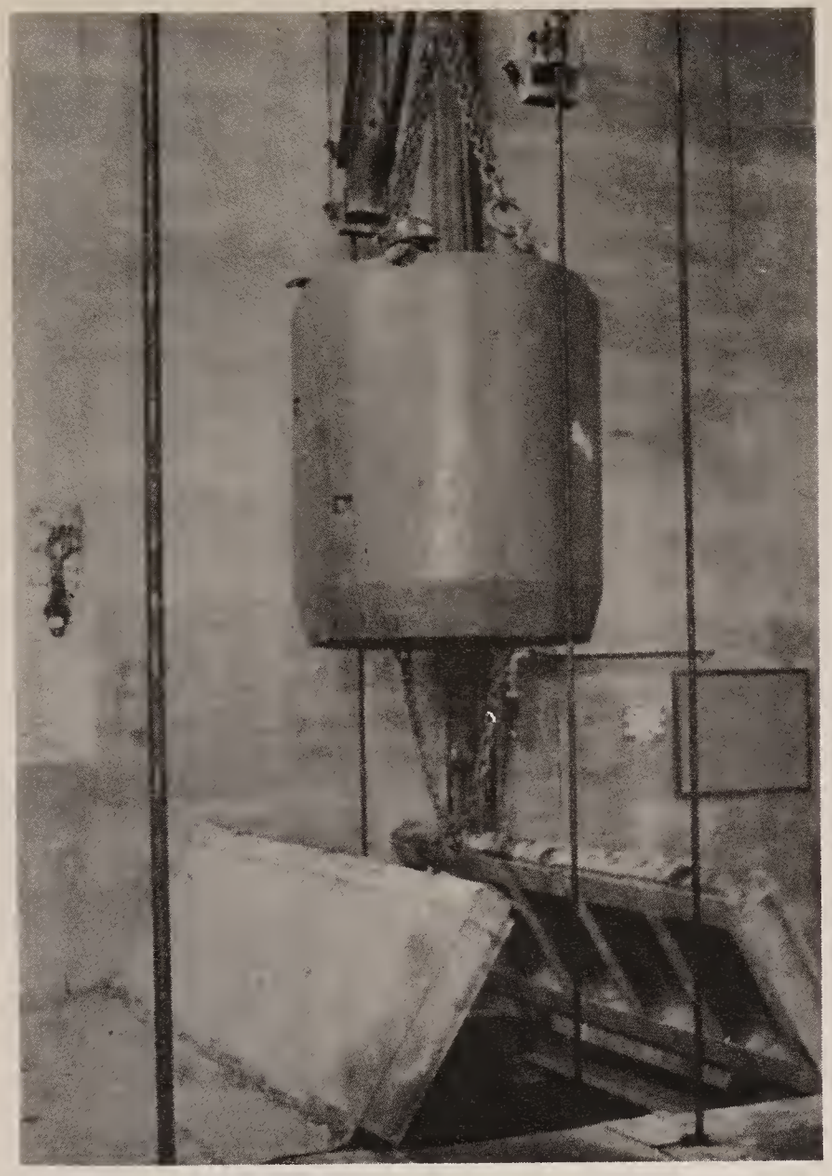


FIGURE 4-7

Production Shaft Bucket Above
Collar Door - November 1979

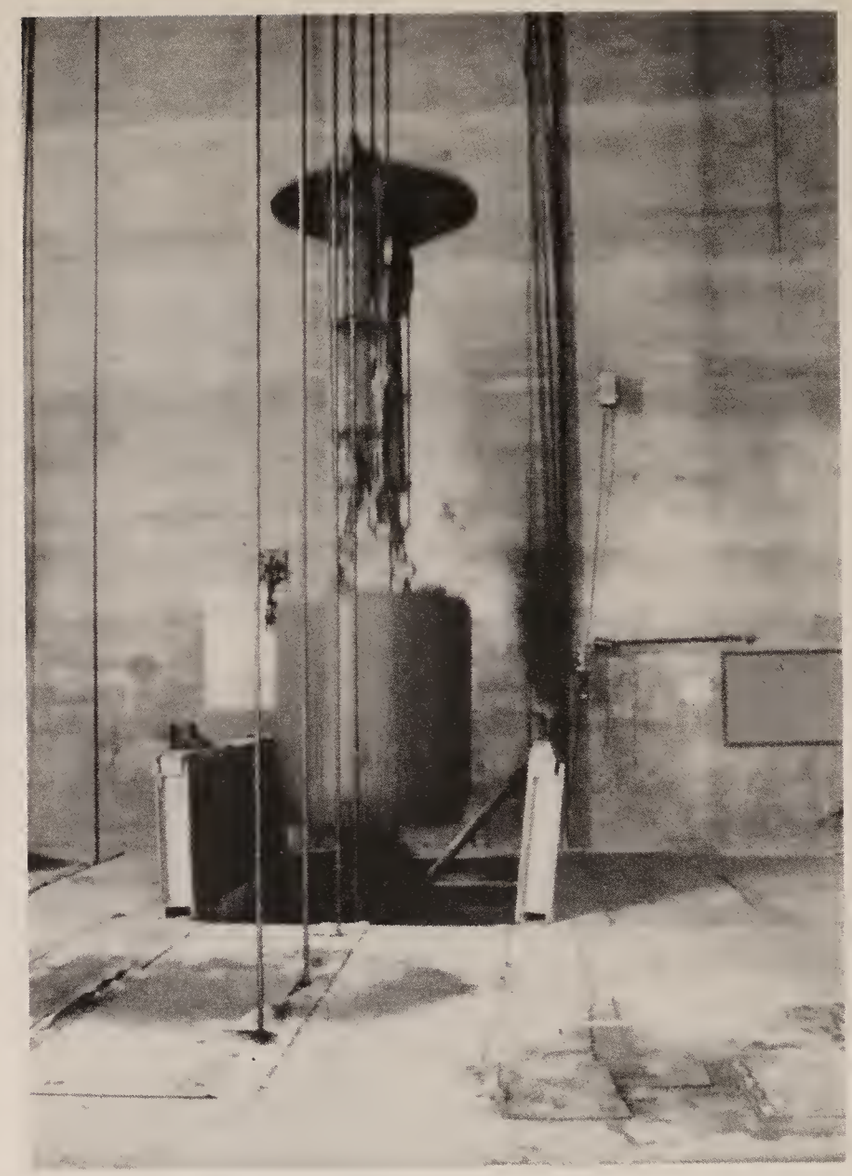


FIGURE 4-8

Production Shaft Bucket
Through Collar Door - August 1979

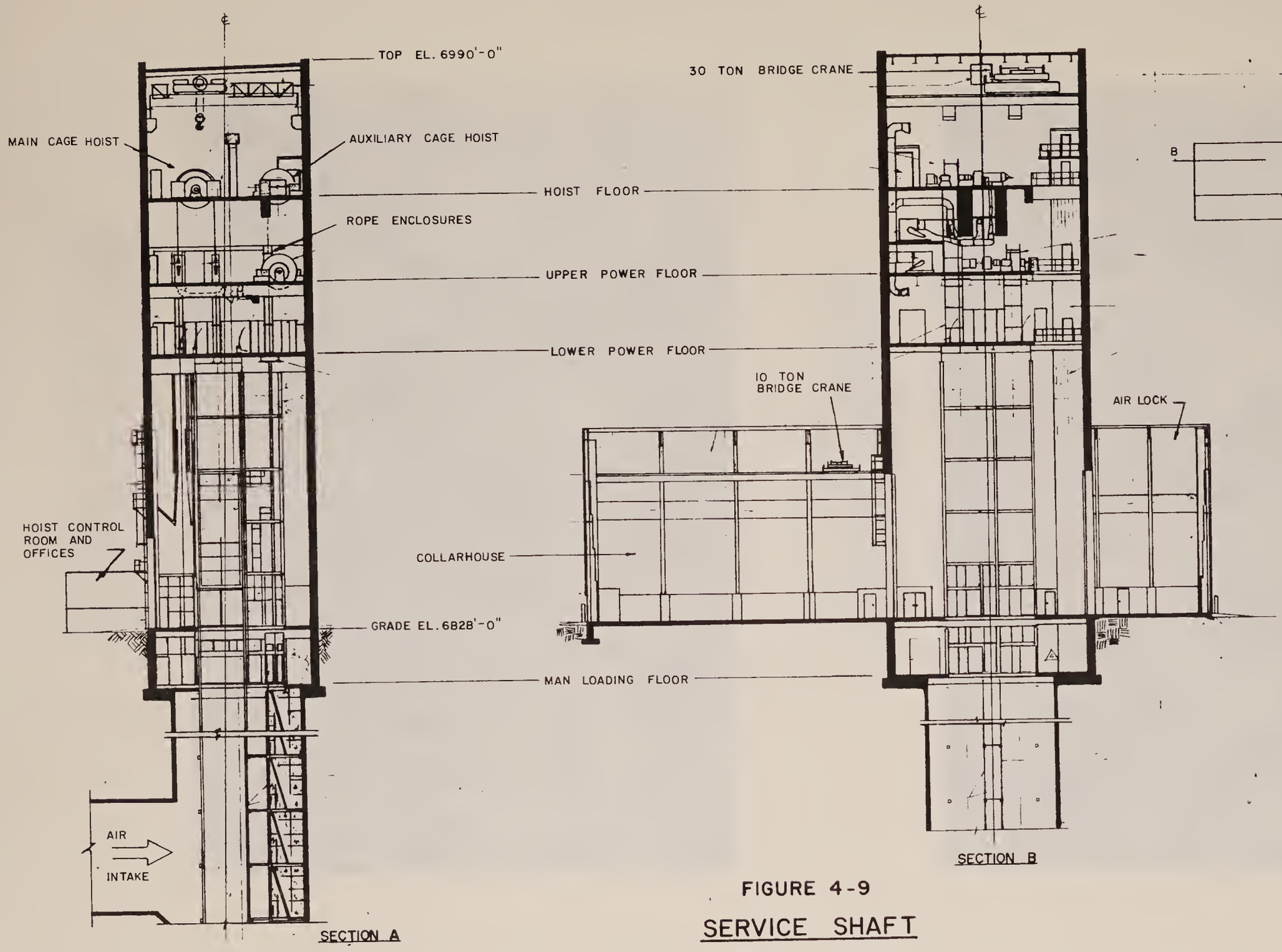


FIGURE 4-9

SERVICE SHAFT

HEADFRAME CROSS SECTIONS

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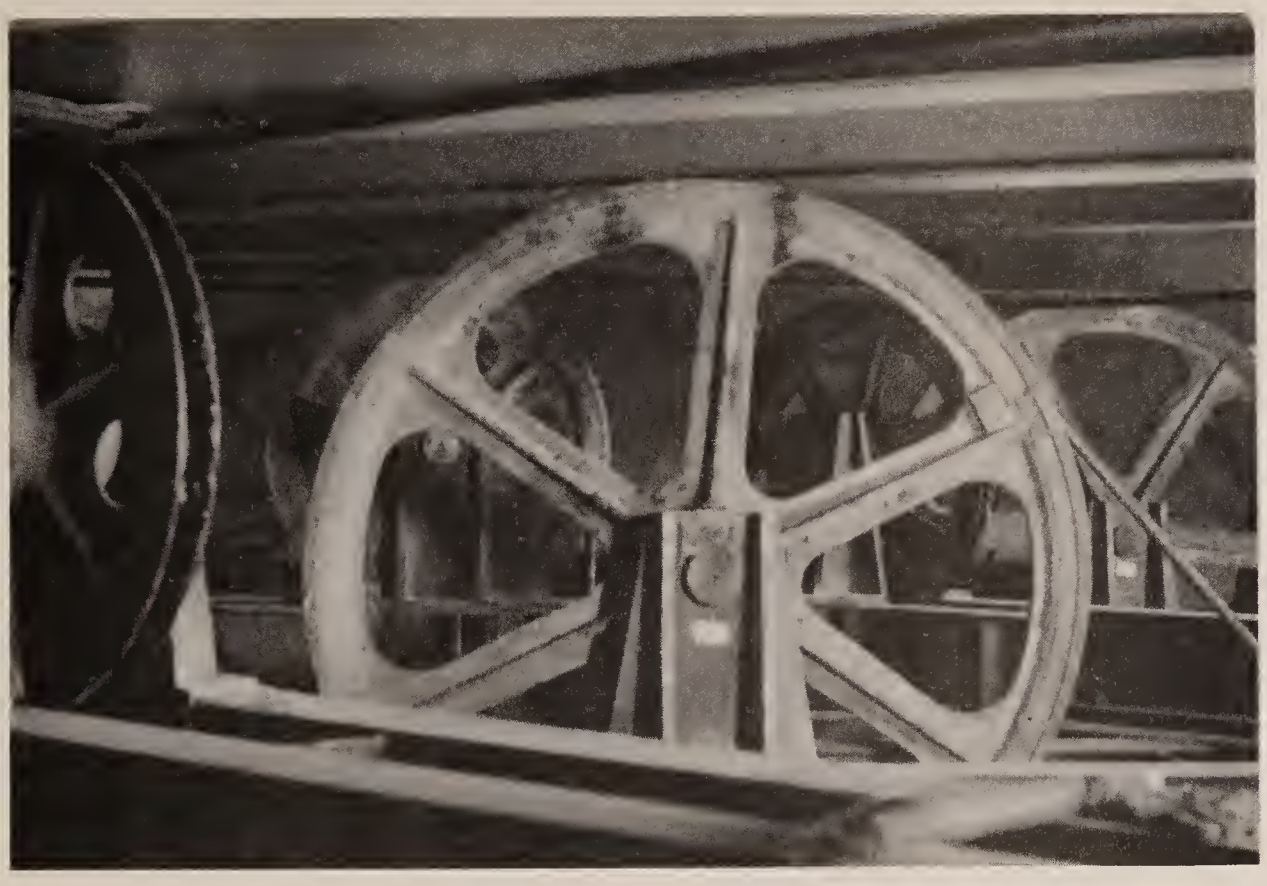

FIGURE 4-10

Sheave Deck - Service Shaft
May 1979

FIGURE 4-11

Exterior View of V/E Shaft and
It's Hoist Houst - August 1979

FIGURE 4-12a

V/E Shaft Hoist Mechanism

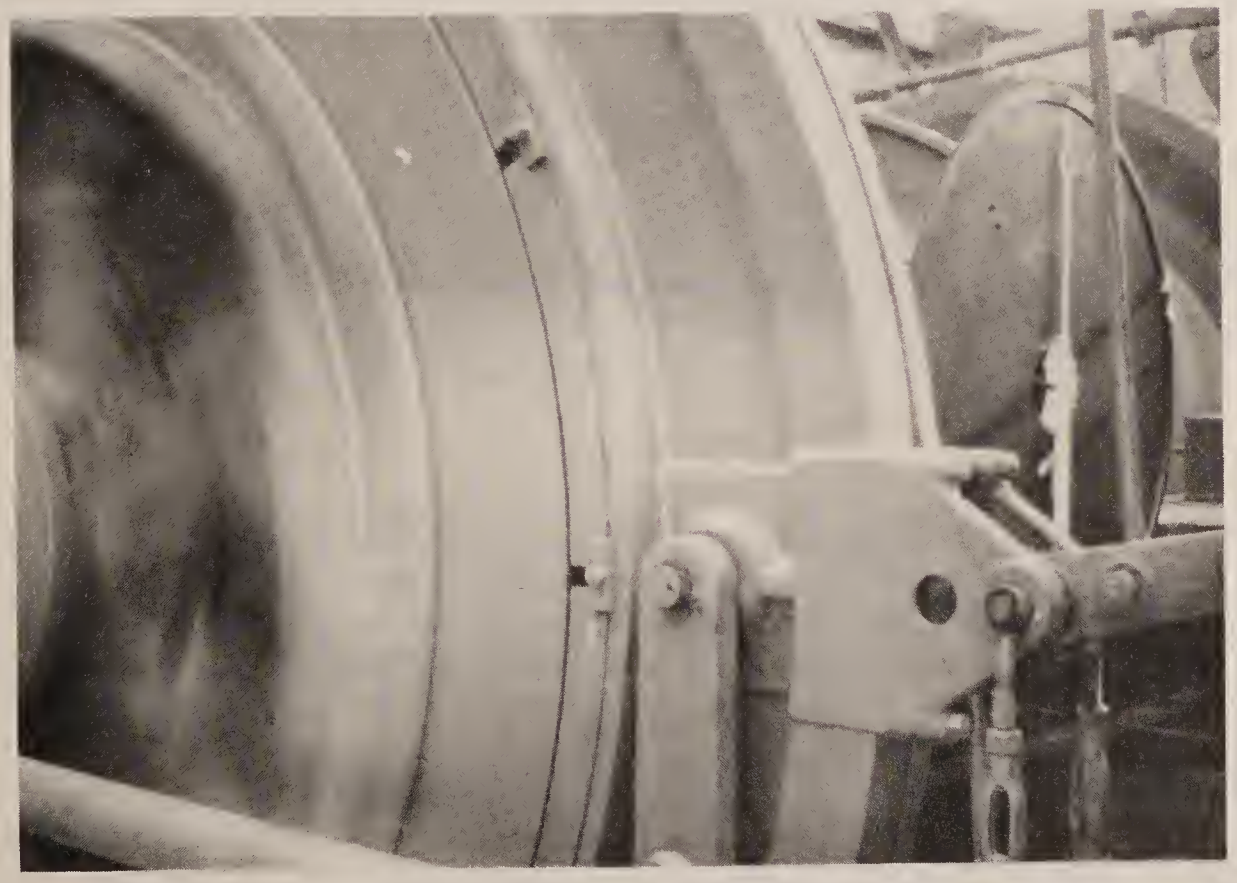

FIGURE 4-12b

V/E Shaft Hoist

4.1.6 Water Wells

During September, a deep-well electric pump (60 gpm capacity) was installed on each of coreholes 33X1 and 32X12 to provide water for early development in the V/E shaft area and mine support area. Well piping and chlorinator installation were sixty-percent complete at the end of the year. These wells will eventually provide well water to dry rooms and site drinking water when treatment systems are completed. A short-term well and storage tank at the Piceance Creek access-road crossing supplied water for construction use.

4.1.7 Buildings

The buildings which were completed and in use during 1979 were previously listed on Table 4-1. All buildings are pre-engineered, pre-fabricated, structural steel, sheet metal construction except for the wood-framed guard house and the knockdown-panel upper-pond pump house.

4.1.8 Concrete Batch Plant

The concrete batch plant produced 19,000 cu. yards of type-2 concrete during the year. Most of this yardage was for the V/E, Service and Production shaft linings. Bulk cement was also transported from Rifle by commercial carrier. Sand and aggregate were trucked from pits near Meeker and Rifle.

A photo of the completed concrete batch plant is given on Figure 4-13. Progress on the aggregate storage shelter is shown on Figure 4-14 and the completed shelter on Figure 4-15.

4.1.9 Explosives Storage and Use

The explosives storage area is, as shown on Figure 4-1, remotely located from areas of major current Tract activity. Monthly use of explosives for shaft sinking is depicted on Table 4-2. In 1979 approximately 98 tons of explosives were used in 766 instances, or any average number of detonations of slightly over 2 per day.

4.1.10 Surface Water Facilities

Surface water facilities were constructed in 1979 to dispose of excess mine water by direct discharge from the lower ponds, by sprinkler disposal, and by subsurface reinjection into aquifers of like water quality. These facilities are summarized here; water management aspects are presented in Section 7.2. The water management system layout is depicted on Figure 4-16.

Two five-acre-foot ponds designated "A" and "B" as shown in Figure 4-17 were constructed in January. The energy dissipation system below the discharge point from these ponds is shown in Figure 4-18. Pipelines and outlet structures were completed from the V/E shaft in April. The lower pond pumphouse was completed in June (Figure 4-19). The pipeline from the Production and Service shafts to these lower ponds was completed in June. Total flow at year-end to

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FIGURE 4-13

Concrete Batch Plant
July 1979

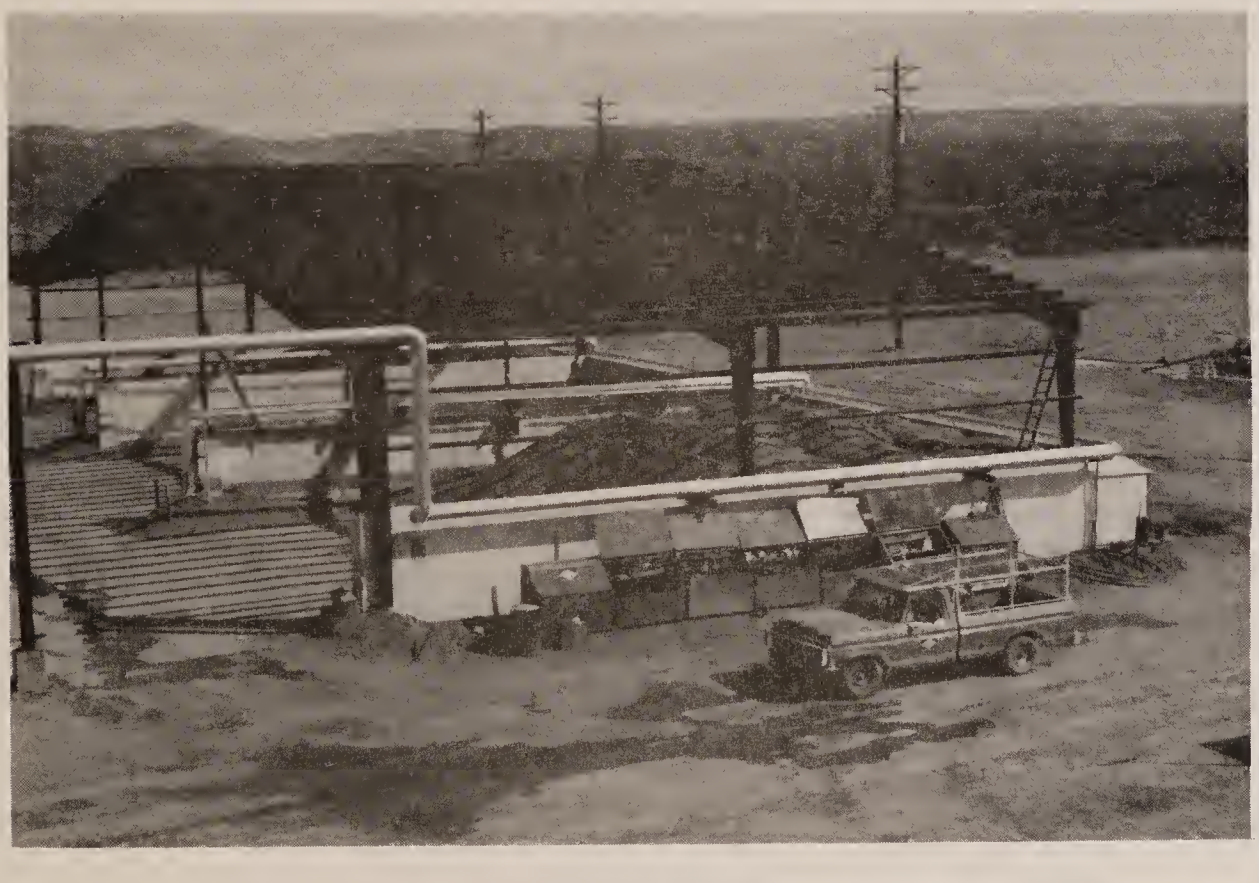


FIGURE 4-14

Progress on Aggregate Storage of the Concrete Batch Plant.
September 1979

FIGURE 4-15

The Completed Aggregate Shelter - October 1979

TABLE 4-2 C.B. Monthly Consumables Usage In 1979

ITEM	UNITS	MONTHLY USAGE												
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
DIESEL FUEL # 1	10^3 gal.	15.2	3.3	3.3	0.09	0.04	0.05	0.08	0.04	0.04	0.04	7.6	0.7	30.5
DIESEL FUEL # 2	↓	19.0	9.0	17.0	7.3	21.6	18.9	14.6	6.6	15.8	3.3	15.6	4.8	153.5
GASOLINE GAS		7.5	5.6	7.6	5.3	5.9	6.0	4.9	6.7	6.3	5.4	6.3	6.8	74.3
GASOLINE PROPANE		19.7	14.0	9.0	1.3	0.5	1.6	0.5	1.3	0.5	2.0	5.8	2.9	59.1
NATURAL GAS	10^9 BTU	3.7	3.2	7.8	10.3	10.6	10.7	13.3	13.7	12.8	16.2	16.3	17.6	136.2
DUST PALLIATIVE *	10^3 gal.	0	0	0	0	0	0	0	5.6	0	0	0	0	5.6
MINED SHALE	10^3Cu Yd	0	0	0	0	0	0	0	0	0	0	0.2	0.1	0.3
MINED SHAFT ROCK	↓	0.7	1.0	3.0	2.8	7.5	16.2	7.8	3.6	6.0	3.8	1.1	3.0	56.5
EXPLOSIVES: POUNDS	10^3 lbs	1.3	7.8	11.7	10.5	26.1	23.5	28.0	14.0	22.3	22.2	15.3	12.9	195.6
EXPLOSIVES: FREQUENCY	Number	25	58	61	39	96	78	93	45	80	60	70	61	766

*See also water used for dust control in Table 4-3.

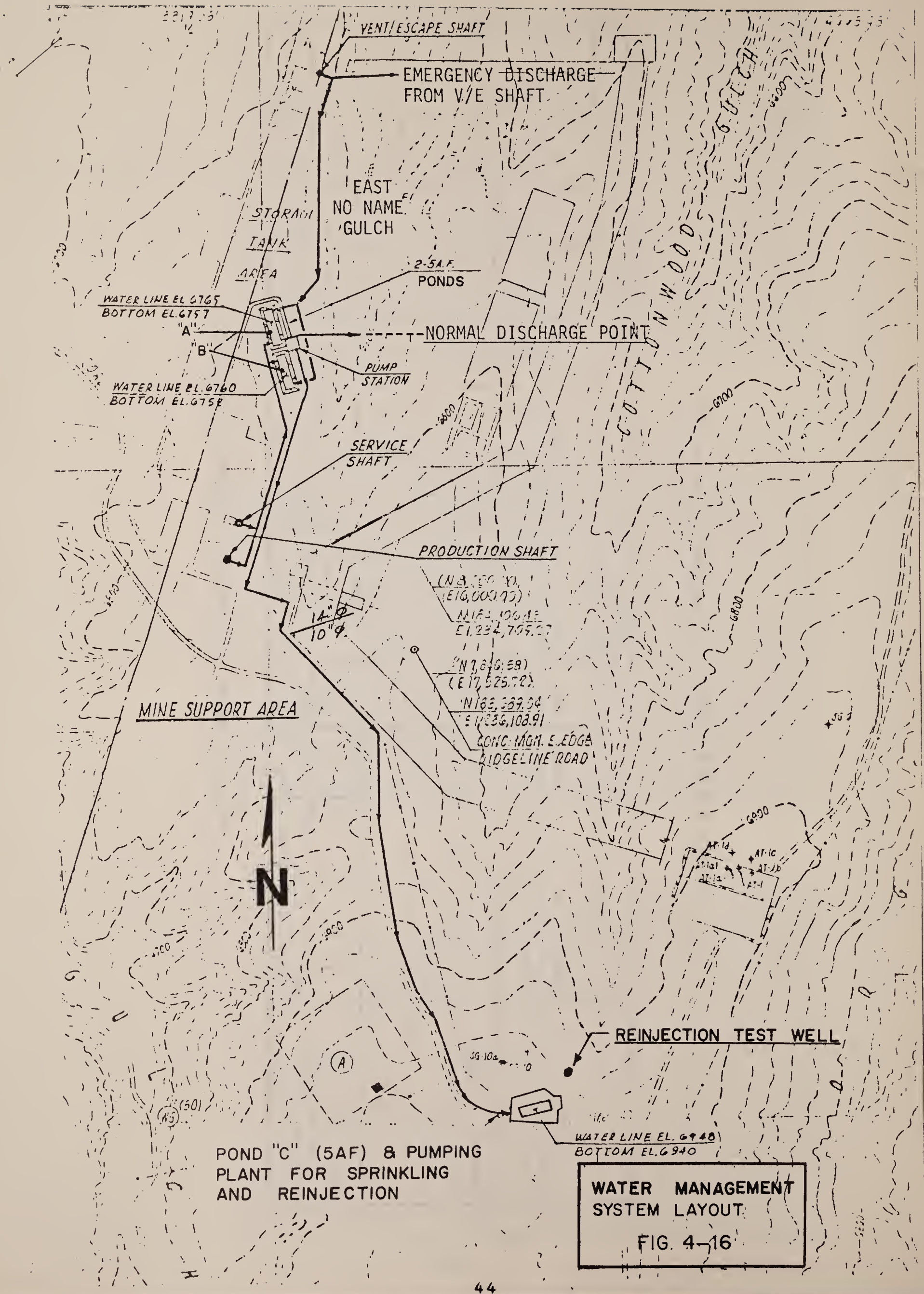
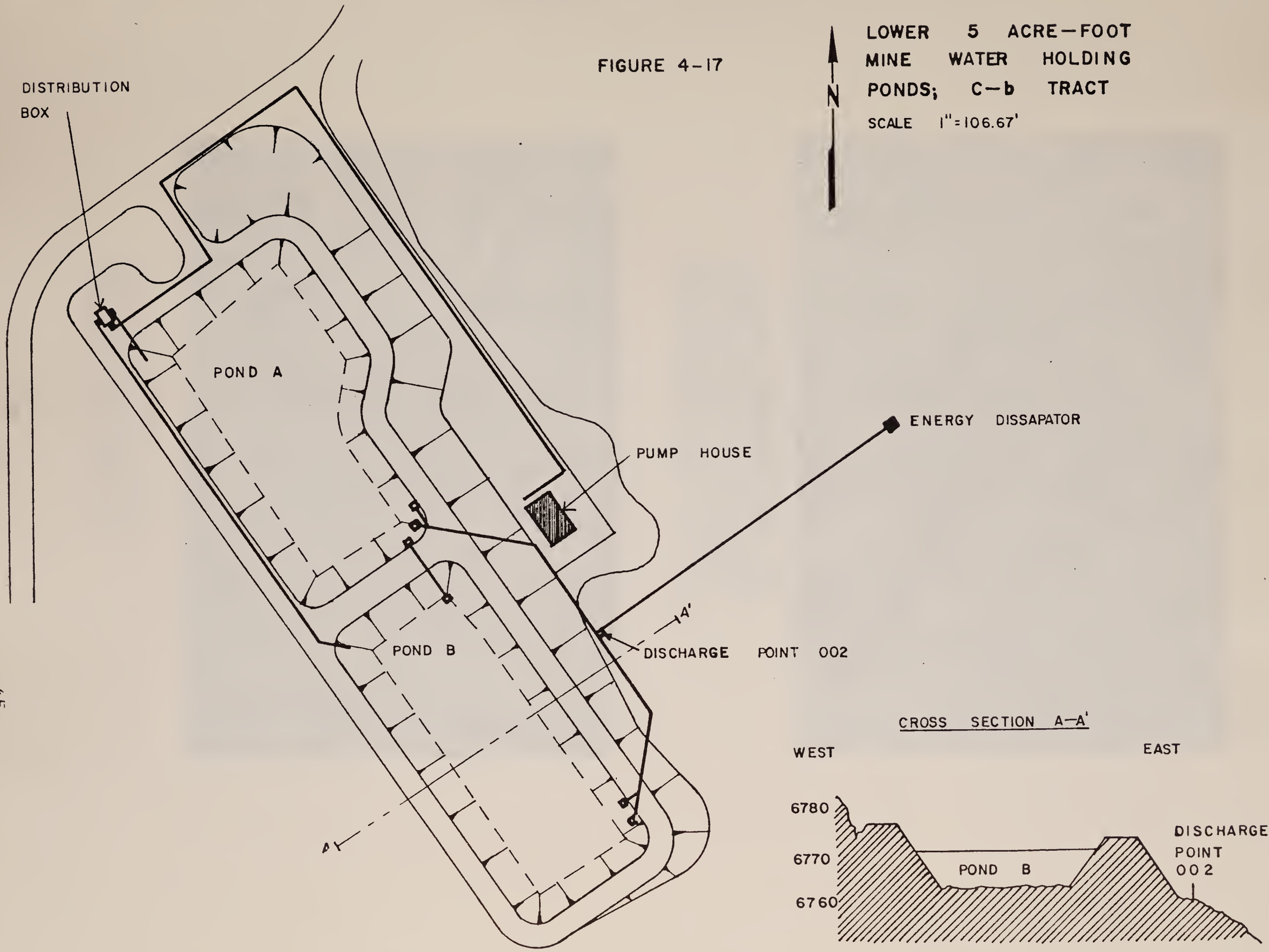

VENT/ESCAPE SHAFT
EMERGENCY DISCHARGE FROM V/E SHAFT
EAST NO NAME GULCH
STORAGE TANK AREA
2-5A.F. PONDS
WATER LINE EL 6765
BOTTOM EL.6757
"A"
"B"
NORMAL DISCHARGE POINT
PUMP STATION
WATER LINE EL.6760
BOTTOM EL.6752
SERVICE SHAFT
PRODUCTION SHAFT
14"Ø
10"Ø
MINE SUPPORT AREA
RIDGELINE ROAD
COTTONWOOD
6700
6800
6900
7000
N
REINJECTION TEST WELL
WATER LINE EL. 6948
BOTTOM EL.6940
POND "C" (5AF) & PUMPING PLANT FOR SPRINKLING AND REINJECTION
WATER MANAGEMENT SYSTEM LAYOUT
FIG. 4-16

FIGURE 4-17

LOWER 5 ACRE-FOOT MINE WATER HOLDING PONDS; C-b TRACT

SCALE 1"=106.67'



CROSS SECTION A-A'

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FIGURE 4-18

Energy Dissipation (Erosion Control) System below Lower Pond Discharge Point - East No Name Gulch - August 1979

FIGURE 4-19

Pump Inside the Lower Pond Pumphouse - July 1979

pond A (and then to B) was about 247 gpm of mine water from the three shafts; Table 4-3 summarizes water pumped from each shaft on a monthly basis as well as water used on Tract. Since mid-year, water pumped has exceeded that used; excesses have been discharged as enumerated in Table 4-2 and discussed in Section 7.2.

A five-acre-foot pond designated pond "C" was constructed in June as shown on Figures 4-1, 4-20a, -20b, and -20c. A 14-inch pipeline from the lower ponds to the upper pond area was completed in July as an alternative to discharge from pond B. No water has yet been pumped to this upper location. To provide future system flexibility water stored in pond C can either be sprinkler-irrigated or reinjected.

A 3000-foot header with lateral distribution system for sprinkling at about 650 gpm over 25 acres was completed in August. The distribution system is located along the ridge between Cottonwood and Sorghum gulches. This system has not yet been tested.

A reinjection-well disposal system was designed to dispose of the anticipated lower-quality mine water from the retort mining horizon. A test reinjection well was drilled adjacent to pond C. The well extended 1,771 feet into the horizon with a 7-5/8 inch casing. Both test well and a 7-foot pond C monitoring well were completed in November. The equipment for filtration, chemical injection, 30,000 gallon water storage and pumping is about ninety-percent complete at year-end. Design flow rate for the equipment is 650 gpm at 650 PSIG which is anticipated to be suitable for two to four wells in 1980.

Photos of the upper pond pumphouse and associated sprinkler and reinjection system piping are shown on Figures 4-21a, b, and c. Sprinkler irrigation piping, routing and a typical sprinkler-head installation are shown on Figures 4-22a and b.

4.1.11 Summary of Engineering Status

The major engineering efforts for 1979 were in support of shaft sinking, White River Electric permanent power system/design and development of a master project schedule. Major contractors were V. B. Cook, Dravo, Colorado Ute, and Fluor; each is discussed in turn:

V. B. COOK: V. B. Cook completed their engineering design of the V/E, Service and Production shaft headframe and downshaft equipment.

DRAVO: The Dravo Corporation completed a Master Project Schedule from construction through mine development and retorting to 100,000 BPD as part of a conceptual design to be incorporated in possible future modifications to the Detailed Development Plan in 1980. They completed modification of the V/E shaft station development to accord with a modified mine design as part of this DDP related work. Work started on a new mining plan, haulage system and off-site needs for potential surface retorting facilities.

TABLE 4-3

1979 C-B WATER USAGE (10**6 GALLONS, * =ACRE FEET)

	USE	SOURCE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YTD TOTAL
OFF-TRACT WTR USED	POTABLE	TWN RIFLE	.02 .06*	.02 .06*	.02 .06*	.02 .06*	.02 .06*	.02 .06*	.02 .06*	.02 .06*	.02 .07*	.02 .07*	.02 .07*	.02 .07*	.25 .76
TOTAL OFF-TRACT WTR USED			.02 .06*	.02 .06*	.02 .06*	.02 .06*	.02 .06*	.02 .06*	.02 .06*	.02 .06*	.02 .07*	.02 .07*	.02 .07*	.02 .07*	.25 .76
TRACT WATER USED	CONSTR	PONDS	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.55 1.68*	.51 1.56*	.47 1.43*	1.94 5.96*	2.54 7.79*	1.73 5.31*	1.33 4.07*	9.06 27.80
	CONSTR	WELLS	.16 .51*	.18 .55*	.86 2.63*	1.29 3.96*	.76 2.35*	1.43 4.39*	1.70 5.22*	2.69 8.25*	1.04 3.19*	1.12 3.45*	.67 2.06*	.84 2.58*	12.75 39.13
	DUST CNTL	PONDS	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.37 1.14*	.25 .78*	.00 .00*	.00 .00*	.63 1.92
	NPDES REL	PONDS	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.33 1.00*	4.49 13.79*	3.58 10.98*	5.88 18.06*	6.10 18.73*	7.64 23.46*	28.03 86.02
	REINJECT	PONDS	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00
	SPR IRRIG	POND C	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00
TOTAL TRACT WATER USED			.16 .51*	.18 .55*	.86 2.63*	1.29 3.96*	.76 2.35*	1.98 6.07*	2.53 7.78*	7.65 23.47*	6.93 21.27*	9.80 30.08*	8.51 26.10*	9.81 30.11*	50.47 154.86
WATER IN STORAGE	-	POND A	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.57 1.76*	1.10 3.38*	.00 .00*	.44 1.35*	1.40 4.30*	N/A
	-	POND B	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	1.40 4.30*	1.50 4.60*	.00 .00*	1.20 3.68*	N/A
	-	POND C	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	N/A
TOTAL WATER IN STORAGE			.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.57 1.76*	2.50 7.67*	1.50 4.60*	.44 1.35*	2.60 7.98*	N/A
WATER PUMPED	-	WELLS	.16 .51*	.18 .55*	.86 2.63*	1.29 3.96*	.76 2.35*	1.43 4.39*	1.70 5.22*	2.69 8.25*	1.04 3.19*	1.12 3.45*	.67 2.06*	.84 2.58*	12.75 39.13
	-	V/E SHAFT	.00 .00*	.00 .00*	.51 1.57*	.98 3.02*	2.80 8.59*	4.46 13.69*	6.74 20.67*	4.55 13.97*	4.86 14.90*	5.62 17.26*	4.77 14.63*	7.44 22.84*	42.74 131.14
	-	PROD SHAFT	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.03 .09*	.46 1.41*	.89 2.74*	1.66 5.08*	2.01 6.16*	1.94 5.97*	2.01 6.16*	9.00 27.62
	-	SERV SHAFT	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.00 .00*	.25 .76*	1.15 3.53*	1.56 4.79*	1.51 4.64*	1.56 4.79*	1.51 4.64*	1.56 4.79*	9.11 27.94
TOTAL WATER PUMPED			.16 .51*	.18 .55*	1.37 4.20*	2.27 6.98*	3.56 10.93*	6.17 18.93*	10.05 30.83*	9.70 29.75*	9.06 27.81*	10.32 31.66*	8.90 27.30*	11.85 36.38*	73.60 225.83

FIGURE 4-20a

Pond C Construction Progress
July 1979

FIGURE 4-20b

Pond C Progress - October 1979

FIGURE 4-20C
UPPER 5 ACRE-FOOT MINE WATER HOLDING POND
C-b TRACT

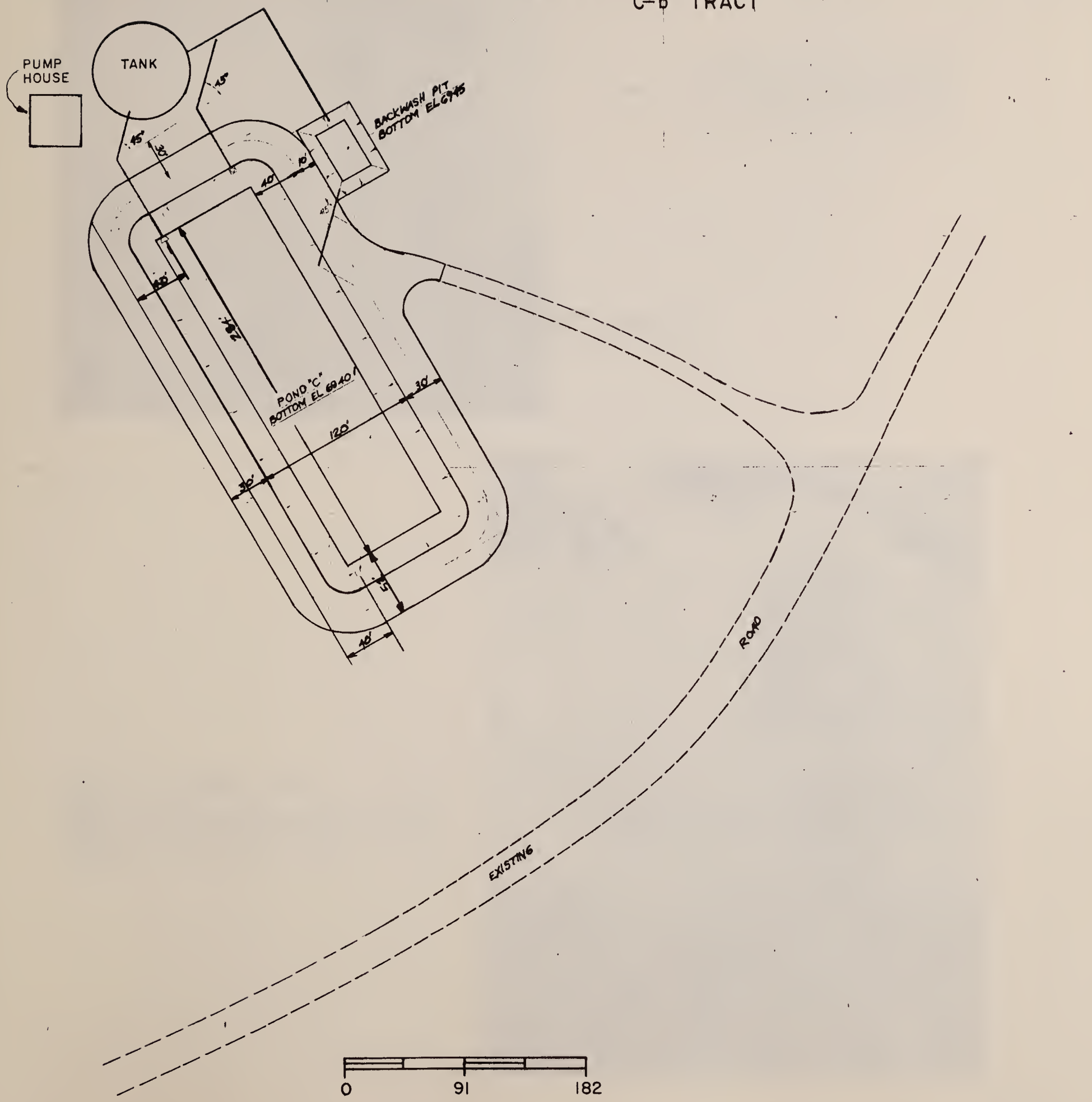

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FIGURE 4-21a

Upper Pond Pumphouse Exterior
September 1979

FIGURE 4-21b

Upper Pond Pumphouse Irrigation
Piping - September 1979

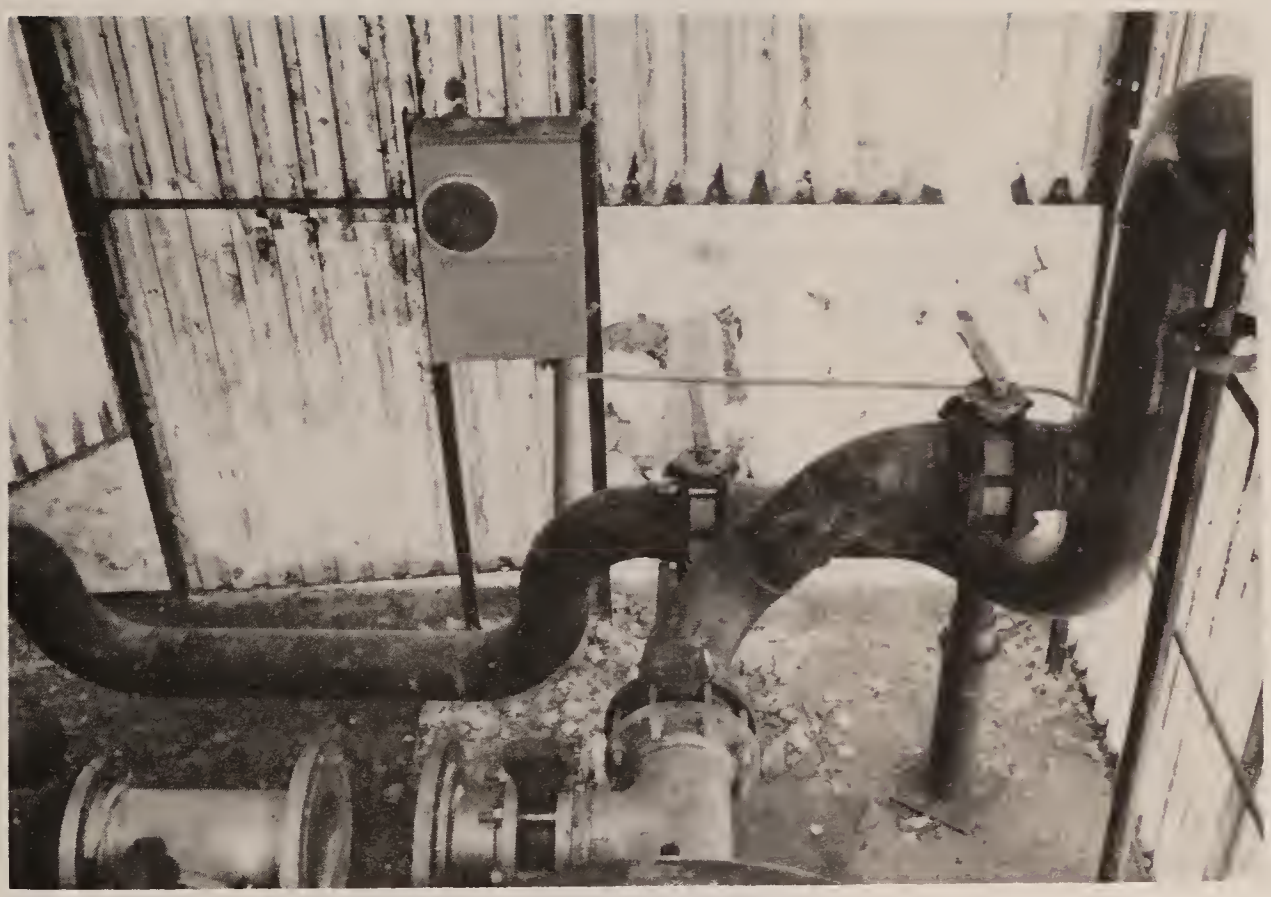


FIGURE 4-21c

Upper Pond Pumphouse Reinjection
Piping and Filtering System
October 1979

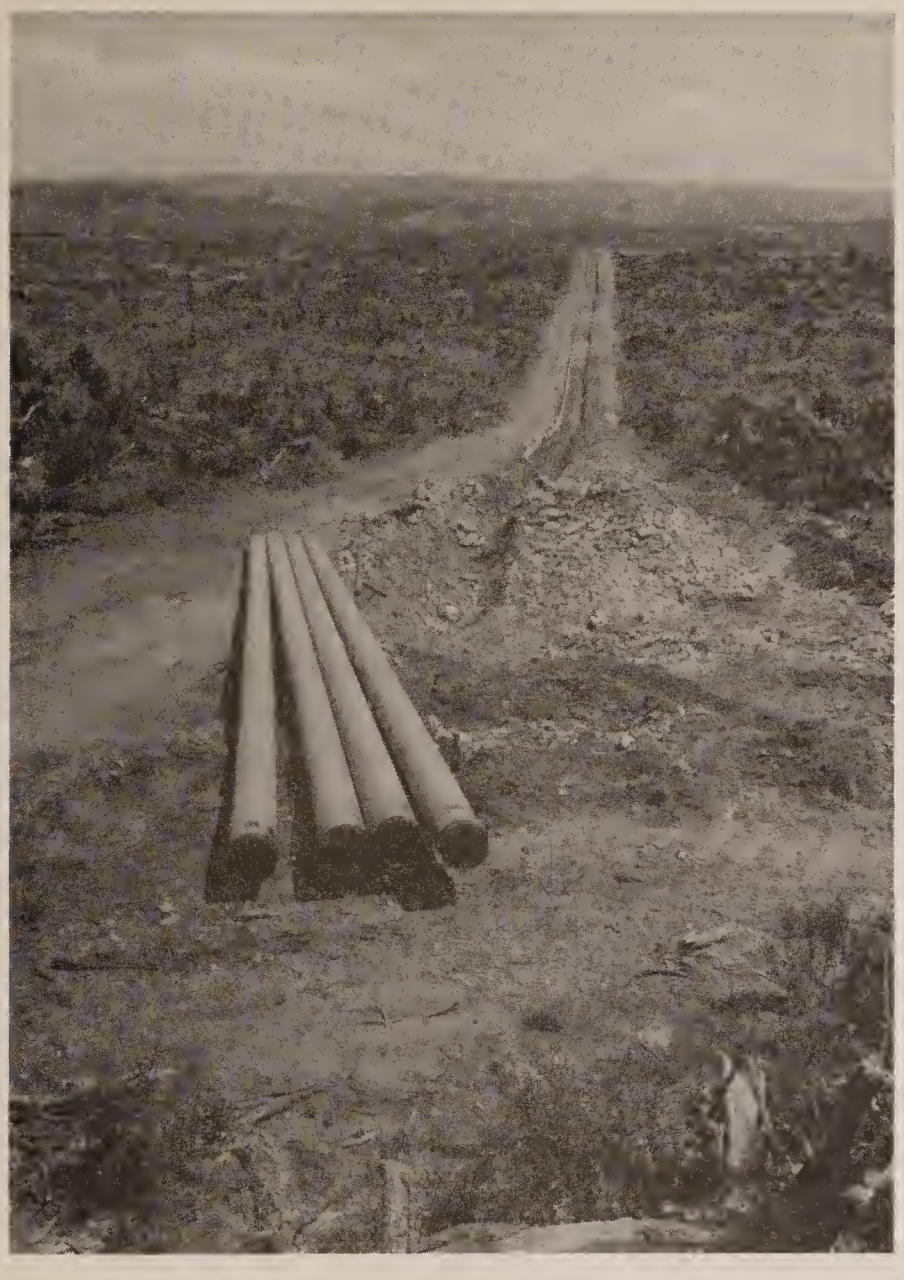


FIGURE 4-22a

Sprinkler Irrigation System
Pipeline Routing - July 1979

FIGURE 4-22b

Sprinkler Irrigation System.
Typical Sprinkler Head.
August 1979

COLORADO UTE: Colorado Ute's Engineering Department commenced work on the Tract commercial power design, procurement and construction for White River Electric REA. The design and construction covers an expanded 138 KV substation at Meeker, a 24-mile transmission line from Meeker to the Tract and two distribution centers on the C-b Tract. The environmental assessment report was submitted for the right-of-way. An aerial survey was completed for the planned route.

FLUOR ENGINEERS AND CONSTRUCTORS, INC.: Fluor developed a conceptual design and order-of-magnitude estimate for a 60,000 BPD MIS surface process facility. They also generated the basic data needed for a Prevention-of-Significant-Deterioration Application.

SMALL FIRMS: Numerous small engineering service firms were utilized by OXY. Energy Consulting Associates of Denver provided hydrology and engineering services for mine water reinjection equipment definition. Sonics of Houston evaluated and made recommendations for mine water treatment. A consultant from the Colorado School of Mines was utilized for operations planning of the reinjection well. Tipton & Kalmbach of Denver developed an engineering design for a reservoir and a mine water sprinkler system. Armstrong Engineers of Grand Junction provided soil analyses and construction specifications for repair of "A" pond dike. Chen and Associates of Glenwood Springs were utilized for soils and concrete work. Miller Sales of Tucson provided temporary mine water pump station design. International Ground Support, Inc. of Denver provided shotcrete design and application instructions.

4.2 Off-Tract Facilities Description

4.2.1 Grand Junction Office

Occidental Oil Shale completed construction of its Grand Junction headquarters' office in December 1978. This facility was first occupied in January of 1979. The building is located at 751 Horizon Court and is headquarters for Cathedral Bluffs' oil shale operations in Colorado.

4.2.2 Grand Junction Laboratory

Occidental's Grand Junction laboratory continues to be housed in facilities at 2372 G Road. The initial planning was begun in 1979 to relocate this facility to a more suitable location. In addition to this initial planning for the Grand Junction Lab, steps were undertaken in 1979 to establish a hydrology and air quality laboratory at the C.B. project. These facilities should be in place during 1980.

4.2.3 Rifle Warehouse and Railroad Property

The project continued to utilize a rail siding adjacent to the Rifle railroad station for the off-loading of bulk cement and other materials necessary for construction.

In the first quarter of 1979, the project leased a 5,000 sq. ft. warehouse in Rifle, Colorado. This facility is presently being used for storage of head-frame hoisting equipment being received from Canadian General Electric.

During the third quarter of 1979 initial negotiations were commenced to obtain acreage adjacent to the Denver and Rio Grande Western Railroad to be used for the construction of a staging area in the future.

4.2.4 Off-Tract Electrical Facilities

During 1979, Oxy entered an agreement with White River Electric Association, Inc., to construct a power supply system consisting of a 138,000 volt transmission line about 24 miles long, and to expand the main substation at Meeker, Colorado. The powerline route is depicted on Figure 4-23. In addition, a high voltage switch station and a 30,000 KVA substation, both to be located on the C.B. site, are included in the agreement.

White River signed a contract with Colorado-Ute Electric Association, Inc., in which Colorado-Ute agreed to serve as Engineering and Construction Manager for the project. Engineering design started in August 1979, and is well underway. As previously mentioned, the Environmental Assessment is currently being prepared.

4.3 Access/Service/Support Activities

4.3.1 Roads

The main access road from Piceance Creek to the Tract was paved in 1978.

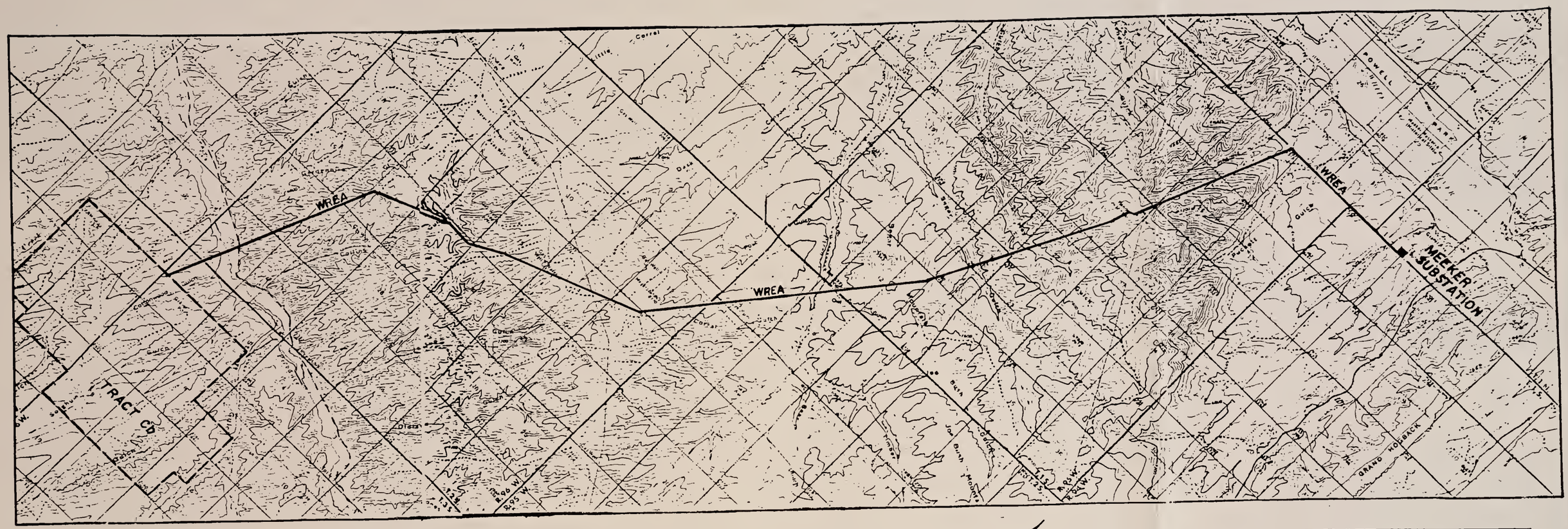
Approximately one mile of resurfaced access road was added to the mine support area in 1979. In addition, earth berms were added to unprotected roadways as guards.

4.3.2 Fuel Storage and Dispensing

Fuel for outside use continues to be dispensed from temporary storage tanks. No action was taken on the permanent service station or piping to the major construction storage tanks. Underground storage was used for the temporary generator stations and Gilbert shop fuels. About 184,000 gallons of diesel fuel, 74,000 gallons of gasoline, 59,000 gallons of propane and 139 x 10^9 BTU of natural gas were dispensed on Tract during the year as indicated in Table 4-3.

4.3.3 Sewage Facility

No new work on a sewage facility was undertaken in 1979. Substantial work is planned for 1980 and will be reported in the next report.



WREA PROPOSED TRANSMISSION LINE 138 Kv

OIL SHALE TRACT C-B

FIGURE 4-23
POWERLINE RIGHT-OF-WAY & SITE AREA

4.3.4 Gland Seal Water Supply

Gland seal water to flush the mine water pumps free of suspended solids was hauled by tank truck throughout 1979. A pump system was completed at the lower pond pumphouse to use settled mine water in August but was not put in use during the year. Figure 4-24 shows the gland seal pumps in the lower pond pumphouse.

4.3.5 Fire Water Loop

Until such time that C.B. surface plot plan is finalized no design work done on the Fire Water Loop System will be undertaken.

4.3.6 Pipelines

No product pipelines were designed or constructed this year. Two on-Tract water pipelines have been previously discussed in Section 4.1.10 - that for transporting treated mine water from the lower ponds to the upper pond and that for the sprinkler irrigation system.

4.3.7 Communications

During 1979, a Dimension PBX was installed at the C.B. project. Our phone service was greatly enhanced with the installation of this PBX, which is manned on a five-day a week basis.

During the third quarter of 1979, a contract was signed with Mountain Bell which provides for the construction by Mountain Bell of ten land trunks into the C.B. project. This effort was initiated in September 1979 and is projected to be completed by the first quarter of 1980.

4.3.8 Helicopter Service

In the fourth quarter of 1979, a Bell 206L1 (Longranger) Helicopter was purchased. This helicopter is scheduled for delivery during the first quarter of 1980 and will be used to provide transportation between Grand Junction, Logan Wash, and the C.B. project.

4.3.9 Surface Mobile Equipment

All roads used and heavy work areas were sprinkled daily or as needed with water/coherex as a dust suppressant. (See next paragraph.) One hydraulic road grader was in constant use for road maintenance. Trucks and loaders were used to clean out culverts after flash storms. Sanding crews were in use to maintain a safe road surface during periods of freezing weather.

4.3.10 Consumables Usage

Monthly water reports to the State Engineer include the water data depicted on Table 4-3: water pumped from the shafts, water used and discharged, and water stored. In addition to these data quarterly reports to the

EPA under the existing Prevention-of-Significant-Deterioration (PSD) permit report the information on Table 4-3 for additional consumables: fuels, dust palliatives, shaft rock and shale mined, and explosives used.

4.4 Mining

As previously mentioned, the major Tract activity this past year has been the sinking of the Production shaft, the Service shaft and the Ventilation/ Escape shaft. The sinking techniques employ the conventional drill, blast, muck-out and line sequence. Multiple small drill holes (under 2 inches) are sunk in approximately 8-feet lengths, filled with dynamite, blasted and mucked-out. This sequence is repeated until about 25 feet of shaft is sunk (in Service and V/E shafts or 30 feet in the Production shaft). Then the shaft is lined with reinforced concrete.

4.4.1 Production Shaft

Shaft-sinking progress for the 29-foot diameter Production shaft is shown on Figure 4-25. This was initiated in April reaching a depth of approximately 850 feet below the surface by year-end. Average water make from this shaft has been 17 gpm; year-end water make was approximately 45 gpm (Table 4-2). Future shaft-sinking progress (estimated as of 12/31/79) is shown as a dotted line.

Photos taken inside the Production shaft in August and November 1979 are shown in Figures 4-26, 4-27, and 4-28.

4.4.2 Service Shaft

Shaft-sinking progress for the 34-foot diameter Service shaft is shown on Figure 4-29, with future estimates (as of 12/31/79) shown as a dotted line. This was initiated in February reaching a depth of approximately 790 feet below the surface by year-end. Average water make for this shaft has been 17 gpm; year-end water make was 35 gpm.

4.4.3 Ventilation/Escape Shaft

Shaft-sinking progress for the 15-foot diameter Ventilation/ Escape shaft is shown on Figure 4-30. This was initiated in January, reaching an approximate depth of 1031 feet below the surface by year-end. Average water make for this shaft has been 81 gpm; year-end water make has been 167 gpm. Future shaft sinking progress (estimate as of 12/31/79) is shown as a dotted line.

A grout curtain has been utilized in the V/E shaft to help seal off water inflows; this is explained in Section 4.4.5.

4.4.4 Mid-Shaft-Station Drift

A 20-foot high by 30-foot wide horizontal 300-foot long drift connecting the Production shaft and the Service shaft was started in November

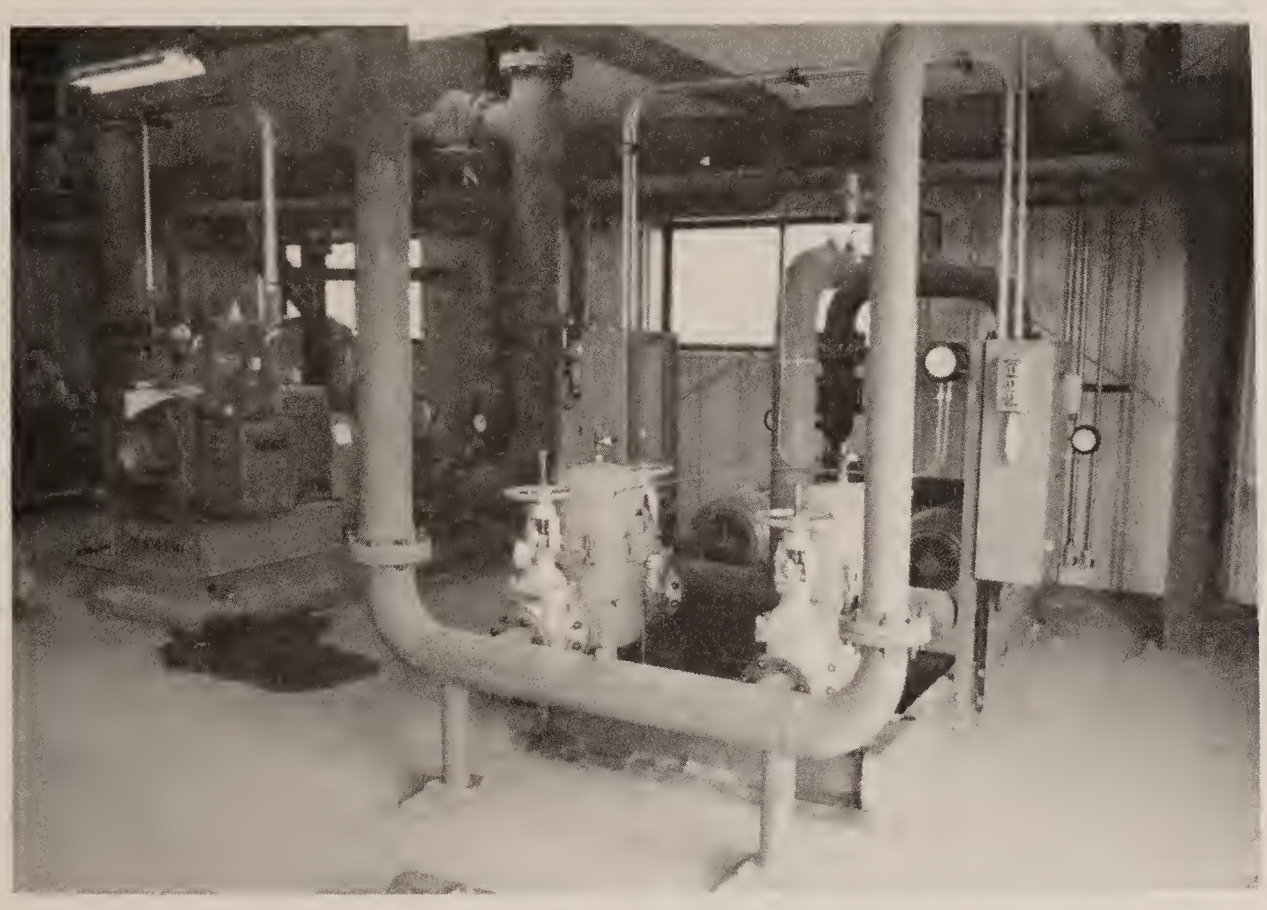


FIGURE 4-24

Interior View of the Lower Pond Pump House Showing the Gland Seal Pumps. - September 1979

FIGURE 4-25
PRODUCTION SHAFT SINKING PROGRESS

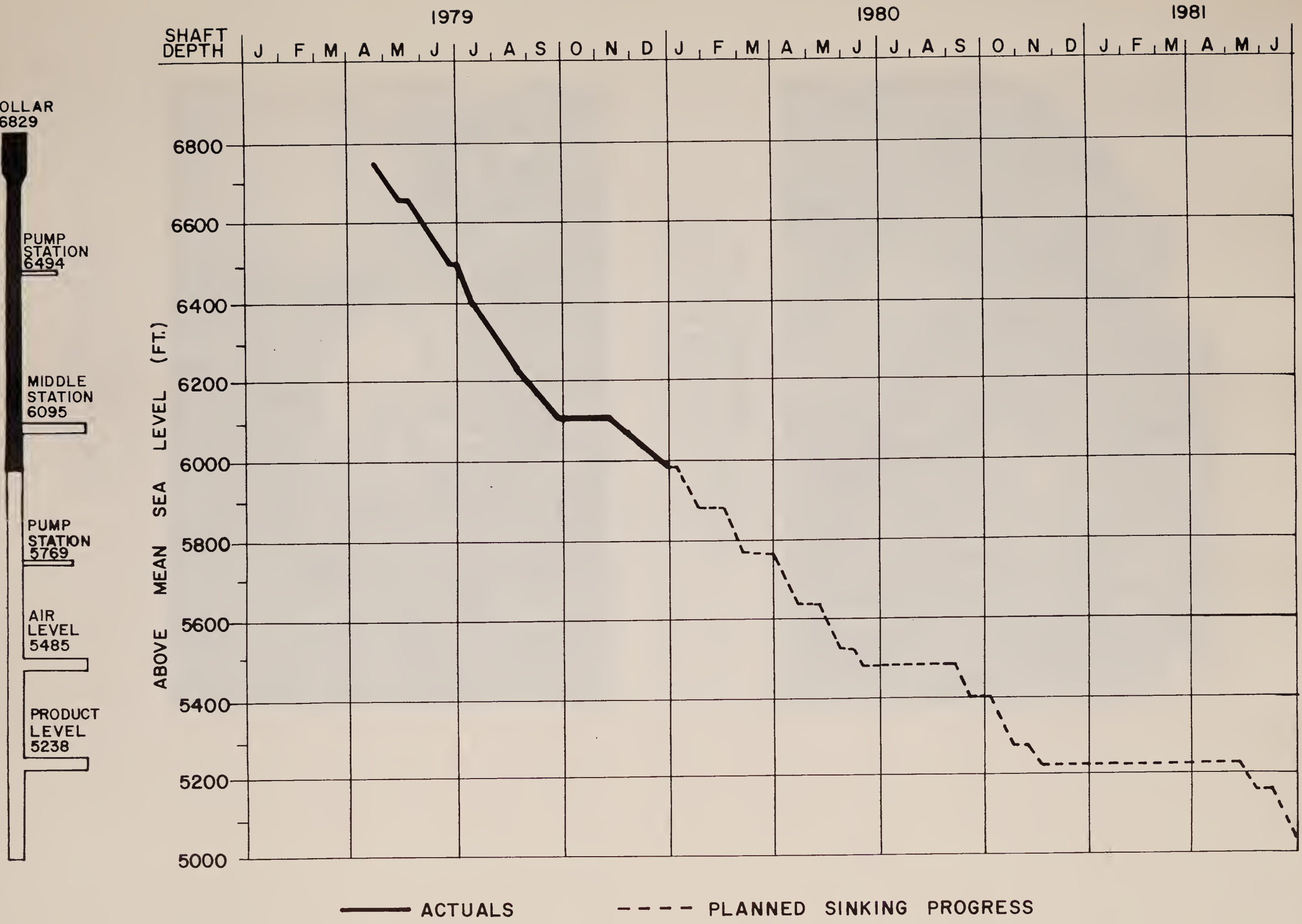


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FIGURE 4-26

View Looking Down the Production Shaft from Galloway at a 931 Loader. - August 1979

FIGURE 4-27

Inside Production Shaft
August 1979

FIGURE 4-28

Production Shaft Bucket at
Bottom of Shaft - November 1979

FIGURE 4-29
SERVICE SHAFT SINKING PROGRESS

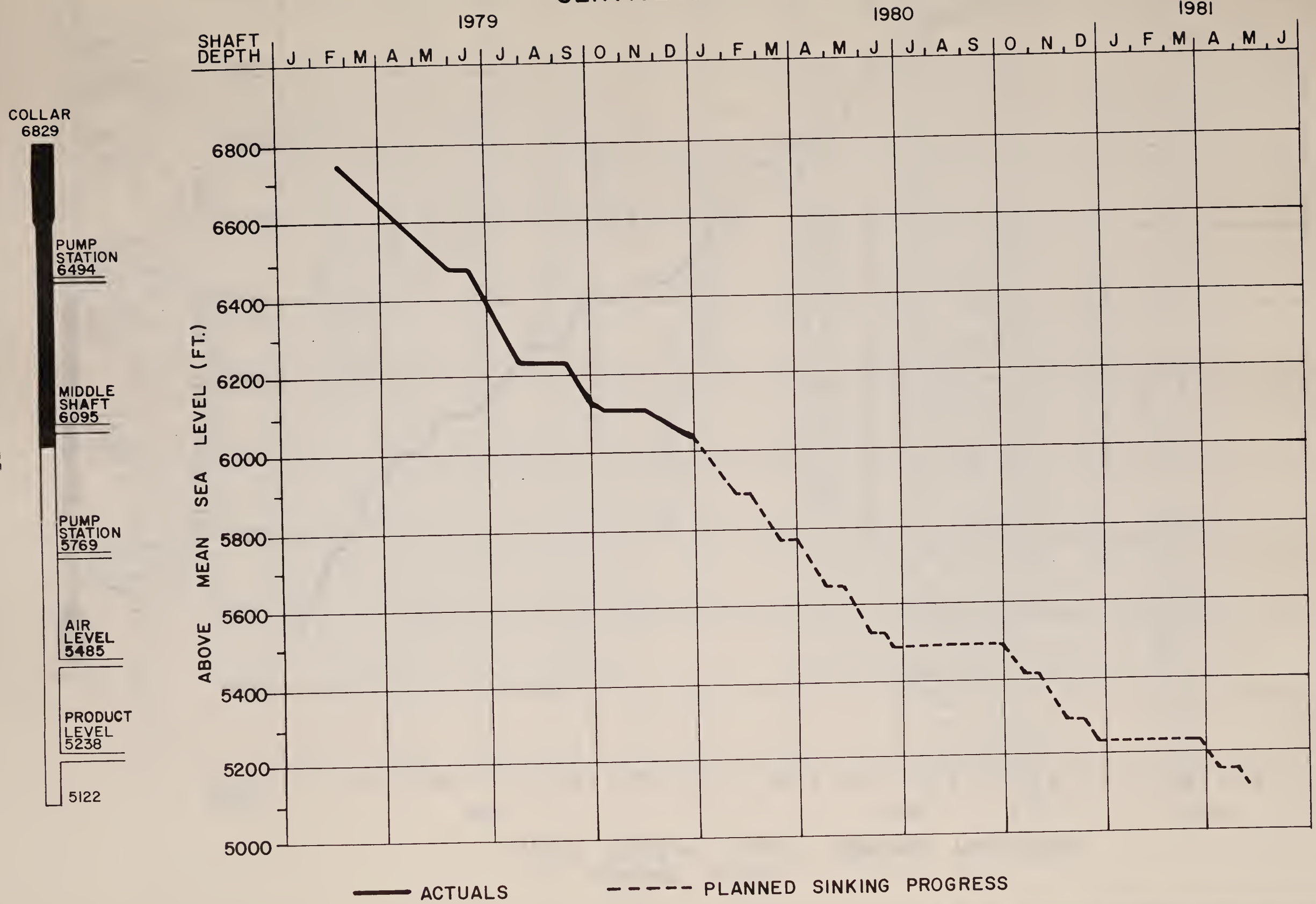
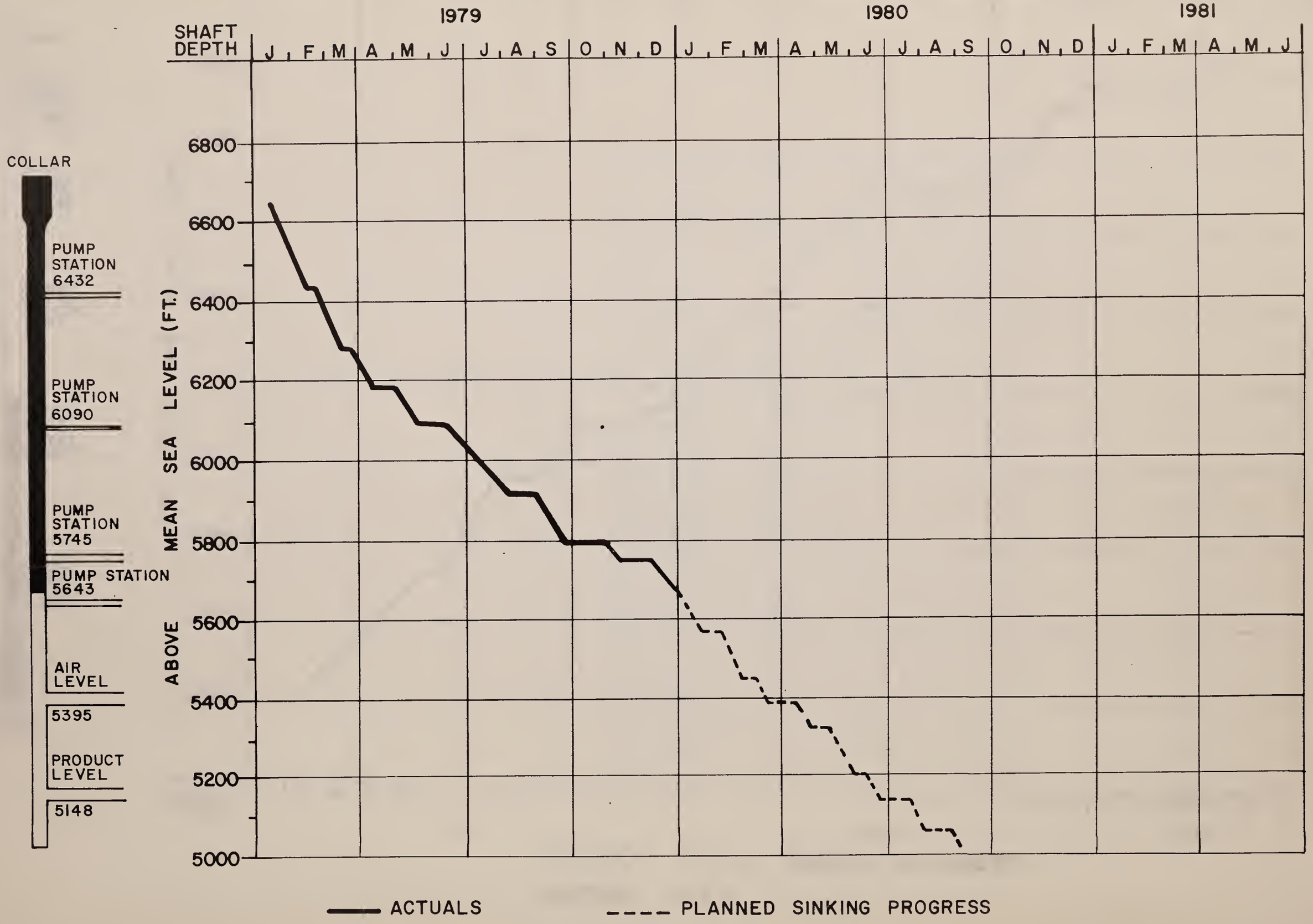


FIGURE 4-30
VENT ESCAPE SHAFT SINKING PROGRESS



1979 (Figure 4-31) and completed in January 1980. The elevation of the mid-shaft-station is 6095 feet above mean sea level (MSL). This drift houses dewatering pumps (Figure 4-32) and electrical equipment.

4.4.5 Geologic Mapping Program for C.B. Shafts

Up until this point in time, approximately 30 drill and/or core holes were taken at the C-b Tract and many more throughout the basin. From these data, the subsurface geology-hydrology interpretations were made. The sinking of three shafts of 15 feet, 29 feet, and 34 feet in diameter presented a unique opportunity to physically map the subsurface rock during sinking and confirm or modify the drill/core hole data. Based on this a sampling and mapping program was devised to conform with access restrictions into the shafts and at the same time gather as much data as possible. It was initiated in July 1979.

Listed below are the major points in the mapping program:

1. Rock Types - Comparison with Geologic Logs
2. Major Structural Features
   - A. Fractures
     - a. Dips
     - b. Orientation
     - c. Planar or Non-planar
     - d. Open or Closed
     - e. Coatings, i.e., Clay, Carbonate, etc.
   - B. Breccia Zones
     - a. Collapse
     - b. Fracture
   - C. Vuggy Zones
     - a. Leached or Non-leached
3. Water Conditions
   - A. Water Bearing Intervals
   - B. Water Flow Rates
4. Stratigraphic Horizons
   - A. Uinta Formations
     - a. Basal-Transitions Zone
   - B. Top of Parachute Creek Member
   - C. Four Senators Zone
   - D. A-Groove
   - E. Mahogany Zone
   - F. B-Groove
   - G. Lower Oil Shale Zones
   - H. Gas Evolution - Correlation with Drilling Logs
5. Probe Hole Pristine Water-quality Sampling Program
6. Location of Mining Levels Based on Rock Type Observed
7. Detail Fracture Lines for Computer Processing whenever possible.

All data collected will then be used to:

A. Prepare sterographic projections for comparison with known surface and core data.

B. Prepare cross-sections and plan maps of shafts to illustrate important features, i.e., fractures, structures, breccia zones, etc.

C. Correlation with geologic logs of wells 33X-1 and 32X-12.

D. Correlation of water-producing zones with geologic logs.

Data collected thus far in the Service/Production shaft area are to a depth of 900 feet within the Uinta formation. The major point fracture set strikes N72W and dips 62 degrees to the North with minor sets striking N57W and East-West dipping to the South at 55 degrees.

Other minor sets strike Northeast and have nearly vertical dips. Water production at year-end was about 35 gpm from each shaft. Additional probe holes to 1000 feet have not encountered any large flows of water.

The V/E shaft is deeper into the section than the two larger shafts. At year-end this shaft was developed into the Four Senators Zone (depth 1030 feet) about 50 feet below the top of the Parachute Creek formation oil shales. The major fracture set mapped at the 960 foot level strikes N71W and dips to the South at 75 degrees. The next strongest set strikes N68W and dips to the North at 62 degrees.

Because this shaft has sunk into the subsurface aquifers under C-b Tract, grouting has been utilized specifically to limit water inflows and subsequent discharges during the sinking phase of operations. The method used at C-b is stage grouting where approximately 150 feet of rock are grouted at a time. Figure 4-33 illustrates the procedure and Figure 4-34 the drilling pattern used during grouting. As water is encountered, cement (grout) is forced into the rock at that point until a certain pressure is achieved. Then another hole is drilled and grouted. This procedure is repeated until all 12 holes are grouted to approximately 150 feet. This procedure will be used in the Service/Production shafts when significant water flows are encountered.

At year-end, total water inflow into the V/E shaft was approximately 170 gpm. As station development takes place, data will be collected along these station drifts.

FIGURE 4-31

Mid-Shaft-Station Drift Connecting Production and Service Shafts - November 1979

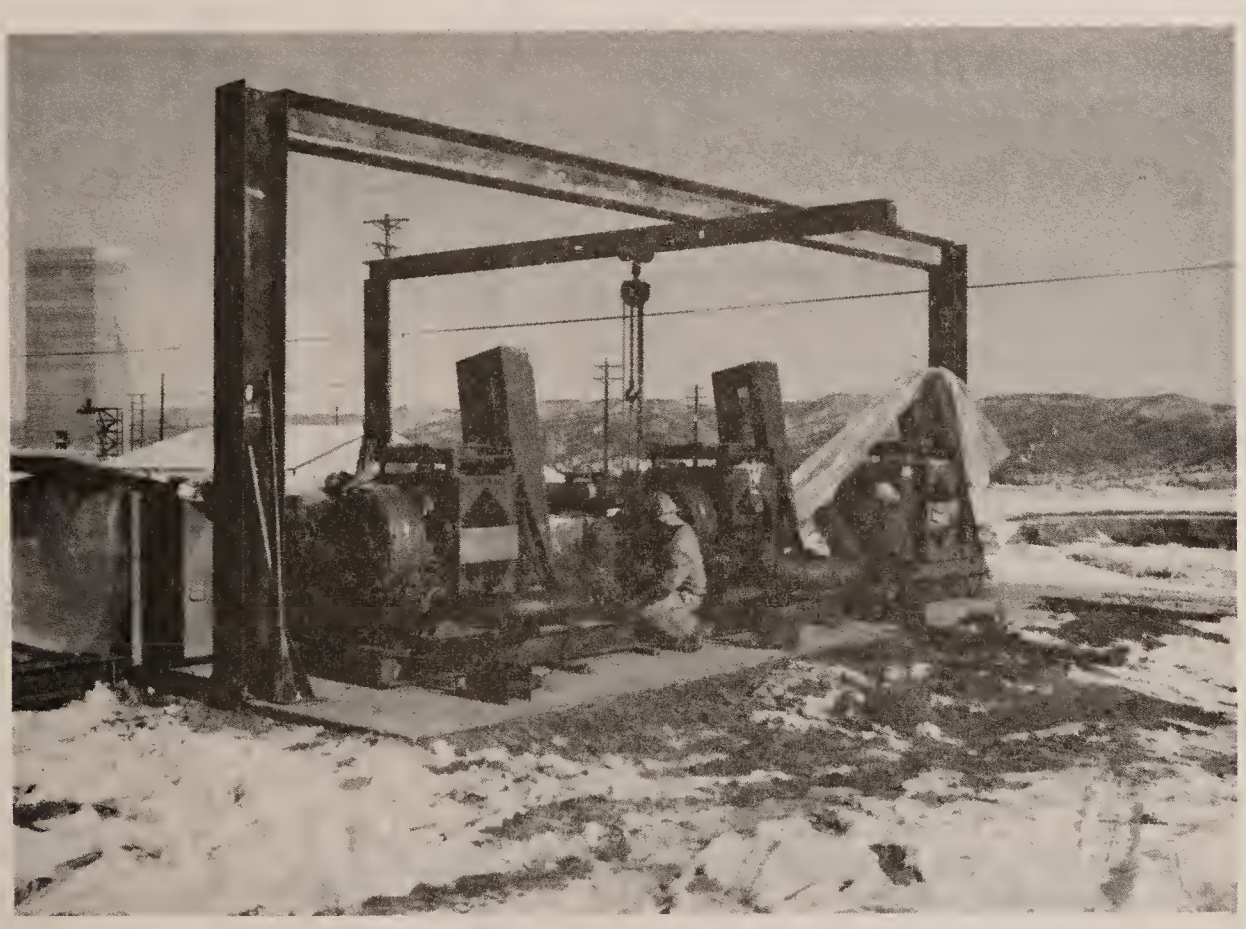
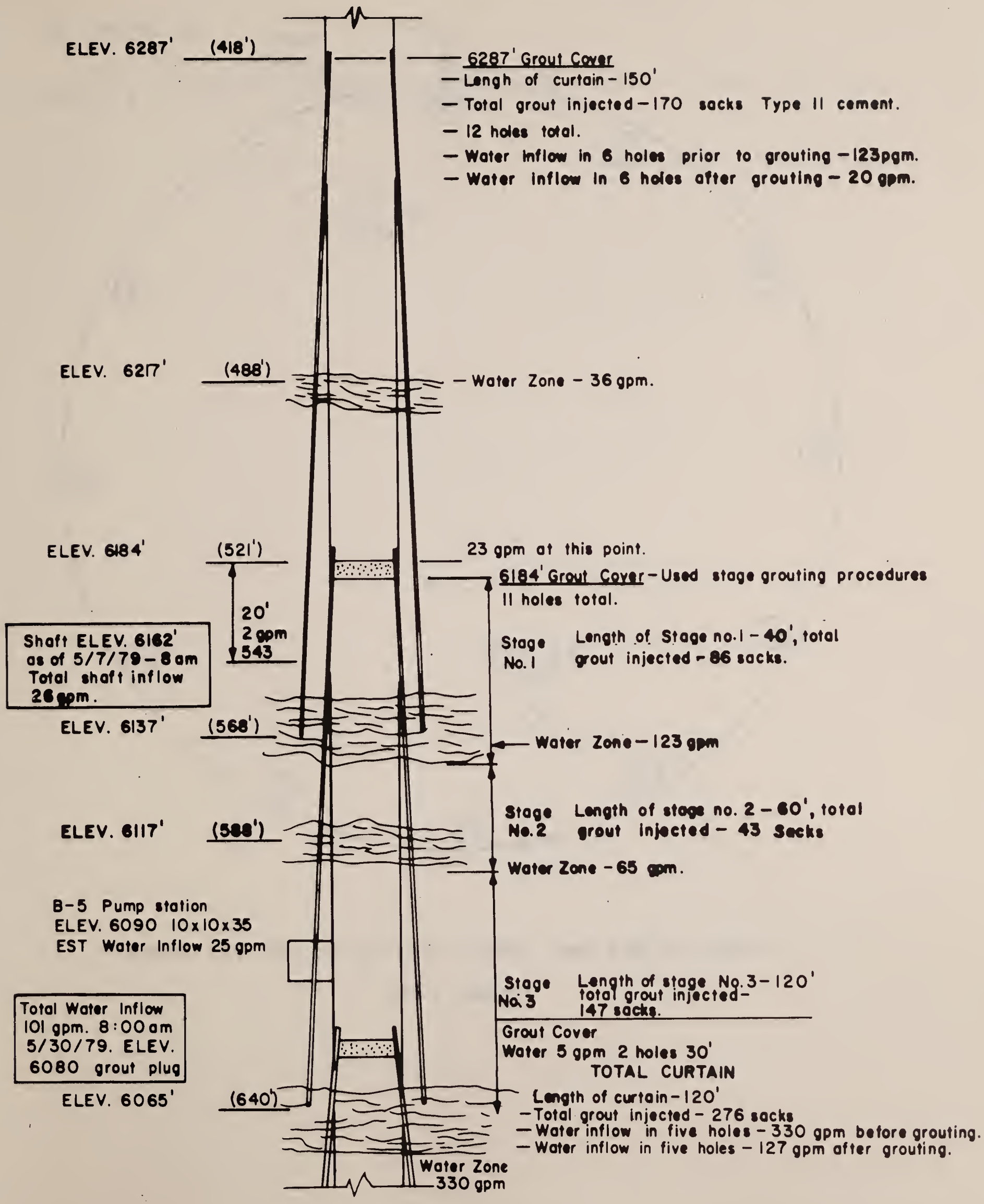


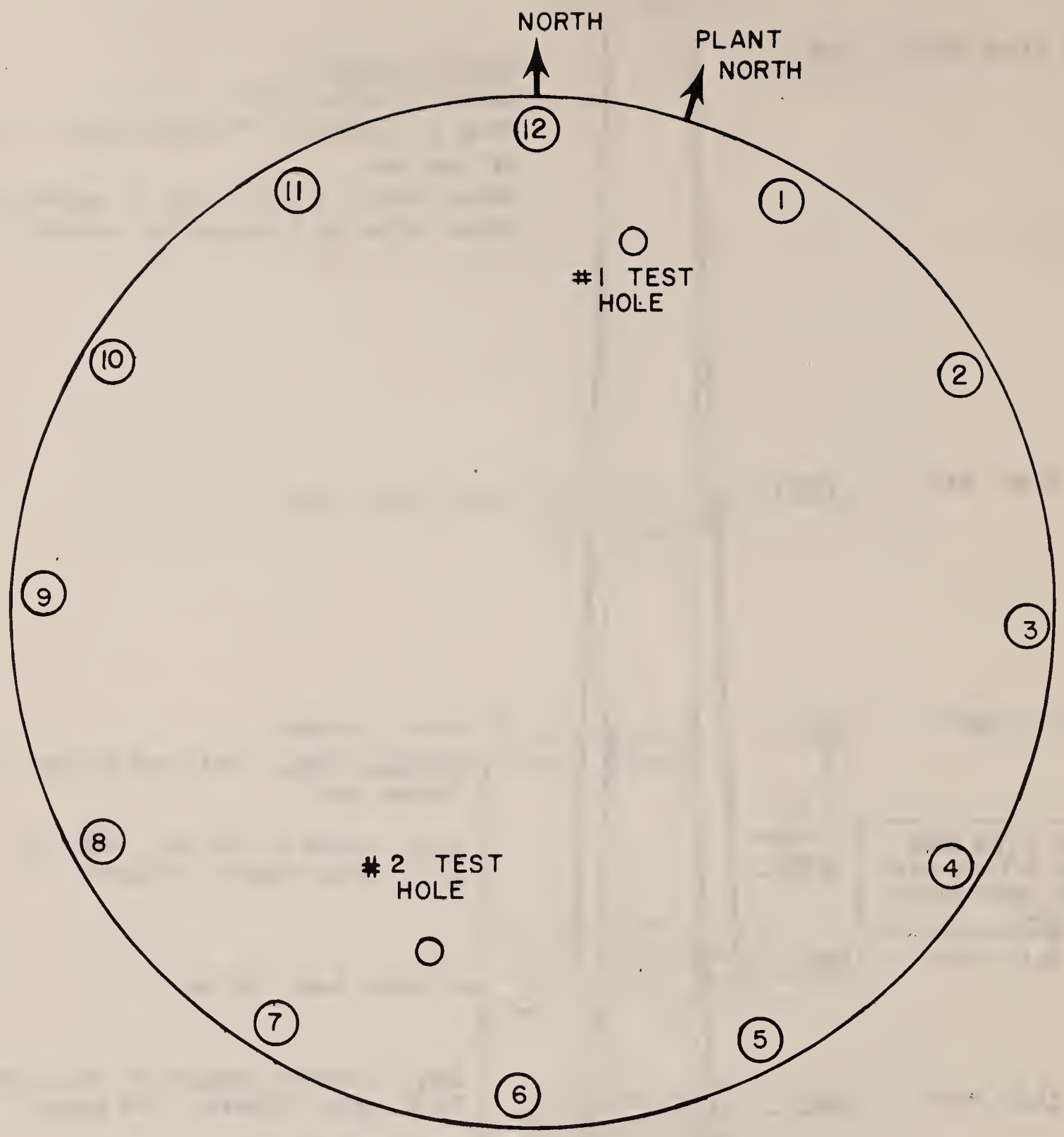
FIGURE 4-32

Fabricating the Mine Dewatering System - October 1979

FIGURE 4-33

TYPICAL GROUTING PROCEDURE — V/E SHAFT





TYPICAL 12 HOLE DRILL / GROUT PATTERN IN THE V/E SHAFT

FIGURE 4-34

5.0 PROCESSING

No processing activities have yet occurred on the C-b Tract. Refer to Section 4.1.11 for Fluor conceptual design studies.

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6.0 DISTURBED AND RECLAIMED AREAS

6.1 Disturbed and Reclaimed Acreage

The number of acres disturbed during the year was 30.2, associated with the irrigation system. See Figure 6-1. The number of acres reclaimed for the year was 12. These areas consist of stockpiled soil south of support areas and irrigation system pipelines (5 acres), temporary soil stockpile (3 acres), East No Name Dam site (1 acre), and barrow area (3 acres). Only 5 of the 30.2 acre irrigation system was reclaimed; approximately 2 acres around pond C are access roads and facilities and the remaining 23.2 received minimum disturbance not requiring reclamation. Slash was replaced on irrigation system pipelines and other areas were mulched with hydro-mulch. The activity schedule of the 1978 Annual Report has been updated here as Table 6-1.

6.2 Overburden Storage

The overburden was backfilled into East No Name Gulch. This berm covered a total area of 3 acres, 1 acre in 1978 and 2 acres in 1979. The total amount of overburden mined and stored in this berm in 1979 was 56,500 cubic yards.

6.3 Shale Storage

Shale storage began in November 1979. It was backfilled into the same berm as the overburden. The total amount of shale mined and stored in 1979 was 300 cubic yards.

6.4 Reclamation/Revegetation Status and Control

6.4.1 Backfill

Backfilled area for 1979 consisted of the berm in East No Name Gulch (2 acres).

6.4.2 Graded Lands

There have been no additions to the 162 acres graded in 1978.

6.4.3 Topsoil Replacement

Topsoil has been replaced on the 4 acres disturbed by the irrigation system pipelines.

6.4.4 Revegetation

See Section 6.1. Figures 6-2a through 6-2e show 5 years of revegetation progress at the NQ-4 slant corehole site.

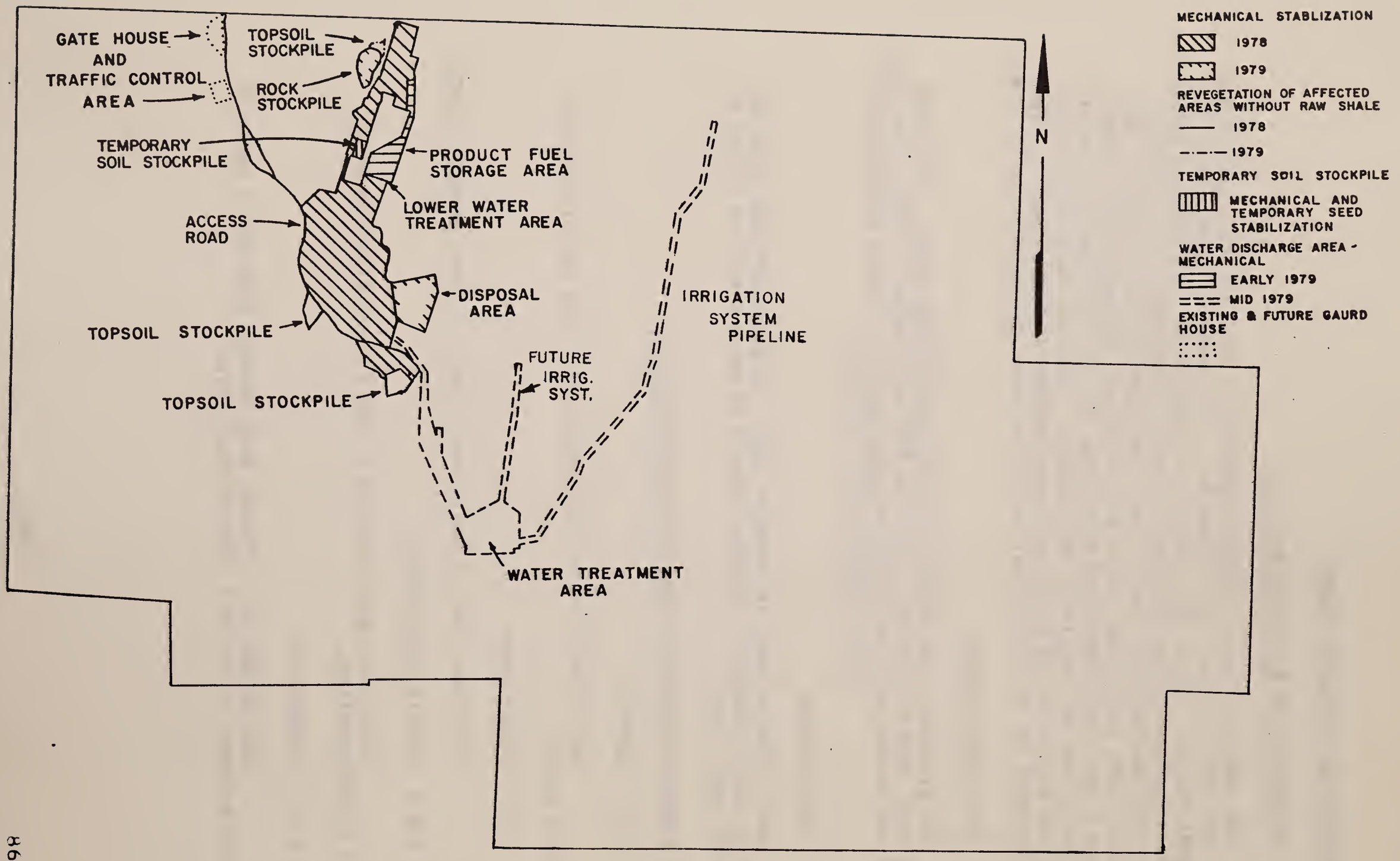

FIGURE 6-1
C-b TRACT
DISTURBED & REVEGETATED
ACREAGE

TABLE 6-1

DISTURBANCE/RECLAMATION ACTIVITY SCHEDULE (UPDATE 1979)

Affected Areas	(1978=1) Disturbance Timetable	Reclamation Phase-Years	Acreage
Existing Guard House	1	61	1
Traffic Control Station & Future Guard House Area	1	61	3
Access Road	1	61	12
Abandoned Access Road	1	1	10
Mine Support & V/E Shaft Area (Administration, stockpiled rock areas, batch plant, sedimentation impoundments, water treatment)	1	61	101
Barrow Area (Acreage included with Mine Support and Ancillary Area)	2	2	3*
Stockpiled Rock - V/E Shaft Area	2	61	3*
Stockpiled Soil - Support Area	1	1	5
Stockpiled Soil - V/E Shaft Area	1	2	1
East No Name Dam - Investigation	1	2	1
East No Name Dam - Potential Site	3	61	40
Explosives Area	1	61	1
Process Area	3	61	20
Temporary Soil Stockpile	2	2	3*
Product Storage Area	3	61	9
Water Discharge	2	61	26
Land Application	2	2	4
Disposal Embankment	1	4	1
Initial Berm into East No Name Gulch			
Fill into East No Name	2-3	4	5
Berm across Cottonwood Gulch	3-4	5-6	53
	5-6	6-7	105
Advancing Face in Cottonwood & Sorghum and	7-10	8-11	151
Starter Berms	11-15	12-16	118
	16-29	17-30	339
Advancing Face across Sorghum Gulch	30-35	31-36	169
	36-40	37-41	271
	41-50	42-51	231
	51-60	52-62	212
		TOTAL	1,886 Acres

*Included in the Mine Support and V/E Shaft area acreage (101)

6.5 Overburden and Topsoil Management

6.5.1 Vegetation Plantings/Mixtures

The temporary soil stockpile area was seeded in April, 1979. All other revegetated areas were seeded in October 1979.

All areas were seeded with permanent seed mixture (Table 6-2) for north facing slopes.

Fertilizer is not scheduled for application to the topsoil areas until two years following seeding.

Seedings other than exploration drill-pad sites have not been established long enough to evaluate. Evaluation is planned following the third growing season.

6.5.2 Associated Costs

The costs associated with reclamation and revegetation activities on tract amounted to approximately $20,000 in 1979. The majority of these costs ($10,500) are attributed to the purchase of machinery and material (straw mulcher, hydro-seeder and straw crimper) which will be used in future years, but were charged as a one-time cost in 1979. Remaining costs of $9,500 were attributable to contract wages and equipment rental.

FIGURE 6-2

Revegetation Progress at the NQ-4 Corehole Site.

1975 (a)

1976 (b)

1977 (c)

Figure 6-2 (Cont'd)

Revegetation Progress at the NQ-4 Corehole Site.

1978 (d)

1979 (e)

TABLE 6-2

SPECIES LIST FOR C.B. RECLAMATION

Species		Lbs/Acre Drilled North & East and Level Areas	Lbs/Acre Drilled South & West Areas
Grasses:			
*Agrophyron cristatum	- crested wheatgrass	1	1
*A. elongatum	- tall wheatgrass	-	1
*A. spicatum var. inerme	- beardless bluebunch wheatgrass	2	2
*A. smithii (rosana)	- western wheatgrass	1	2
*A. intermedium (amur)	- intermediate wheatgrass	1	1
*Bromus marginatus	- mountain brome	1	-
*Elymus cinereus	- Great Basin wildrye	1	-
*E. junceus	- Russian wildrye	1	1/2
*Festuca ovina	- hard sheep fescue	1	-
*Oryzopsis hymenoides	- Indian ricegrass	-	1
Forbs:			
*Hedysarum boreale (Utah)	- Utah sweetvetch	1/2	1/2
*Medicago sativa	- alfalfa	1	1/2
*Penstemon sp.	- penstemon	1/2	1/2
Shrubs:			
+Amelanchier spp.	- serviceberry	-	-
*+Artemisia tridentata	- big sagebrush	1/2	-
*Atriplex canescens	- four wing saltbrush	-	2
*A. confertifolia	- shadscale	-	1
*+Cercocarpus montanus	- mountain mahogany	1	1/2
*Cowania mexicana	- stansberry cliffrose	1	1/2
*Eurotia lanata	- winterfat	-	1
*+Purshia tridentata	- bitterbrush	1	1/2
+Symphoricarpos oreophilus	- snowberry		
Trees:			
+Juniperus osteosperma	- Utah juniper		
+J. scopulorum	- Rocky Mountain juniper		
+Pinus edulis	- pinyon pine		
	TOTAL	13 1/2 Lbs/Acre	15 1/2 Lbs/Acre

*Seed (P.L.S. - Pure Live Seed)
+Transplants (40 per acre) will be placed selectively in areas of suitability; (North, East and level areas), transplants will total 320 per acre.

NOTE: Forb seed will be innoculated with Northrup King innoculator.

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7.0 ENVIRONMENTAL PROTECTION AND CONTROL

7.1 Air Pollution Control

Principle activities in 1979 with the potential to affect air quality included the sinking of the Production, Service and V/E shafts, truck transport along haul roads, operation of the batch plant and construction of upper and lower ponds.

Comparisons with ambient air quality standards are made in Volume 2 of this Annual Report.

C.B. holds a valid Prevention-of-Significant-Deterioration (PSD) Permit for the Ancillary Phase from the EPA and a valid Fugutive Dust Permit from the State of Colorado Air Pollution Control Division.

Two air pollution control "systems" are in effect currently at the C-b Tract: baghouses on the concrete plant and applications of water and dust palliatives on unpaved roads. Emissions from temporary power generators are uncontrolled; controls are not required, as they are below horsepower limits requiring controls.

Air pollution control equipment on the concrete batch plant has been in operation since 1978 and consists of four baghouses. Baghouses 1 and 2 are both rated at 658 ACFM and can accept dust loading of 45.12 pounds per hour. Each unit contains 16 dacron bags with a diameter of 0.57 feet. The air-to-cloth ratio is 3.5 CFM:1 ft^2. The systems are equipped with an automatic shaker and are rated with an overall efficiency of 99.5% dust removal.

Baghouses 1 and 2 provide the venting of the six cement silos. Baghouses 3 and 4 collect particulates generated by the batch bin. This facility is permitted in its entirety by Permit Number C-11931(1-5) issued by the Colorado Air Pollution Control Division.

The C.B. Project obtained a Fugitive Dust Permit (C-11,454(FD)) from the Colorado Air Pollution Control Division on August 30, 1977. Pursuant to this permit, C.B. was required to pave the major access road to the Tract. This work was completed in August of 1978. PSD and Fugitive Dust Permits require dust control on haul roads by regular applications of water and dust aplliatives. The PSD Permit requires quarterly reports to the EPA regarding both total water used and the amount and type of dust aplliative applied. Water has been applied to the haul roads, on an as-needed basis; dust palliatives have been applied during 1979. The applications of both water and dust palliatives are indicated in Tables 4-2 and 4-3.

The dust palliative applied was a chemical trade-named "Coherex". It is a water emulsion of petroleum resins and oil that is diluted with water. The ratio of Coherex to water is dependent on usage, moisture content, and texture of material to be stabilized. Heavy use areas (i.e., parking lot north of offices) received a 4:1 (water to Coherex) application. All other areas were

sprayed using a 7:1 dilution rate. These areas included the road to the V/E shaft area and the area itself, road to the Explosive area and the area itself, road to Station 024, White and Sons parking lot and around the shaft areas. Where no traffic is expected (disposal area) a 20:1 rate was used.

As another control measure to reduce vehicular traffic, the busing system instituted in 1978 continued to be used in 1979; approximately 76% of Tract personnel rode the buses in 1979.

7.2 Water Management System

The water handling and treatment system consists of a series of holding ponds, reinjection wells and a land application system. Water from the mine shafts first enters two ponds, A and B, of 5 acre-feet-capacity each. Their functions are primary settling of suspended solids and reduction of pH level. From pond B the water may go directly to a surface discharge or to another holding pond, Pond C. Pond C is above the grade of Pond B and the water is pumped via the pumphouse as shown on Figure 4-17 to Pond C. Pond C has a 5 acre-foot capacity and serves as site for both further settling of suspended solids and as a surge pond for the future reinjection and/or land application systems. From Pond C, water can be pumped to both of these systems simultaneously. The reinjection system is designed to eventually handle up to 2200 gpm (Reinjection Application Section 10.8) recognizing that individual wells in the system may vary from one to another in injection-rate capacity. Water pumped from Pond C to the reinjection system will be filtered through a diatomaceous earth filter, deoxygenated and treated with biocides prior to injection. Water pumped from Pond C into the land application system will pass directly from Pond C into and through a sprinkler system. The land application system is currently designed to handle 650 gpm on a continuous basis and controlled such that water is not applied beyond the consumptive use of the land.

During 1979, Ponds A and B were the only part of the water handling and treatment system that was completed and used. Water was gravity drained from Pond B and discharged through a surface energy dissipating system, (See Figures 4-17 and 4-18) and into East No Name Gulch which, in turn, flows into Piceance Creek. Occidental Oil Shale, Inc., holds a National Pollutant Discharge Elimination System (NPDES) Permit issued by the Water Quality Control Division (WQCD) allowing for discharges into Piceance Creek. The first discharges began the end of July 1979 and continued on a batch basis until December. In December, the pond operation was changed to provide for a continuous discharge from Pond B. In accordance with the terms and conditions of its NPDES Permit, the C.B. Project has provided a monthly report to the WQCD describing the nature of the discharge in terms of the effluent limitations specified. These data have also been submitted to the AOSO via the semi-annual data reports and are discussed in Volume 2 of this report. In addition, Table 4-3 summarizes monthly water storage in the ponds, monthly averages discharged, water pumped from the shafts and water used on Tract.

Water pumped from the shafts is of varying quality depending both on the type of work going on in the shaft and on the quality of water in water-bearing

zones. The water quality parameters most severely affected by shaft operations are pH and total suspended solids. High pH is due to the grouting phase of shaft-sinking which provides considerable quantities of lime in the grout to be exposed to shaft water allowing for the slaking of lime. During grouting phases, it has been necessary to treat the shaft water as it enters Pond A with sulfuric acid to reduce the pH.

In the Fall of 1979, suspended solids began to increase in concentration requiring additional treatment. Various flocculants have been tested successfully.

Engineering redesign of settling ponds A and B has been completed to increase residence time of the water for settling purposes. Construction of this modification will commence early in 1980. Periodic cleaning of the treatment ponds to remove sediment is anticipated throughout their operational period.

7.3 Water Augmentation

C.B. has a valid Water Augmentation Plan as obtained from the Water Court, District No. 5, of the State of Colorado (Case No. W-3493 and others). This conditional decree covers use of C.B. water rights for "dewatering, monitoring, industrial, mining, retorting, refining, manufacturing, stream flow augmentation, providing of replacement waters, substitute supply, reinjection, dust control, land reclamation, irrigation, land application, domestic and all other beneficial uses, either by direct diversion and application or by storage (directly or by exchange into facilities in which Applicant or its successors in interest then have the right to store water) and by subsequent application or by exchange . . . ." Under this Plan, monthly water use reports are submitted to the State Engineer. See Table 4-2 for this information. Also a vastly increased water monitoring program over that required by the lease was required to be operational in August 1979. This decree calls for the following additional stations over those monitored under the lease:

27 wells
10 springs and seeps
4 USGS stream gauging stations
7 precipitation stations.

Locations of these stations and monitoring frequencies are given in Volume 2 of this Annual Report. The principle purpose of this monitoring system is to detect changes in water levels in the wells and changes in flows of springs and surface streams in the vicinity of the Tract related to dewatering of the mine.

7.4 Oil and Hazardous Materials and Their Spill Contingency

An updated Spill Prevention Control and Counter-Measure Plan was prepared in 1979 and will be submitted to the AOSO for approval shortly. It includes a description of the potential for accidental spills or release of oil and other hazardous materials as a result of the Lessee's development of the Tract and associated off-Tract pipelines and terminals. This plan summarizes

the potential source of accidental spills, reviews the current regulations and standards that would apply to the Lessee's activities, defines and inventories the hazardous materials within the plant, and presents the Lessee's spill prevention, control and contingency plans for the plant and associated pipelines.

7.4.1 Summary of Potential and Actual Spills During Construction

During construction activities, spills of diesel fuels and other fuels and lubricants are possible during transportation, loading and unloading operations, both on-Tract and at construction staging areas and rail spurs. Dust suppressants and smaller amounts of miscellaneous chemicals used during construction activities also pose pollution threats if quantities of these materials reach drainages or flowing streams near the Tract. The trucking, loading and unloading of hazardous supplies during construction is a potential source of accidental spills.

There were no major spills requiring activities of the spill contingency plan during the year. The most frequent minor oil spill control problem was from mining equipment lubricant products becoming involved with mine water and finding their way into the lower ponds. Selective oil absorption blankets were used to soak up this oily material for subsequent disposal with solid waste off-Tract.

7.4.2 Oil and Hazardous Materials Inventory

A list of substances expected to be present in substantial quantities within the shale oil plant for commercial operations is presented on Table 7-1 and compared with that existing in 1979. The list identifies those both on-and off-Tract which would be classed as pollutants if allowed to escape. With regard to oily sludge it is anticipated that it will be produced in small enough quantities that no storage need be provided and that it is of such nature that it can be cycled into conceptual surface retorting facilities.

7.4.3 Notification Under the Response Plan

In the event of an accidental spill of oil or other hazardous material reaching or having the potential of reaching a waterway, various government entities must be notified as follows:

Notification	Spills Situation
EPA, Region VIII and Colorado Department of Health	Spills on or near Tract
U. S. Coast Guard, 2nd District	Pipeline or transportation-related
Colorado Division of Wildlife	Danger to fish, etc., in surface waters
Water Quality Control Division, Colorado Department of Health	Contamination of water supplies

TABLE 7-1

OIL AND HAZARDOUS MATERIALS INVENTORY

Material Stored	Commerical Operations Storage Capacity BBL	1979 Storage BBL
On-Tract		
Process Retort Water Stripper Feed	60,000	0
Process Condensate Water Stripper Feed	80,000	0
Plasticrete	100	50
Diesel Fuel	4,000	830
Gasoline	250	35
Chlorine	50	10
Oil-Water Separator Liquid	1,000	0
LPG	250	190
Ammonia	13,000	0
Shale Oil	350,000	0
Sulfuric Acid	100	30
Off-Tract		
Ammonia	1,500	0

Colorado Highway Department	Move vehicles, control traffic
AOSO	All spills
BLM, USFS	Certain cases
Local, City, Fire, Police, Health Departments	Major Spills

7.4.4 Spill Response Team

All spills not involving the product oil pipeline will be responded to by an in-plant spill response team which will be especially organized and trained for this purpose. A Spill Response Coordinator (SRC) will have the primary responsibility for deciding the action required and assembling the necessary team elements.

The following is a list of Spill Response Team Members:

Spill Response Coordinator	W. W. Shriver
Cleanup Coordinator	S. L. Stringer
Government Liaison Coordinator	E. B. Baker
Public Relations Coordinator	M. D. Talbert
Legal Coordinator	R. Kerr
Environmental Protection Coordinator	E. B. Baker
Procurement and Logistics Coordinator	R. Kerr
Document Coordinator	T. H. Pysto
Accounting Coordinator	L. G. Barth
Training Coordinator	J. C. Leinberger
Safety and Security Coordinator	D. I. McClung

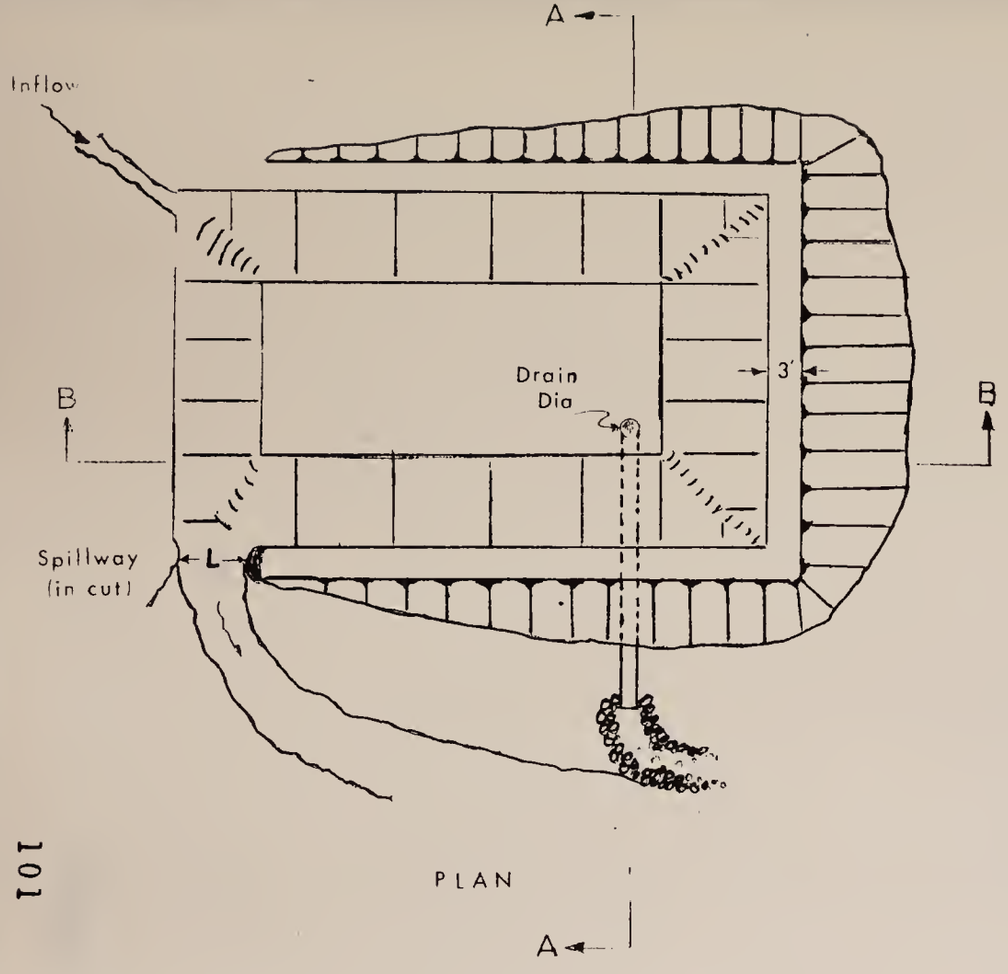
7.5 Waste Disposal

Sewage sludge and gray water from the Gilbert change house was hauled daily from the Tract to an approved dumping site. Solid waste (trash) accumulated in waste bins was trucked off-site as frequently as necessary to approved land fills. Metal scrap is accumulated in a scrap trailer and sold for recycling.

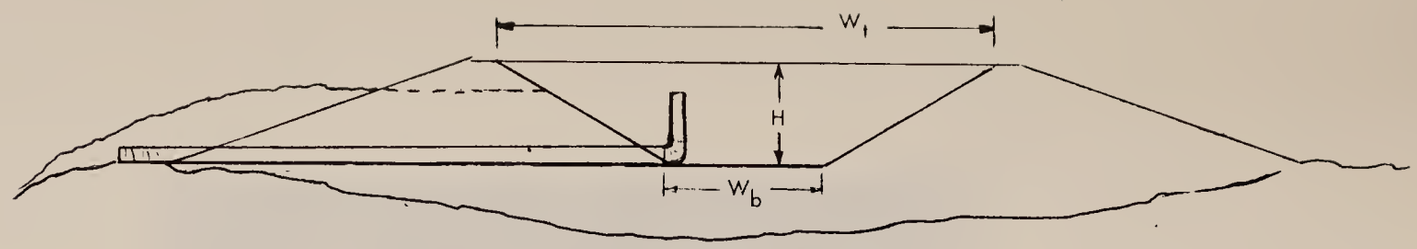
7.6 Erosion Control

The six sediment basins on-Tract, originally constructed under a ten-year flood design, were redesigned to produce a contained runoff for a twenty-five year flood and controlled runoff for a one-hundred (100) year flood with proper detention time for natural precipitation events. The basins were reconstructed to meet the new design criteria in November, 1979 and are shown on Figure 7-1; site locations are shown on Figure 4-1. Erosion control is further discussed and defined in the revised Erosion Control Plan for the C-b Tract submitted to the AOSO and dated October 18, 1979. This dynamic plan describes present design and future concepts that will be utilized as new disturbances take place.

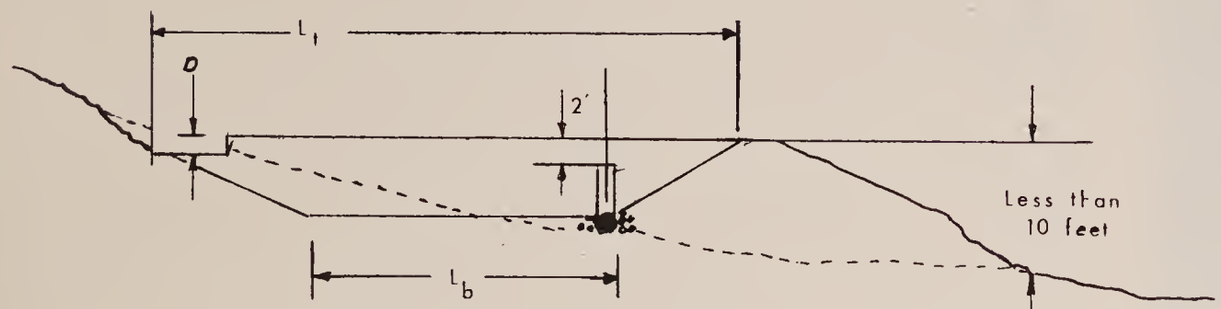
A photo of a typical sediment control basin is shown on Figure 7-2.



PLAN



SECT A A



SECT B B

Top Dimensions based on 2h:1v max embankment slopes

DIMENSION (feet)	BASIN 1	BASIN 2	BASIN 3	BASIN 4	BASIN 5	BASIN 6
L_b	173	100	100	57	50	50
W_b	100	50	63	50	30	40
L_t	205	132	132	89	82	82
W_t	132	82	95	82	62	72
H	10	10	10	10	10	10
Predicted Runoff (ac.ft.)	3.97	1.35	1.63	.83	.51	.63
Basin Volume (cu. ft.)	173,344	59,200	71,264	36,496	22,240	27,520
Drop Inlet Dia. (inch)	18	18	18	18	12	12
Spillway Dia.	L-4 D-1.75	L-2 D-1	L-2 D-1.5	L-2 D-1	L-2 D-1	L-2 D-1
Peak Flow Rate (cfs)	38.6	13.3	15.9	8.2	4.9	6.2

FIGURE 7-1

SEDIMENT BASINS FOR EROSION CONTROL

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FIGURE 7-2
One of the Erosion Control Basins
August 1979

7.7 Historic, Scientific, and Aesthetic Values Protection

As an initial part of the lessee's plan to protect these assets, archaeological and scenic-value studies have been undertaken on the Tract and surrounding area and reported in prior years. During construction no significant findings have occurred.

Where possible, existing vegetation was saved; and stockpiles were contoured and seeded to blend with surrounding habitat.

7.8 Noise Control

Occupational noise control for employee protection is accomplished where feasible by equipment design. When this approach is not feasible, or when engineering design does not reduce noise levels below the maximum allowable limit, all exposed persons are required to wear ear protection.

Monitoring of environmental noise and its compliance is discussed in Volume 2.

7.9 Health, Safety, and Security

The C.B. Project is regulated under the new code of Federal Regulations, Title 30, Part 57, Mine, Saftey, and Health Administration and by the Colorado State Division of Mines laws.

7.9.1 Health, Safety and Security Program

All levels of C.B. management have made a complete commitment to employee protection. Top management conducts regular meetings during which health and safety matters are subjects of discussion. Various contractors on-site conduct regular safety meetings for their employees with the active participation of the C.B. Safety Department. New employees are indoctrinated with on-site safety rules. A training plan in conformance with Mine Safety and Health (MSHA) regulations has been developed and implemented.

Presently on-site, C.B. has a Safety and Security Supervisor and a Senior Safety Inspector. Two major contractors also have full-time safety personnel.

Around-the-clock emergency medical service is provided by two paramedics and six EMT's. A modern, fully equipped ambulance is available on-site for emergency medical evacuation. A comprehensive medical surveillance program has been established with the assistance and through the cooperation of local physicians who also provide ongoing specialized training for emergency medical personnel. Part of this EMT/Paramedic training program consists of monthly demonstration sessions and shaft-evacuation-training classes. Complete physical examinations, with periodic re-examination, are being conducted for all Occidental employees.

In 1979, the Security Guard Gate at the C-b Tract site entrance was completed. (Figure 7-3). Security also took over contractor time-keeping functions that were formerly handled by Ralph M. Parsons Company.

7.9.1.1 Accident Frequency Analysis

Due to the unique situation of Tract C-b having three separate MSHA identity numbers, safety programs are the responsibility of the individual entities, with overall program monitoring supplied by Oxy. The I. D. Numbers are as follows:

1.	Occidental Oil Shale, Inc.	05-03140
2.	Ralph M. Parsons	05-03148
3.	Gilbert Corp. of Delaware	05-03149

Using the MSHA formula,

$$\text{I.R.} = \text{Injury Rate} = \frac{\text{Number of Accidents x 200,000}}{\text{Hours of Employee Exposure}}$$

the breakdown of accident rate by I. D. Number is as follows:

I. D. #05-03140 - No reportable injuries in 62,424.2 manhours.

I. D. #05-03148 and 05-03149 - Five reportable injuries, which include four lost time accidents in 462,467 manhours, resulting in an injury rate of 2.16. The three I. D. Numbers logged 524,891.2 manhours in 1979 with five reportable accidents for a site I. R. of 1.91.

A fatality occurred in the V/E Shaft on August 6, 1979; no official statement as to the cause has been released at this time.

7.9.1.2 Inspection Reports and Responses

The Tract has had eighteen visitation days by MSHA this past year, resulting in issuance of 97 citations to the Gilbert Corporation of Delaware, eight citations to Ralph M. Parsons Company, and none to Occidental Oil Shale, Inc. All citations were abated. AOSO also performs inspections and furnishes copies of them to the Project.

Colorado Division of Mines inspected the property ten times during 1979 resulting in 45 citations all of which were abated.

7.9.2 Possible Health Hazards

7.9.2.1 Dust

Dust is controlled on unpaved sections of roadways by the application of dust suppressant as discussed in Section 7.1. Dust is controlled during rock drilling operations by the use of water. Although there

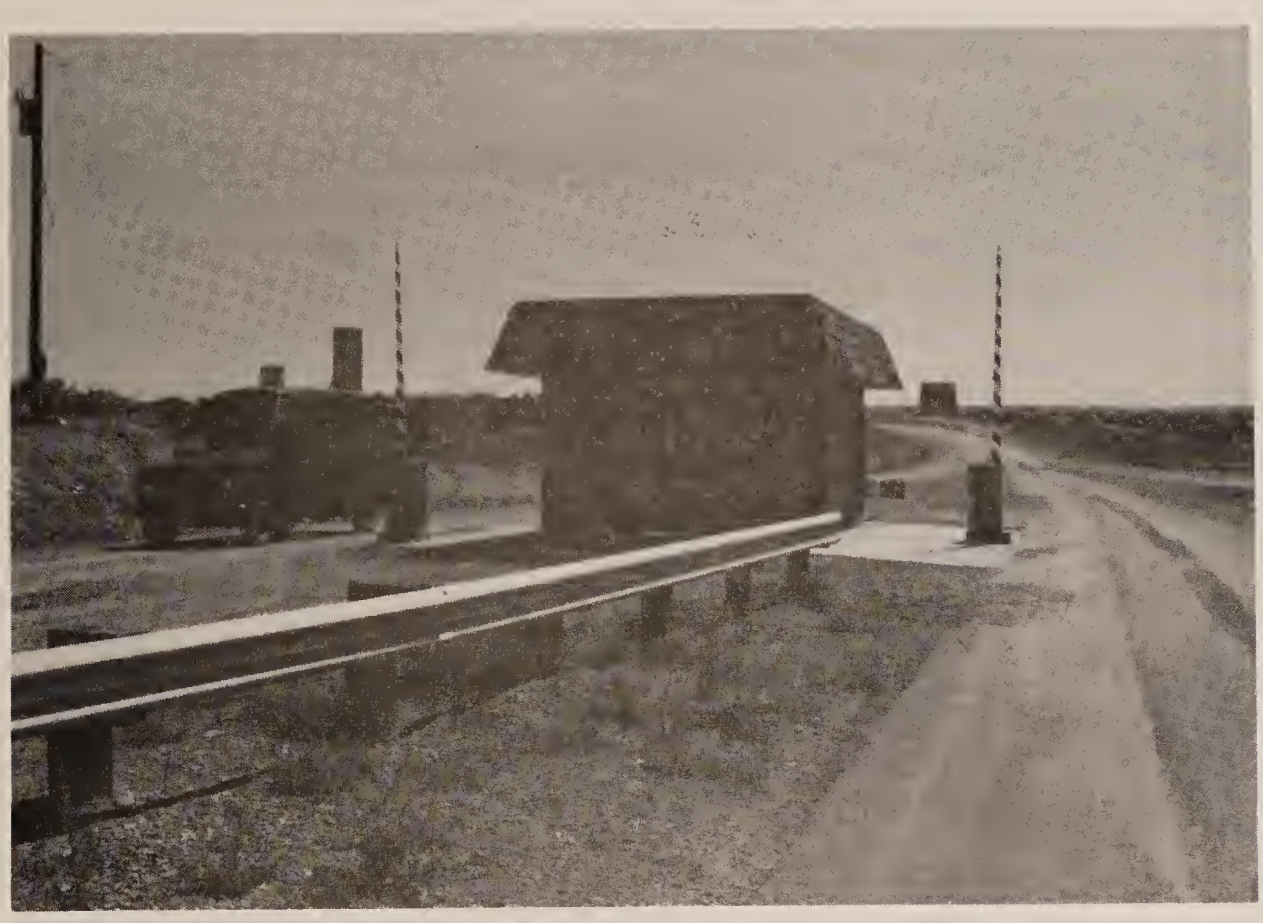

FIGURE 7-3

New Security Building on the
Main Access Road - August 1979

have been no surveys conducted yet to determine full-shift employee-exposure to dust, it is not anticipated that problems exist in this area. Respirators are provided for employee use when assigned to dusty areas both above ground and in the shafts.

7.9.2.2 Explosives Handling and Storage

Explosives for mining and surface-construction use are stored in remotely located surface magazines which meet the criteria of the appropriate regulatory agencies. Explosives-handling and transportation from magazine to the work site are conducted only by experienced, trained workers. Damaged and outdated explosives are burned in a remote location on Tract by the safety personnel under appropriate permit.

7.9.2.3 Fumes

A program has been initiated for gas sampling in the mine shafts utilizing vacuum bottles and analysis by an on-site gas chromatograph. Samples are taken on a twice-a-week basis.

The mine was classified as gassy on 1/2/80 on the basis of an air sample collected by MSHA on 12/18/79. Concentration was 0.29% flammable gas. Gassy mines are defined for concentrations of 0.25% or more.

7.9.3 Fire Control

The fire control system presently utilizes chemical hand-held-and-wheeled fire extinguishers. All buildings, including the hoist house, are so equipped. A gaseous extinguishent (Halon 1301) system has been designed for the Ventilation/Escape Shaft hoist house and was installed in 1979.

Rubber-tired water-tanker trucks are available for use in extinguishing brush fires that might develop on-site.

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7.10 Fish and Wildlife Protection

7.10.1 Objectives

This plan has been developed to provide procedures to avoid or minimize adverse effects on fish and wildlife caused by the development and operation of oil shale facilities on Tract C-b. The habitat management plan uses the baseline environmental data as a frame of reference. It delineates habitat losses that may occur and mitigation efforts needed either to replace in-kind or to improve alternative habitat for selected species of animals.

7.10.2 Estimated Access-Road Effects

It was previously estimated that the main access-road might impede deer movement through the pinyon-juniper vegetation type north of the Tract and that a major ecosystem impact might result from deer/vehicle collisions. Neither has proven to be the case. Deer still cross the road frequently; no deer have been hit by vehicles along the main access from Piceance Creek Road to Tract C-b.

7.10.3 Mitigative Actions Taken in 1979

A total of approximately 102 acres of mature and decadent sagebrush were cut in Gardenhire and Oldland's Gulch, north of Piceance Creek Highway in cooperation with BLM. Both areas will be seeded with early spring grasses, forbs and browse species. The main purpose of the brush cutting is to increase browse and herbaceous productivity. One small check dam was built in each area to provide Spring and Fall water for wildlife and livestock. Pellet group transects will be established to monitor mule deer use.

Magnetic loops for new traffic counters, replacing the pneumatic counters, were installed so traffic flow patterns on Piceance Creek Road could be monitored more efficiently.

7.10.4 Future Possible Mitigation Projects

Several mitigation projects have been proposed, including: more brush cutting in selected draws; prescribed burning in chained areas; building fences for better cattle distribution; and building additional stock tanks and improving existing springs.

7.11 Off-Tract Corridors

The status and route for a 138 KV powerline corridor from Meeker to the Tract has been discussed in Section 4.2.4. Final draft of the Environmental Assessment is expected shortly.

7.12 Abandonment

The Abandonment Plan is contained in Supplemental Material to Detailed Development Plan Modifications submitted July, 1977. The plan is still valid.

7.13 Permit Status

A C.B. permit status report of permits obtained to date is presented on Table 7-2.

TABLE 7-2

C-b PERMIT STATUS REPORT
ACTIVE PERMITS RECEIVED

	No.	Permit Title	Purpose	Agency	Permit No.	Date Submitted	Date Approved	Expires
AIR								
	Federal Clean Air Act							
	1.	P.S.D.	Prevention of Significant Deterioration of background air before lighting any retort.	EPA		10/17/77	12/15/77	At end of Ancillary phase.
	2.	Fugitive Dust	Control fugitive dust during site preparation and shaft sinking.	CAPCD	C-11,454(FD)	6/27/77	8/29/77	5/05/80
	3.	Emission Permit	Batch Plant	CAPCD	C-11,931-165	5/18/78	6/23/78	
WATER								
	Federal Water Quality Act							
	1.	NPDES	To discharge water into Piceance Creek during operations.	CWQCD	CO-0033961	8/19/77	3/27/79	12/31/80
	2.	SPCC	Spill Prevention & Countermeasure Control Plan	CWQCD, AOSO		11/79	Not required	
	State Water Quality Act							
	1.	Underground Injection Control	Mine water injection	CWQCD		4/03/79	6/05/79	

TABLE 7-2 (Continued)

No.	Permit Title	Purpose	Agency	Permit No.	Date Submitted	Date Approved	Expires
WATER (Cont'd)							
State Water Law							
1.	Piceance Creek C-b Pipeline #1	Transport water from Piceance Creek to C-b	Water Court	W-3441	7/27/77	2/28/78	
2.	Piceance Creek Water Right	Construction Water	Water Court		7/26/77	Not required	
3.	Water Augmentation Plan	To replace any water removed from C-b Tract	Water Court		8/31/77	5/21/79	Life of Project
4.	Water Storage Right	To store water in Scandard Gulch	Water Court	W-3874	8/31/77	4/27/79 Date to be confirmed	
5.	Water Storage Right	To store water in East No Name	Water Court		8/31/78	4/27/79 Date to be confirmed	
6.	White River option agreement with White River Resources for Piceance Creek Pipeline and Powell Park Reservoir	Water rights for diversion and storage	Water Court	W-225-77 W-226-77	Appropriation date - 8/5/66 Decree date - 6/14/73		
7.	Well Permit	Construction water from Piceance Creek	State Engineer				

TABLE 7-2 (Continued)

No.	Permit Title	Purpose	Agency	Permit No.	Date Submitted	Date Approved	Expires
LAND							
Bureau of Land Management							
1.	Monument Peak Right-of-Way	Microwave Communications	BLM	C-25677	7/31/77	10/20/77	Good indefinitely
2.	Road Right-of-Way	Construct Access Road	BLM	C-15824 RW	9/13/77	1/24/78	Good for life of Tract
3.	Temporary Use Permit	A-5-A Monitoring Wells	BLM	C-28390 TUP	6/18/79	7/23/79	7/22/80
State of Colorado, Department of Natural Resources							
1.	Notice of Prospecting	To allow site preparation and shaft sinking activities	CMLRB		3/77	Not required.	
2.	Mined Land Reclamation Plan	Plan for Surface Disturbance Reclamation	CMLRB		11/07/77	3/23/78	
Rio Blanco County, Colorado							
1.	Special Use Permit	Permanent Zoning	Rio Blanco County		10/10/78		Life of Project
Others							
1.	FCC License	Microwave Communications	FCC	(15562-IP-67x) (15563-IP-67x) (15564-IP-67x)	5/31/77	8/02/77	8/02/82
2.	FAA Notice of Proposed Construction	Structures over 200 feet	FAA		8/18/78	Not required	

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8.0 SOCIO-ECONOMIC ACTIVITIES

8.1 Work Force

During 1979, the on-site work force varied from a low of 178 to a high of 267. Figure 8-1 depicts the latest revised manpower projections through 1981 on the C.B. Project. This slight variance over the previous projection was basically attributable to the change in shaft sinking schedule that took place in 1979 from the projected schedule published in the original Detailed Development Plan (DDP).

8.2 Population Buildup

At the present time the work force population is living in the Meeker and Rifle (Colorado River Valley) in the following proportions: Meeker - 11%, Rifle - 67%, Colorado River Valley (other than Rifle) - 20%, Miscellaneous - 3%. The work force has indicated a definite preference for living in the Rifle and Colorado River Valley between Glenwood Springs and Grand Valley. The project has provided equal housing between the towns of Rifle and Meeker and the preference of the work force has shown without question the desire for living in Rifle.

8.3 Transportation

Transportation in the form of over-the-road highway bus coaches has been provided throughout 1979 from Rifle and Meeker to the C.B. Project. This fleet grew to five by December (Figure 8-2). This service is provided on a seven-day-a-week, three-shifts-a-day basis. To facilitate this service, parking lots were constructed in both Rifle and Meeker during 1979 for the work force to park their cars before boarding the bus service. During 1979, 6,695,300 passanger miles were accumulated in providing transportation to the project work force; approximately 76% of the work force utilized these buses.

8.4 Housing

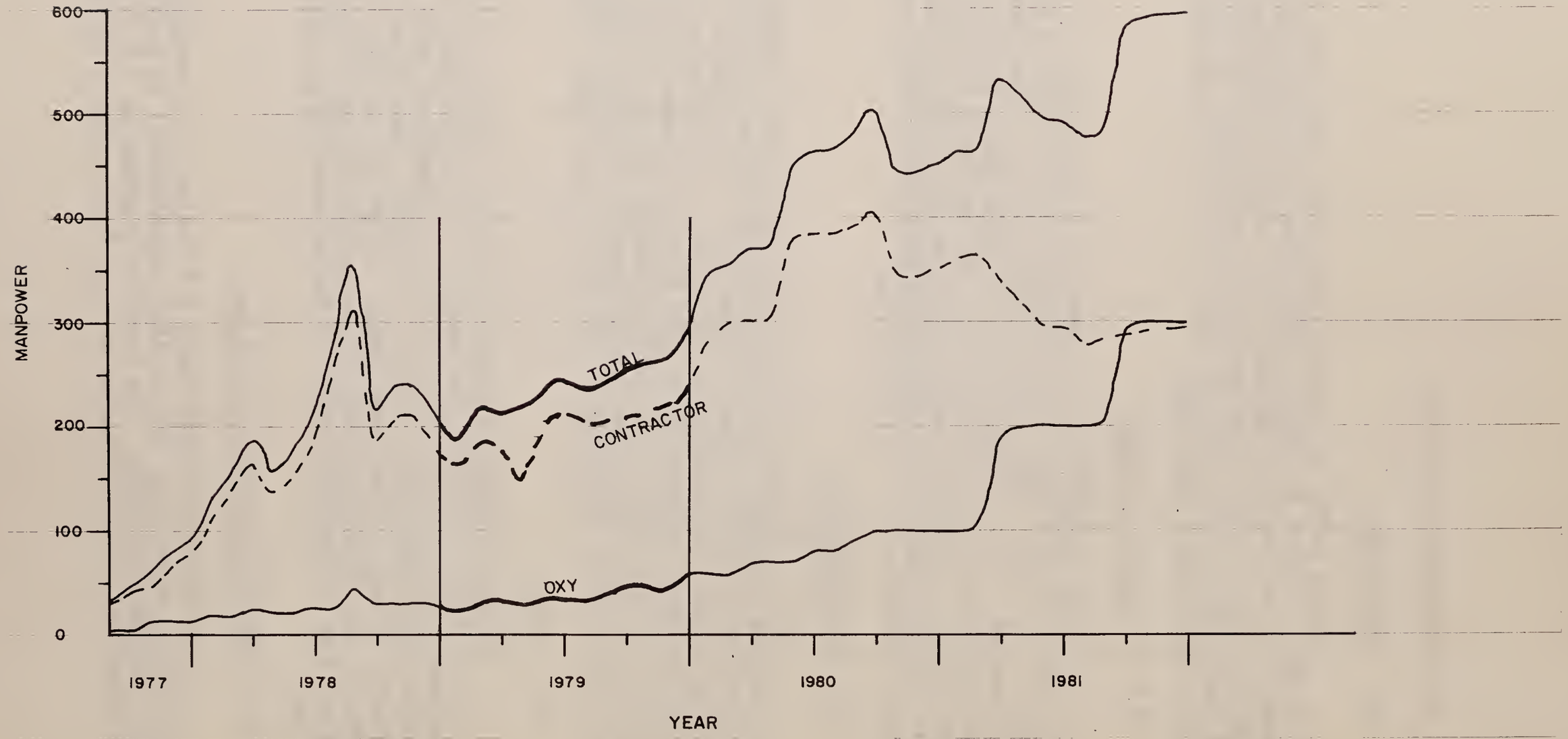
The total number of housing units for use by C.B. Project employees in Rifle and Meeker remained the same in 1979 as they were in 1978. There are 40 apartment units in Rifle (Figure 8-3), 10 townhouse units in Rifle, and a 103-space mobile-home park in Rifle. In Meeker, the project has 48 two-bedroom apartments for use by Tract employees. By the end of 1979, the Rifle housing (apartments and townhouses) was 97% occupied, the mobile home park was 60% occupied, and the apartment units in Meeker were 60% occupied by C.B. Project employees.

8.5 Mitigation Task Force Support

The Cathedral Bluffs Shale Oil Project is providing their own representation as well as that of their consultants' to meetings held in Rangely, Meeker, and Rifle. The services provided by C.B.'s consultant to these impact mitigation meetings and task force support include up-to-date

FIGURE 8-1

C-b MANPOWER PROJECTIONS



information as to existing project manpower and the projected manpower necessary for construction of the project. In addition, C.B.'s consultants actively work with special interest groups at all locations to provide technical support regarding grants, applications, etc. Specifically, during the third and fourth quarters of 1979, C.B.'s consultant assisted the Meeker Recreational District in the application of a grant for further study of recreational facilities in the town of Meeker.

In addition, the C.B. Project donated $5,000.00 to the town of Rifle as monetary support for the second phase of Rifle's Comprehensive Development Plan.

8.6 Worker Programs and Monitoring

The C.B. Project funded throughout 1979 a monitoring program by their consultants that provided information regarding location of domicile, numbers in family, permanent residents, school age children, etc., and published this information on a semi-annual basis for use by local communities and school districts. This effort of providing socio-economic data to the local communities is an ongoing one to be continued throughout 1980 and during the construction period of the C.B. Project. This type of information will assist the local communities by providing the backup information necessary for grant applications, service expansion, etc.

8.7 Training

Occidental Oil Shale, Incorporated and Cathedral Bluffs Shale Oil Company formulated and initiated an in-house training program. The company completed a study that defined training programs necessary for their staff and initiated health and safety training as a part of their training effort during 1979. This department will grow and expand, providing all necessary training courses to project employees as the project continues to grow.

8.8 Community Donations

During 1979, Project responded by making donations to several groups. Some of the groups that received funds during 1979 were: Rifle High School Rodeo, Rifle 4-H Program, several youth organizations in Meeker and Rifle, the Meeker golf course, men's basketball, womens softball, the Chamber of Commerce in both Rifle and Meeker, and the Comprehensive Land Use Study in Rifle.

8.9 Public Relations

8.9.1 C.B. Tract Tours

During 1979, Public Relations conducted 102 tours at Tract C.B. Of these, 32 were government-related tours, 27 were industry-related tours, and 23 were news-media tours. There were 852 total visitors involved with these tours.

8.9.2 Lectures, Presentations, and Expositions

A total of 47 lectures and/or presentations were made by various members of the Public Relations Staff during 1979. In addition, there were six major expositions, one of which was in Morocco. Present at all of these exhibits was the recently completed C.B. model and display. The design, engineering and construction of this large model depicting Tract operations was made ready for public viewing in February of 1979. A small model, in concert with the large scale display, is also available for easier handling and transportation purposes to all with a need.

8.9.3 Photography

A complete historical file of 35mm color slides has been assembled, catalogued and filed for future needs regarding Tract C.B. These slides are updated monthly in order that a chronological photo history is maintained for all phases of Tract operation. Photographic support has been rendered for all phases of the project.

8.9.4 Brochures and Public Information

A color brochure entitled "This is Tract C.B." was made available for public information. This brochure covers general knowledge of the C.B. Tract, a historical discussion of the resource and its character and the Oxy modified in situ process, all of which stress the importance of this project to our national energy situation.

FIGURE 8-2

C.B. Bus Fleet (1 more added in December, 1979)

FIGURE 8-3

Rifle Apartments - April 1979

9.0 ENVIRONMENTAL MONITORING

9.1 Scope

The Environmental Baseline Period for Oil Shale Tract C.B. covered the period from November 1, 1974, to October 31, 1976. Results have been reported in 9 Quarterly Data Reports, 8 Quarterly Summary Reports, C-b Annual Summary and Trends Report (1976), and a 5-volume Environmental Baseline Program Final Report (1977), all submitted to the Area Oil Shale Supervisor.

From November 1, 1976 through August 31, 1977, the C-b Tract was under a period of suspension of the Federal Oil Shale Lease. The monitoring conducted during this period was executed under a program known as the Interim Monitoring Phase. Environmental data for this time period were submitted to the Area Oil Shale Office (AOSO) on October 14, 1977 (Interim Monitoring Report #1). The Interim Monitoring Period was later extended by the AOSO to cover the period from September 1, 1977 through March 31, 1978. Data for this time period were submitted to the AOSO on May 15, 1978 (Interim Monitoring Report #2). The Development Monitoring Program was initiated in April 1978. The Development Monitoring Program for Oil Shale Tract C-b was submitted to the AOSO in a document dated February 23, 1979 and approved by the AOSO on April 13, 1979 subject to 13 Conditions of Approval contained in that approval letter. Semi-annual environmental data reports are submitted every January 15 and July 15.

The 1978 C-b Annual Report, Volume 2, Environmental Analysis, presented analyses in all of the broad environmental areas identified in the Development Monitoring Program for data collected since November 1976. Because there is always a data lag and reduction problem, analyses for some studies were based on data only through September 1978. The report was not as detailed or comprehensive as the 5-volume Environmental Baseline Program, Final Report (1977).

The Interim Monitoring and Development Monitoring Programs have been reduced and changed from the Environmental Baseline Monitoring Program in many areas. Therefore, emphasis is now placed on key indicators of environmental quality and/or change. The 1979 C.B. Annual Report, Volume 2 carries on in this same tradition.

9.2 Purpose

The purpose of this report is to fulfill the requirement of the lease to provide the Area Oil Shale Supervisor's Office with an annual report of environmental analyses. The Development Monitoring Plan states the following objectives with respect to environmental monitoring:

> The purposes or objectives of environmental monitoring as defined in Section 1 (C) of the Stipulations are to provide: 1) a record of changes from conditions existing prior to development operations, as established by the collection of baseline data; 2) a continuing

9.2 Purpose - cont'd

check on compliance with the provisions of the Lease and Stipulations, and all applicable Federal, State and local environmental-protection and pollution control requirements; 3) timely notice of detrimental effects and conditions requiring correction; and 4) factual basis for revision or amendment of the Stipulations.

Volume 2 documents the analyses and conclusions relative to assessment of potential environmental impacts and trends that may be indicated in the collected data. Since development activities were not started until 1978, much of the data and analyses may be considered as a continuation of environmental baseline and background definition.

9.3 Summary of Environmental Monitoring

Environmental monitoring and analyses are continuing on Tract C-b. Development activities commenced within the past two years have resulted in increased activity on the Tract in the form of off-road vehicular use, facility construction, shaft sinking, and traffic into and out of the area. All activity has been conducted within strict adherence to environmental, permit, and lease regulations. Environmental impacts, where they exist, have been confined to the immediate area and within limits defined in the Detailed Development Plan.

9.3.1 Tract Photography

A Tract surface and aerial photography program has been initiated to provide permanent records of change and surface disturbance. This year emphasis has been on use of Landsat to yield information on general vegetative conditions and change detection. Change detection information is obtained by comparing early-growing season data with late-growing-season data and via year-to-year comparisons.

9.3.2 Indicator Variables

The Development Monitoring Program has been brought into sharper focus with the identification of Class 1 indicator variables. These are key environmental variables collected at representative stations in at least monthly sampling frequency. Time series plots, largely generated by the computer from the data base and all to a common time scale, are updated in the semi-annual data reports to provide visual analyses of trends and interrelationships.

9.3.3 Hydrology

A development monitoring program has been implemented to provide water quantity and quality data for the purpose of impact evaluation. Presently, streams, springs, seeps, alluvial and bedrock aquifers, shafts and impoundments are monitored. The monitoring station locations are shown in Figures 9-1, 9-2, 9-3, and 9-4. The present hydrologic monitoring network has been expanded over that which existed during the baseline period to account for new requirements under the Water Augmentation Plan and Consent Decree as implemented in August, 1979.

Baseline studies indicated the mean flow for the reach of Piceance Creek adjacent to the Tract to be approximately 15 cfs; records since then indicate no significant change in mean annual flows. One day minimum flows there have reached less than 1 cfs. Previous daily maximum flows upstream and downstream of the Tract have increased as follows:

	Upstream (Sta 007)	Downstream (Sta 061)
Previous Daily Maximum (cfs)	104 (May '75)	116 (Sept. '77)
New Maximum (cfs)	157 (May '79)	149 (May '79)

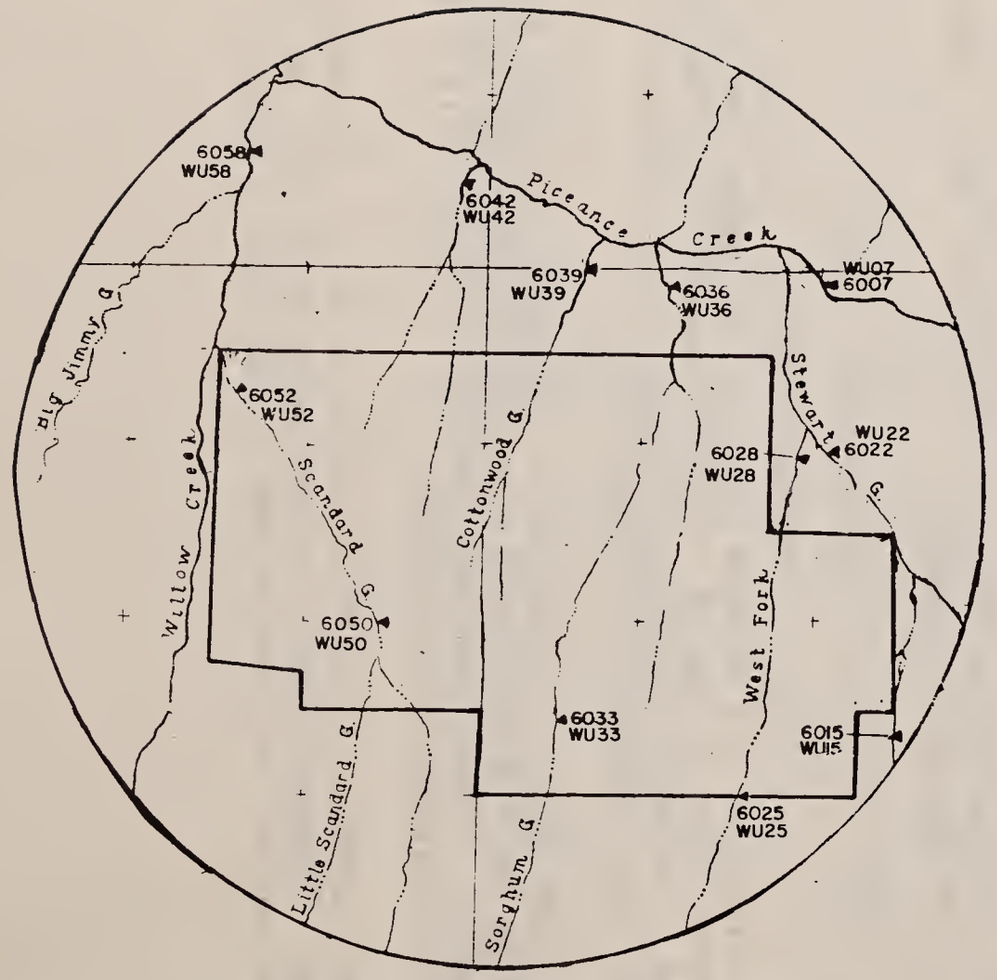
Water levels in the bedrock wells which previously had shown no trends over time now exhibit some decline in close proximity to the shaft sinking area. Table 9-1 lists water levels in all upper aquifer wells as 3-month average differences in 1979 since baseline. Wells 32x12 and 33x1 closest to the Production and V/E shafts are down 39 and 49 feet respectively below their baseline average values as of the end of November.

No significant trends in flows for springs and seeps were noted.

Regarding water quality of Piceance Creek, differences between upstream (Sta 007) and downstream (Sta 061) over time and between stations are summarized for major variables of interest (HCO_3, B, Mg, Ca, CO_3, Cl, Na, pH, NH_3, Specific Conductance) in Table 9-2. The most significant results are increases over time of 20%, 8% and 8% for HCO_3, Mg and Na respectively.

Water quality for springs and seeps, alluvial wells and upper and lower aquifer deep wells is summarized in Table 9-3, showing parameters exhibiting trends at the 5% level of significance. Those parameters that are statistically significant, but not negligible, are so indicated on the table.

The Tract discharges waters under a valid NPDES permit up to 0.1 the value of flow in Piceance Creek. Through October, a peak value of 66 mg/l for total suspended solids was attained; oil and grease peak values were in excess of 10 mg/l on three occasions.



USGS STREAM GAUGING STATION
MONITORING NETWORK
C-b TRACT

FIGURE 9-1

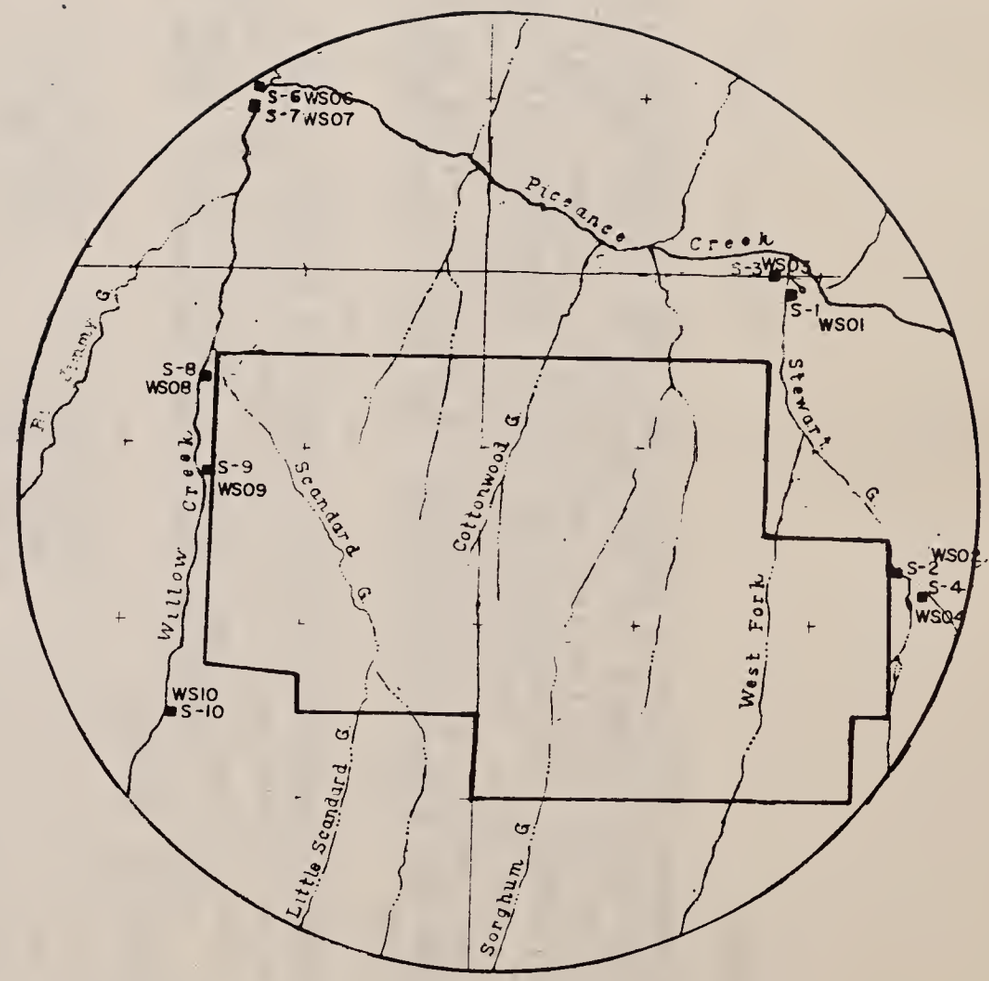


FIGURE 9-2 SPRINGS AND SEEPS MONITORING NETWORK
a) NEAR TRACT

SEE FIGURE 9-2b FOR OFF TRACT MONITORING

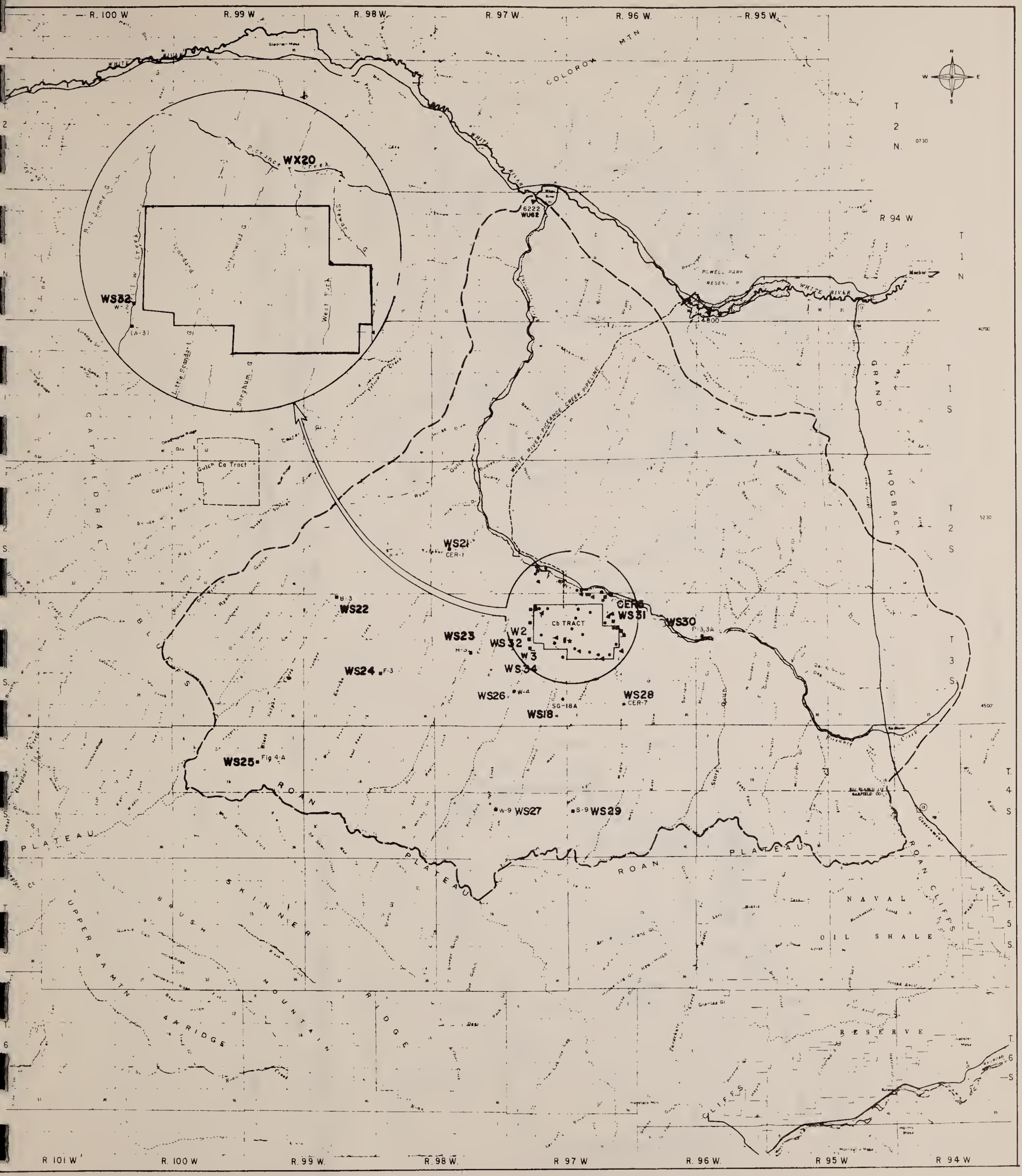


FIGURE 9-2

SPRINGS AND SEEPS MONITORING NETWORK

b) OFF TRACT

ALLUVIAL AQUIFER MONITORING NETWORK
C-b TRACT

Figure 9-3

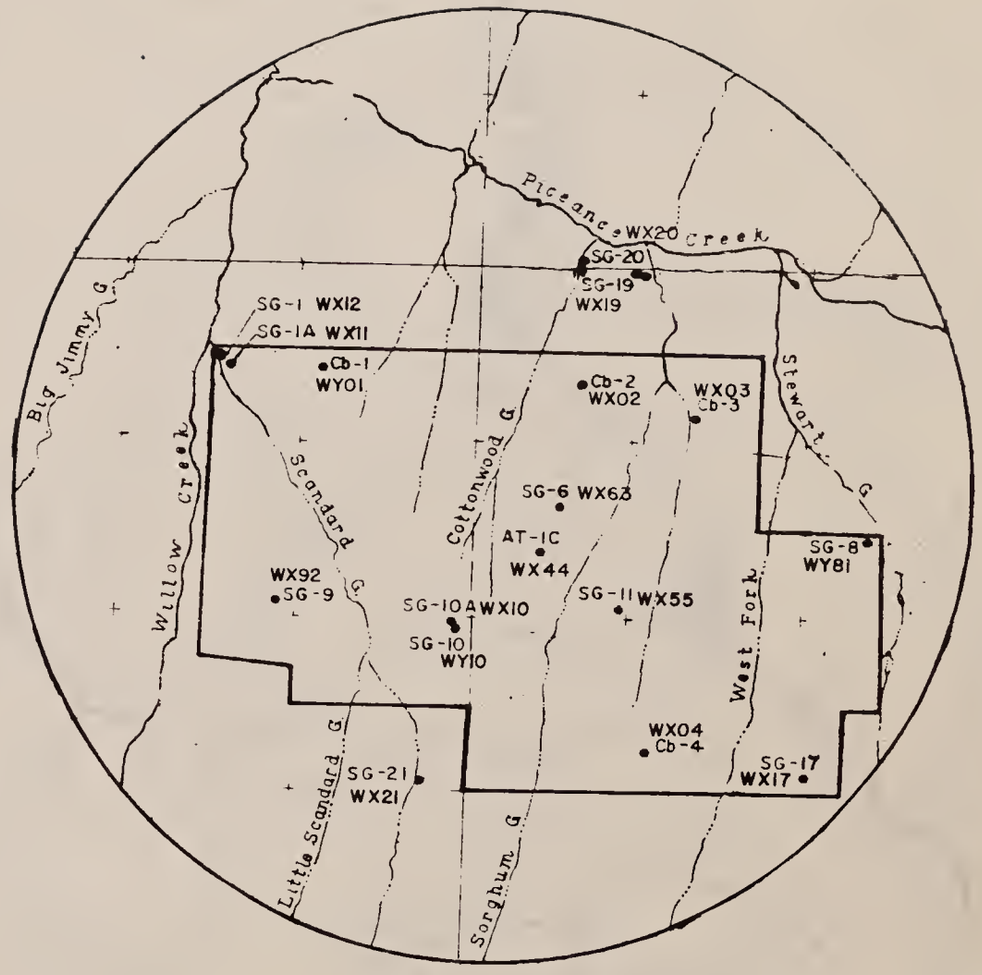


FIGURE 9-4 DEEP WELL MONITORING NETWORK
a) NEAR TRACT
SEE FIGURE 9-4b FOR OFF TRACT MONITORING

Figure 9-4

DEEP WELL MONITORING NETWORK

b) OFF-TRACT

TABLE 9-1

UPPER AQUIFER WELLS AT C-b TRACT SHOWING MEAN
QUARTERLY WATER ELEVATIONS AGAINST MEAN BASELINE
(FEET)

Location			January-March 1979		April-June 1979		July-September 1979		October-December 1979	
Computer Code	Station	Baseline Average*	Elevation	Elevation - Baseline	Elevation	Elevation - Baseline	Elevation	Elevation - Baseline	Elevation	Elevation - Baseline
WX02	Cb-2	6404	6401	-3	6397	-7	6391	-13	6386	-18
WX04	Cb-4	6617	6629	12	6629	12	6633	16	6661	44
WX10	SG-10A	6576	6580	4	6559	-17	6539	-37	6553	-23
WX12	SG-1	6365	6366	1	6364	-1	6360	-5	6356	-9
WX17	SG-17	6640	6636	-4	6638	-2	6644	4	6639	-1
WX19	SG-19	6375	6371	-4	—— NO DATA ——		6366	-9	6362	-13
WX20	SG-20	6358	6358	0	6358	0	6352	-6	6347	-11
WX21	SG-21	6705	6706	1	6707	2	6702	-3	6734	29
WX44	AT1C-3	6547	6540	-7	6541	-6	6538	-9	6535	-12
WX55	SG-11	6546	6564	18	6560	14	6556	10	6556	10
WX63	SG-6	6546	6511	-35	6510	-36	6508	-38	6505	-41
WX92	SG-9	6515	6499	-16	6511	-4	6508	-7	6508	-7
WX32	32X-12	6473***	6470	-3	6473	0	6453	-20	6434	-39
WX33	33X-1	6380**	6378	-2	6362	-18	6315	-65	6331	-49

* - Mean Elevation computed using data from 10/74-12/78
** - Mean Elevation computed using data from 6/78- 3/79
*** - Mean Elevation computed using data from 9/77-12/78

TABLE 9-2 Water Quality at Upstream & Downstream Piceance Creek Stations

	Time			Station		
Parameter	Start	Stop	Span (Yrs)	007 Mean (Upstream)	061 Mean (Downstream)	Ratio 061/007
HCO_3	1/75	12/76	2	471 mg/l	534 mg/l	1.13
	1/77	12/78	2	569	634	1.11
	1/75	5/79	4.4	517	609	1.18
				(1.21)	(1.19)	
B	1/75	12/76	2	0.203	0.205	1.01
	1/77	12/78	2	0.212	0.190	.90
	1/75	5/79	4.4	0.206	0.199	1.04
				(1.04)	(0.93)	
Mg	1/75	12/76	2	45	66	1.47
	1/77	12/78	2	49	71	1.45
	1/75	5/79	4.4	46	67	1.46
				(1.09)	(1.08)	
Ca	1/75	12/76	2	66	76	1.15
	1/77	12/78	2	73	79	1.08
	1/75	5/79	4.4	69	77	1.12
				(1.11)	(1.04)	
CO_3	1/75	12/76	2	1.51	5.25	3.48
	1/77	12/78	2	0.05	0.04	0.80
	1/75	5/79	4.4	0.97	3.24	3.34
				(0.03)	(0.00)	
Cl	1/75	12/76	2	14.7	13.6	0.93
	1/77	12/78	2	14.9	15.2	1.02
	1/75	5/79	4.4	14.7	14.2	0.97
				(1.01)	(1.12)	
Na	1/75	12/76	2	118	143	1.21
	1/77	12/78	2	129	154	1.19
	1/75	5/79	4.4	199	146	0.73
				(1.09)	(1.08)	
pH	1/75	12/76	2	8.3	7.9	0.95
	1/77	12/78	2	8.2	8.2	1.0
	1/75	5/79	4.4	8.2	8.1	0.99
				(0.99)	(1.04)	
NH_3	1/75	12/76	2	0.03	0.03	1.00
	1/77	12/78	2	0.04	0.04	1.00
	1/75	5/79	4.4	0.03	0.03	1.00
				(1.33)	(1.33)	
Sp. Cond.	1/75	12/76	2	1059 µmho	1295 µmho	1.22
	1/77	12/78	2	1067	1298	1.22
	1/75	5/79	4.4	1054	1281	1.22
				(1.01)	(1.00)	

NOTE: Numbers in parentheses refer to ratio $\frac{\text{1977 to 1978}}{\text{1975 to 1976}}$

For example: $1.21 = \frac{569}{471} = \frac{\text{1977 to 1978 value}}{\text{1975 to 1976 value}}$

TABLE 9-3

Statistically Significant Positive (+) or Negative (-)
Trends in Water Quality Variables, Flow and Level

R \ C	USGS Guaging Stations	Springs and Seeps	Alluvial Wells	Aquifer Wells	
				Upper	Lower
Flow/Depth				SEE NOTE 1 BELOW	SEE NOTE 2 BELOW
SC			+(WA06)		
B	-				
F				-	-
Al	-	-	-		
K	-	-	-		
HCO_3		-	-	-	-
TDS			-		
Ca	-	-	-		
Mg		-	-		
DOC				-	-
SO_4	-			-	-
Mo	-			-	-
pH				-	-
WATER TEMP.			+(WA06)	-	-
Na					
NH_3					
As		+(WS07)		-	-

NOTES:

1. -Trend in depth for WX02, WX10, WX12, WX32, WX33, WX44, WX63, and WX92.
2. +Trend in depth for WY10, WY16, WY44, WY52, WY54, WY61, and WY91 (thru October 1979)
3. A hyphen indicates that the regression analyses was not run for this variable.
4. A blank indicates that the statistical trend is not significant at the 5% level. Four digit code entries are used where trends were significant along with a plus or minus sign for trend direction.

9.3.4 Aquatic Ecology

Biological production in Piceance Creek continues to be restricted by a combination of natural and man-caused factors. Natural factors limiting biological production are the unstable nature of most of the streambed and irregular discharge. Loose sand, silt and mud comprise much of the substratum. These materials are easily shifted about by currents, particularly those associated with runoff of snowmelt and high intensity thunderstorms. In times of low flow, much of the streambed becomes dewatered, thus exposing biota to possible desiccation.

Land use practices along Piceance Creek intensify the adverse effects of some natural limiting factors. Cattle grazing has probably reduced the vegetative cover of the watershed and thereby contributed to the irregularities in stream flow. Cattle trample stream banks and willow growth along the streams and thus destroy cover for fishes. Irrigation diversions dewater sections of Piceance Creek and return water probably leaches salts from the fields and increases the load of dissolved solids. Ammonia and nitrogen may be leaching in significant amounts from manure emanating from winter feeding concentration of cattle along Piceance Creek.

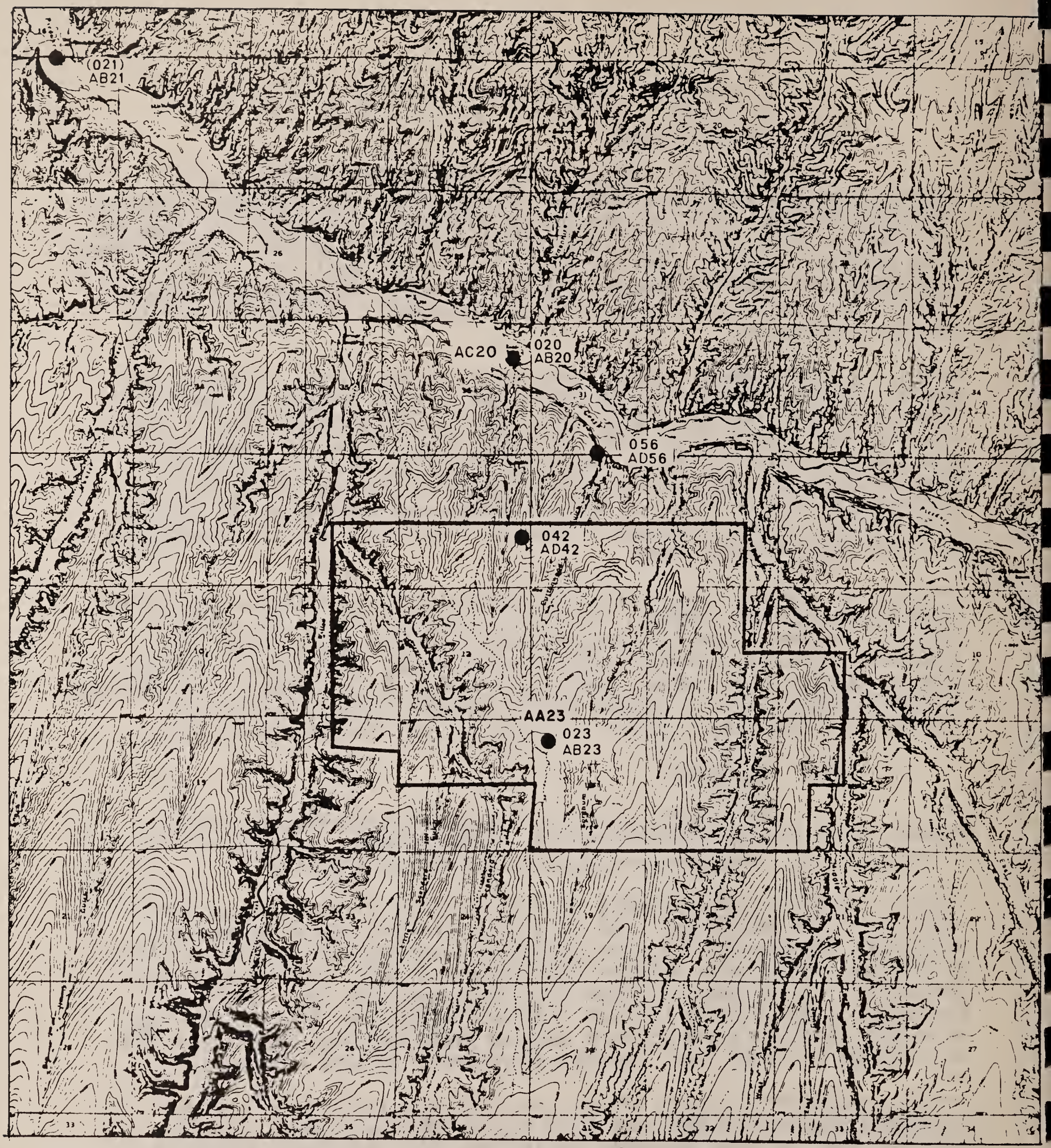
The water of Piceance Creek is high in dissolved salts relative to the "average" North American stream; however, the load in Piceance Creek is not unusually great for streams in semi-arid western localities. Low quality-high salinity groundwater from deep aquifers reaches Piceance Creek via springs discharging into it, especially in reaches downstream from Ryan Gulch. Although the salinity of lower Piceance Creek is greater than in upstream reaches, there is no unambiguous evidence that salinity is limiting total biological production.

9.3.5 Air Quality

With regard to air quality, gaseous constituents measured include sulfur dioxide, hydrogen sulfide, carbon monoxide, ozone, and oxides of nitrogen; total suspended particulates have also been measured.

The air quality monitoring network is shown on Figure 9-5; systems-dependent stations are not operational. The air quality trailers making gaseous and particulate measurements and associated meteorology are Stations AB23 and AB20; in addition, particulates data are also measured at AD56. A 60-meter meteorological tower is located at Station AB23, instrumented at three levels. Precipitation measurements continue to be made at Stations AB20 and AB23, and as of August, at the extra stations required under the Water Augmentation Plan as indicated in Figure 9-6. Minimum data-reporting frequency is hourly.

For the overwhelming majority of the time, SO_2, H_2S, and CO have indicated background levels below the lower level of significance of the instruments. Only for ozone and total suspended particulates have significant values been measured.



AMBIENT AIR QUALITY DEVELOPMENT MONITORING NETWORK

FIGURE 9-5

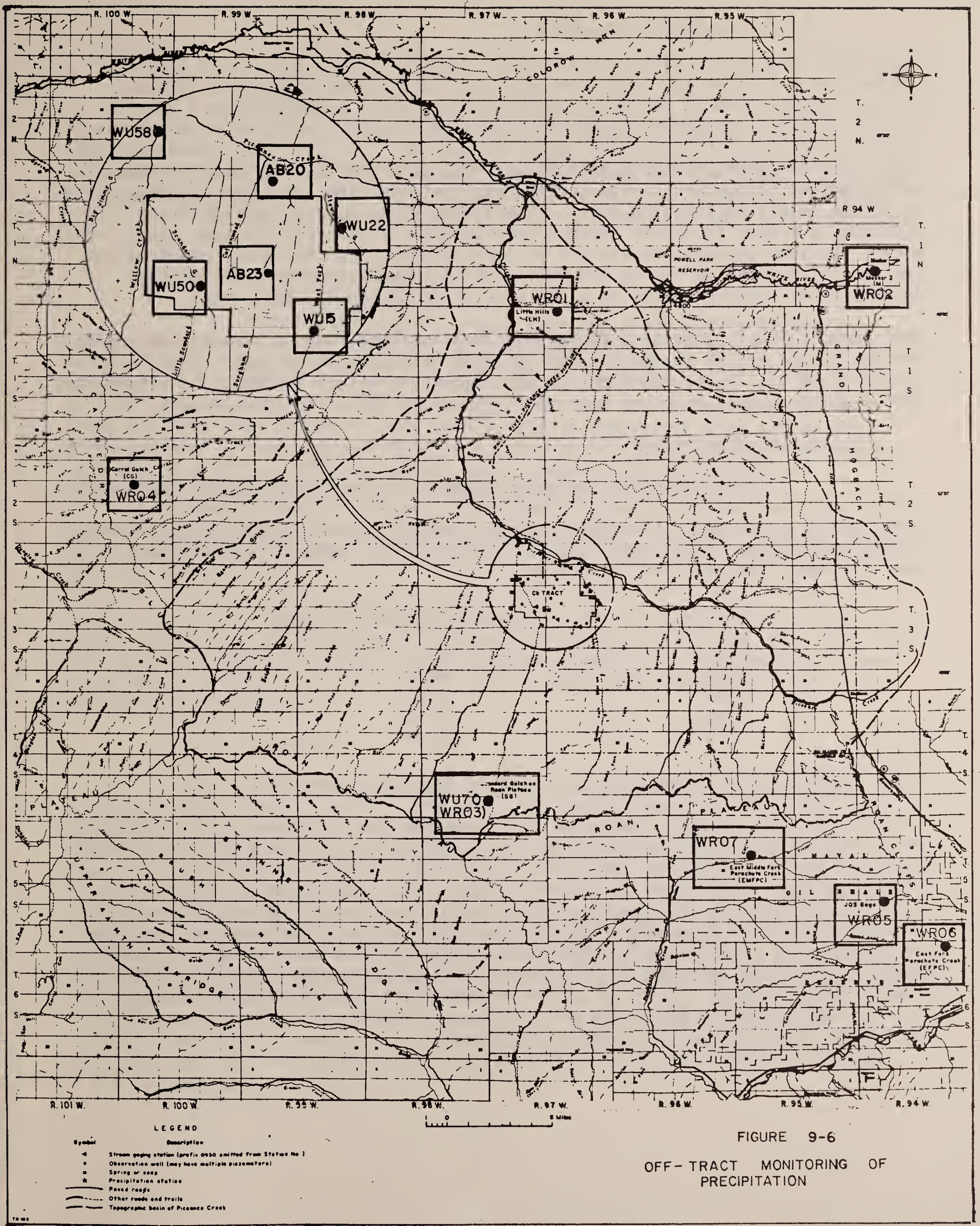


FIGURE 9-6

OFF-TRACT MONITORING OF PRECIPITATION

9.3.5 Air Quality - cont'd

The highest and second highest peak hourly readings for ozone in 1979 (through October) were 246 and 203 ug/m^3 respectively; the ozone standard in 1979 was changed to 240 ug/m^3 as an annual expected exceedance, averaged over 3 years. The peak 24-hour reading for particulates was 80.6 ug/m^3, well below the standard.

Ozone-concentration shifts to high values show correlation with weather-related meterological parameters. High particulate concentrations to date are judged to be due solely to fugitive dust. Time series plots do not identify any discernible trends in either gaseous constituents or particulates over time, except for some seasonal variations in particulates. Particulate concentrations are usually highest in spring and fall with minimums in winter. No specific dependence of concentrations on wind speed or direction has been noted.

Mean annual visual range in 1979 was 127 km (79 miles), with a seasonal Spring minimum of 122 km (76 miles) and Fall maximum of 135 km (84 miles). These compare with 81, 78 and 86 miles for the respective values in 1978. No significant change in the annual mean has been noted since the 1975-1976 measurements.

9.3.6 Meteorology

Climatological records indicate an annual mean temperature of 6-7° C. over the past five years. Time series analysis of monthly means has demonstrated no trend in long-term values. Cold air drainage results in winter minima in Piceance Valley near -43° C. Precipitation summaries on the Tract over the past five years are as follows:

Year	Annual Precipitation (cm)
1975	44.95
1976	35.78
1977	35.92
1978	36.07
1979	36.72

Peak storm intensities reached 4.3 cm precipitation on September 3, 1977.

Predominant winds on Tract continue to be from the south-southwest with Spring and Summar showing higher wind speeds (5-8 m/sec) than Fall and Winter (1-3 m/sec) at the 10 meter level above the surface. Winds from the Tract direction generally become channelled by Piceance Valley walls toward the WNW downstream direction of Piceance Creek during late afternoon and night; directions reverse in daytime. Air is typically stable during night and early morning and unstable in late morning and afternoon. Afternoon mixing-layer-height estimates have been improved utilizing both the '74-75 aircraft and pibal flights and the combined EPA/C-b pibal flights of '78. Wintertime averages from 1500 meters increase to over 1800 meters by April and are in excess of this until late Fall when they start to decrease back to Wintertime levels.

9.3.7 Noise

The environmental noise program deals with both traffic and tract-generated noise levels. The discrete (weekly) traffic noise level measuurements indicated noise levels approximately 9 dbA above baseline peaks. Continuous noise measurements (every 6th day) indicate no significant increases due to the tract activities in average noise levels for two 12-hour periods (7 p.m. - 7 a.m. and 7 a.m. - 7 p.m.).

9.3.8 Wildlife Biology

With regard to deer counts observed along Piceance Creek, maximum weekly counts since baseline have always occurred in Spring and have varied from 1804 in 1979 to 1034 in 1978 with 1975, 1976 and 1977 values intermediate to these. Road kills in any week usually vary from less than 1% to 1.5% of those counted in any given week. A total of 131 deer were killed along the road from September 1978 to May 1979 in comparison with 125 in the previous year. Use of company buses has been the principal mitigative measure in reducing traffic on Piceance Creek road. Natural deer mortality has substantially increased this year, probably due to the severe winter.

Regarding medium-sized mammals, fewer coyotes and more cottontail rabbits were noted in 1978 than in 1977. Coyotes have varied from a high of 188 (1974) to a low of 50 (1978).

As with previous sampling periods, greater avian songbird diversity has been noted in pinyon-juniper woodlands as opposed to chained pinyon-juniper; similarly more mourning doves were found in the unchained habitats. No changes have been noted between control and development sites. Development activiites have not affected raptor activity.

9.3.9 Vegetation

Regarding vegetation, the conclusions reached this year are essentially the same and are supportive of the conclusions reached in the 1977-1978 vegetation monitoring studies: The production patterns observed on the Tract in 1979 are essentially the same as those observed during the baseline data collection year. During 1979 herbaceous utilization of nonwoodland vegetation types was approximately 25 percent. The only type where the measured production differences between range cages and open areas was statistically significant was in the upland sagebrush shrublands. Differences in production at Plots 1 and 2 (chained pinyon-juniper - development and control, respectively), and 5 and 6 (pinyon-juniper-development and control, respectively) were statistically significant. These differences most likely relate to natural causes rather than to development activities. Yearly fluctuations in total production appear to be closely related to precipitation. Winter precipitation and precipitation in April, May and June are probably more influential in affecting production than is the total yearly precipitation.

9.3.9 Vegetation - cont'd

The fertilization program on the ridges above Scandard Gulch and Cottonwood Gulch has not significantly increased production. On the average, production was increased approximately 7 percent in the fertilized areas.

Revegetation monitoring will be conducted on sites which have undergone surface disturbance and on future raw-shale disposal sites. Erosion control and rehabilitation are discussed in Ch. 6, including the reclamation activity scheduled defining affected areas, disturbance timetable, reclamation time span, and disturbed acreage.

9.3.10 Ecosystem Interrelationships

Ecosystem interrelationship studies have been continued as a means of assessing the potential impact of environment perturbations resulting from development activity. Quantitative studies to date included: (1) effects of climatic variations on herbaceous productivity; (2) effects of traffic, climate, and size of mule-deer herd on deer road-kill; and (3) a new study on the potential effects of mine dewatering on vegetative conditions both in Piceance Creek and on Tract was initiated. Last year's study on the effects of urbanization on hydrologic response time has been terminated because six erosion control basins are specifically designed to control such runoff. Principal results, previously established that still hold are as follows: (1) herbaceous productivity correlated best with precipitation in April-May-June and total precipitation of the previous year; (2) deer road-kill correlated best with deer road-count.

9.3.11 Items of Aesthetic, Historic, or Scientific Interest

Surface activity was very limited at the site in 1979. A concerted effort has been made to paint and locate new structures in such a manner as to reduce any aesthetic impact. Additionally, the on-site manager has thoroughly investigated every site of disturbance and no additional historic or scientific finds have been made.

9.3.12 Health and Safety

With regard to health and safety, accident frequency analyses and inspection reports (Mine Safety and Health Administration and Colorado Division of Mines) are included in the Development Monitoring Plan and its reports. At C.B. based on 524,891 man-hours, there were ive lost-time accidents. The site injury rate in 1979 was 1.91 (incidents/200,000 man-hours). This compared with three lost-time accidents in 1978, and an injury rate of 1.35.

9.3.13 Toxicology

This project is a jointly sponsored effort by Tosco, Arco, and C.B. under the direction of Dr. R. M. Coomes to the TOSCO Corporation. Acute toxicity tests indicated that shale oil is equivalent to petroleum materials in toxicity and that raw and processed shales are essentially non-toxic. In skin-painting experiments on rats it was concluded that raw and processed shales are not carcinogenic to skin. Chronic inhalation experiments on rats and monkeys demonstrated that no lung tumors or lung changes could be attributed to raw or processed shale exposures.

9.3.14 Data Management

All air, water and microclimate data are currently in a computerized data base called RAMIS. Biological data are in manual data bases, as documented in data reports to the AOSO.

Data tapes for air quality and meteorology have been furnished to the AOSO for data through April, 1979. Additional air and water data tapes will be furnished in 1980.

9.3.15 Reporting

Annual reports are submitted during the anniversary month of the Lease (April). Semi-annual Data Reports are submitted to the AOSO on January 15 and July 15.