

Final Submission

Executive Summary

**Twin Cities
Army Ammunition Plant**

New Brighton, Minnesota

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**Steam/Power Plant
Modernization
Program**

19971016 172

Prepared for



The Department of the Army
Omaha District
Corps of Engineers
Contract No. DACA45-80-C-0090

By



Sanders & Thomas, Inc.
An STV Engineers Professional Firm
Consulting Engineers

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DEPARTMENT OF THE ARMY
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December 20, 1982

U.S. Army Corps of Engineers
Omaha District
6014 U.S. Post Office and Court House
Omaha, NE 68102

Attention: MROED-MC

Reference: Steam/Power Plant Modernization Study
(Modified Increment E),
Twin Cities Army Ammunition Plant,
New Brighton, Minnesota

Subject: Final Submission

Contract No.: DACA45-80-C-0090

Our Job No.: 05-4660

Gentlemen:

Enclosed is the Final Submission of the Steam/Power Plant Modernization Study at the Twin Cities Army Ammunition Plant.

The Study consists of four volumes: (1) Executive Summary, (2) Report, (3) Appendix I: Calculations, and (4) Appendix II: Computer Output.

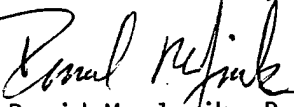
The Study presents approaches to meeting TCAAP's demands during peacetime and mobilization periods. The recommended plan represents a technically practical approach to converting the TCAAP steam/power plant to burn coal and satisfies the intent of the Army's energy goals.

This plan represents a combined effort of Sanders & Thomas and various Army departments. We wish to thank all who were involved in the preparation and review of this report.

Thank you for this opportunity to be of continued service.

Very truly yours,

SANDERS & THOMAS, INC.



David M. Jorik, P.E.
Project Manager

DMJ:llr

Final Submission

Executive Summary

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Army Ammunition Plant**

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PROJECT ABSTRACT

This study is to develop a cost-effective and technically practical modernization program for the steam/power plants at the Twin Cities Army Ammunition Plant (TCAAP) while meeting the intent of the Army energy goals of reduced dependence on oil and natural gas.

The recommended modernization approach is to provide new coal-fired boilers complete with required auxiliary equipment in an addition to Building 515. One existing oil-fired boiler in Building 515 will be converted to burn coal. This approach will satisfy facility steam requirements from peacetime through mobilization demands. Upon completion of construction the remaining boilers in Building 115 and 515 will be abandoned in-place.

Total expenditures required to complete this modernization program are \$59 million in FY 1982 dollars or \$69 million in actual dollars. Funding allocations are anticipated for FY 1985 through FY 1989.

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EXECUTIVE SUMMARY

Project Requirements and Objectives

The purpose of this study is to develop a cost-effective and technically practical modernization program for the steam/power plants at the Twin Cities Army Ammunition Plant (TCAAP), New Brighton, Minnesota. The objective is to reduce dependence on oil and natural gas.

The program plan presents that method which is consistent with present Army energy goals, is technically feasible, and meets peacetime and mobilization energy requirements.

The plant life-cycle analysis is based on a 25-year life with the period from 1950 to 1975 used as a representative life-cycle for peacetime and mobilization periods. This cycle includes a five-year and seven-year mobilization period.

The study considers both technical and economic criteria in developing the final recommended modernization program.

Background

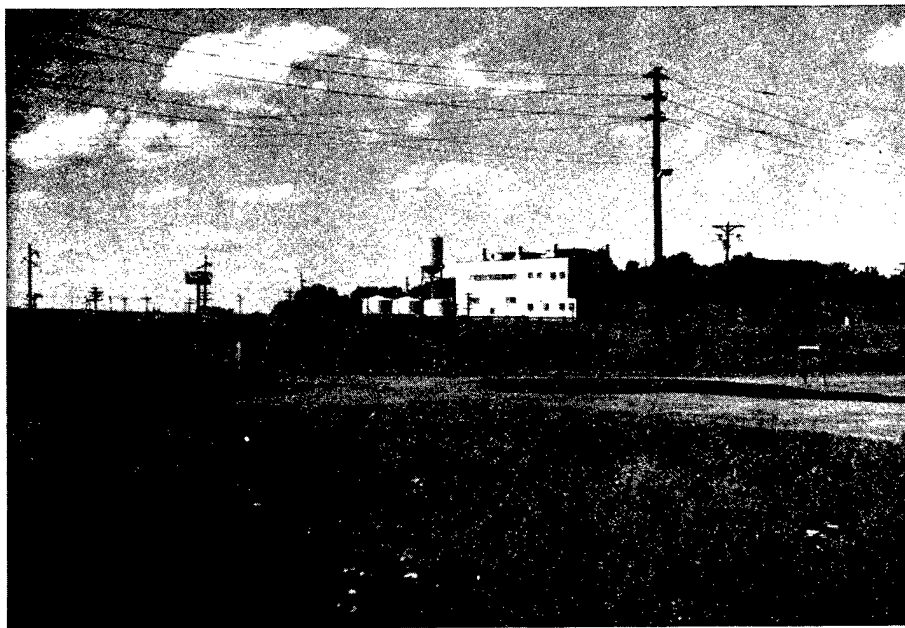
TCAAP is located approximately five miles north of the Twin Cities of Minneapolis and St. Paul. Figure 1: Location Map, shows the plant's location in the Twin Cities Area. The plant is bordered by County Road I to the north, Trunk Highway No. 96 to the south, Lexington Avenue to the east, and Trunk Highway No. 35W and No. 10 to the west.

TCAAP presently has 262 enclosed buildings with a total floor area of about 4.38 million square feet. Most of the buildings were constructed in the early 1940's and were active during World War II, Korea, and Vietnam. Figure 2: Site Map, shows the key features of the plant.

Steam for the entire facility is produced by two interconnected boiler plants in Building 115 and Building 515. The combined capacity of both plants is 555,000 lb/Hr. Each building contains three natural gas and oil-fired boilers installed in 1941 and 1942. The plant is served by an aboveground steam distribution system.



**STEAM GENERATING PLANT
BUILDING 115**



**STEAM GENERATING PLANT
BUILDING 515**



FIGURE 1
TWIN CITIES ARMY AMMUNITION PLANT
LOCATION MAP



FIGURE 2
TWIN CITIES ARMY AMMUNITION PLANT
SITE MAP

Analysis Method

Planning the TCAAP modernization program involved analyzing plant energy use in both existing and proposed plant configurations. Existing configuration energy use is based on historical fuel consumption records extrapolated to future requirements. Energy use for the plant in its proposed configuration is projected based on historical records, previous technical reports and studies, and operating modes. Energy consumption profiles are then developed to determine the proposed plant configuration and size. Economic factors related to the proposed plant configuration are then used as an input to the Life-Cycle Cost Analysis.

The study involved assembling the data base to develop a load profile for peacetime and mobilization periods. Existing equipment was analyzed and evaluated to determine the need for physical improvement. Various energy systems were considered with the final selection based on anticipated load centers, effective distribution systems, and site access. Other factors including heat transfer mediums, cogeneration, potential fuels, and combustion techniques were also examined.

A comprehensive life-cycle analysis was performed for the selected methods, which were then ranked in ascending order of capital cost and life-cycle costs. A sensitivity analysis was performed to determine the impact of key parameters on the life-cycle costs.

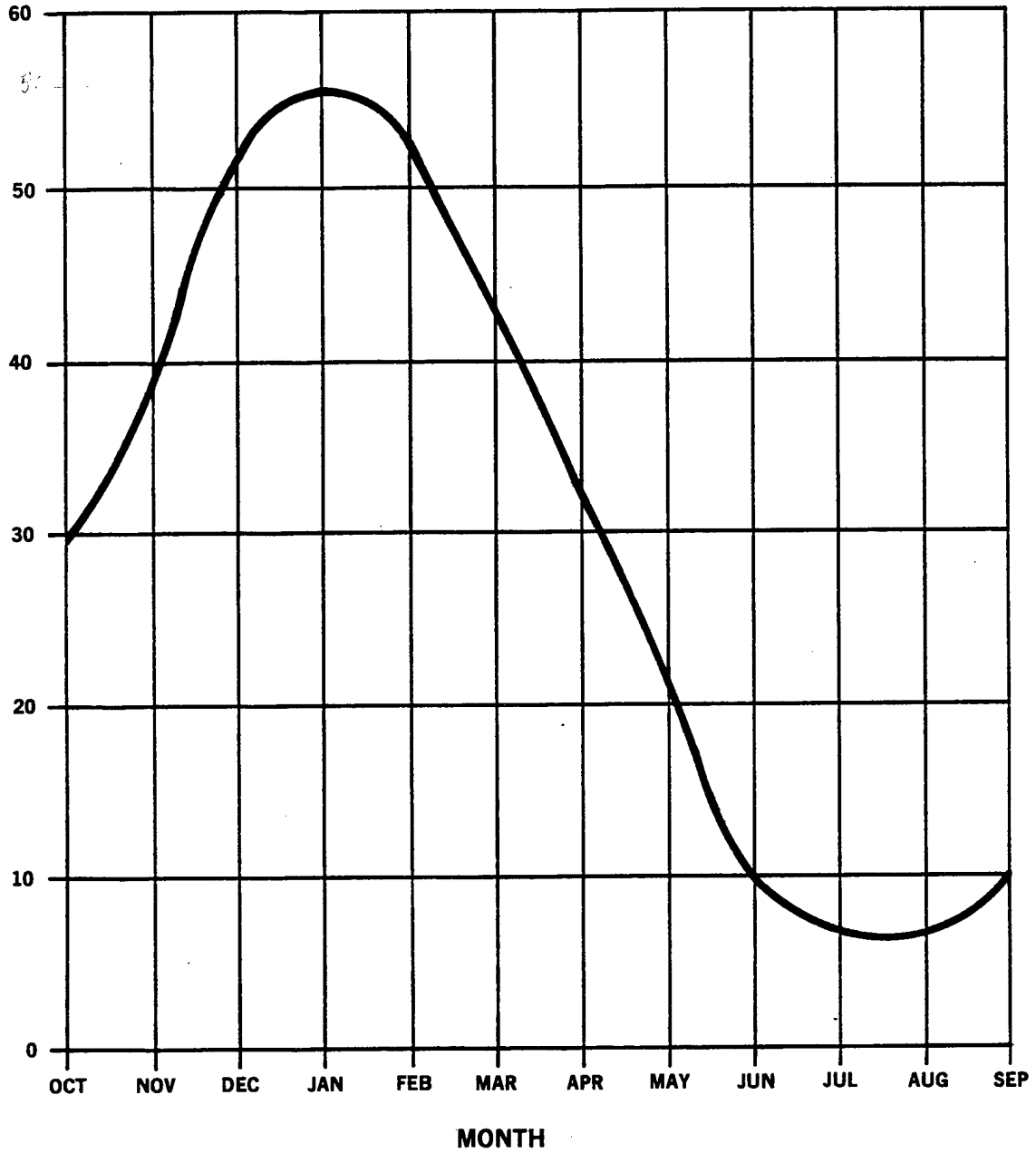
Regulatory Requirements

All applicable Federal, State, Army and Department of Defense regulations have been complied with in preparing this study and its recommendations.

Energy Requirements/Modes of Operation

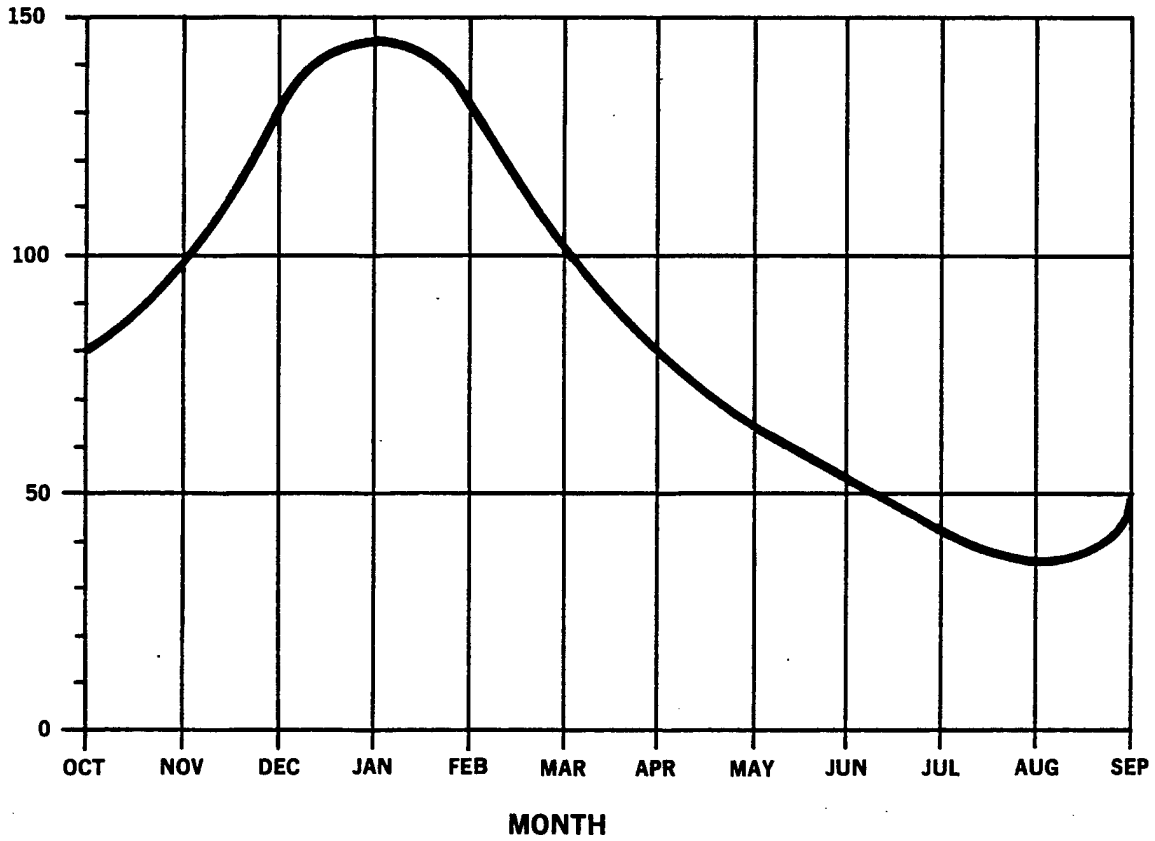
Energy requirements in pounds per hour of steam were established for peacetime and mobilization, as detailed in Figures 3 and 4. The study considered the effects of plant activity levels and their relationship to the heat generating facilities, and developed the optimum heating plant arrangement to furnish energy for peacetime and mobilization requirements.

**LBS STEAM
(X 10⁶)**



**FIGURE 3
ANNUAL PEACETIME STEAM
DEMAND**

**LBS STEAM
(X 10⁶)**



**FIGURE 4
ANNUAL MOBILIZATION STEAM
DEMAND**

The summary energy requirements are as follows:

Steam Requirement (lbs/Hr)

Status	Peak Hour	Peak Month	Yearly Total
Mobilization	242,000	145,881,000	1,022,100,000
Peacetime	96,000	55,831,000	359,625,000

Emerging Technologies

The study examined the applicability of using emerging technologies to produce steam for process and heating. Coal gasification, fluidized bed combustion, and refuse-derived fuels were considered for applicability. Fluidized bed combustion was recommended for further study.

Fuel Selection

Coal and biomass were evaluated as candidate fuels with Montana coal selected as the preferred solid fuel.

Heat Generation Methods Considered

Five possible heat generation methods were considered: Construct New Coal-Fired Central Steam Plant, Construct New Coal-Fired Central HTW Plant, Install New Coal-Fired Steam Generating Equipment in Boiler Plant 515 Maintaining Fuel Oil-Fired Boilers, Convert Boiler Plant 515 to Fire Coal Expanding Capacity to Meet Mobilization Requirements, and Modernize Existing Equipment and Continue Firing Present Fuel.

The above methods were assessed and four were selected for detailed technical and economic analysis. The New Coal-Fired Central HTW Plant was not selected because of high capital costs which would make this method economically infeasible.

SANDERS & THOMAS.

ENGINEERS ARCHITECTS

The four methods evaluated are shown below and are ranked in order of ascending life-cycle and initial capital costs.

Rank	Method	Description	Life-Cycle Cost	Initial Capital Cost (\$1982)
1	D	Modernize Existing Equipment and Continue Firing Present Fuel	\$49,890,000	\$ 2,530,000
2	B	Install New Coal-Fired Steam Generating Equipment in Boiler Plant 515 Maintaining Fuel-Oil Fired Boilers	\$50,980,000	\$38,200,000
3	C	Convert Boiler Plant 515 to Fire Coal Expanding Capacity to Meet Mobilization Requirements	\$60,640,000	\$50,900,000
4	A	Construct New Coal-Fired Central Steam Plant	\$64,500,000	\$56,300,000

Of the four methods, Method A is eliminated due to its high initial capital and life-cycle costs. Methods B and D require use of petroleum fuels and natural gas, which is contrary to the intent of present Army energy policies to reduce dependence on these fuels. Method C is therefore selected as the preferred acceptable method.

Recommended Plan

Method C — Convert Boiler Plant 515 to Fire Coal Expanding Capacity to Meet Mobilization Requirements, is the recommended plan. This method is consistent with the intent of present Army energy policy to reduce dependence on petroleum and natural gas. TCAAP's readiness posture can be maintained during construction by continued reliance on the existing steam generating facilities in Building 515 and 115, which have sufficient capacity to meet peacetime and mobilization requirements. The recommended plan is shown on Figure 7: Plan and Section, and Figure 8: Flow Diagram. Figure 9: Site Plan, shows the location of these improvements.

Cogeneration and Emergency Power

The plant's heating load consumes about 90 percent of the total steam produced during peacetime operation. Therefore cogeneration would only be feasible during winter months.

The distributed emergency power generation system is recommended as the preferred system over the central emergency power generation system because of its lower capital cost and greater system flexibility.

Program Plan Implementation

The overall project schedule showing the program plan appears in Figure 5: Program Schedule. This schedule does not reflect any governmental funding constraints for the defined projects. Government procurement regulations have been followed in determining the schedule.

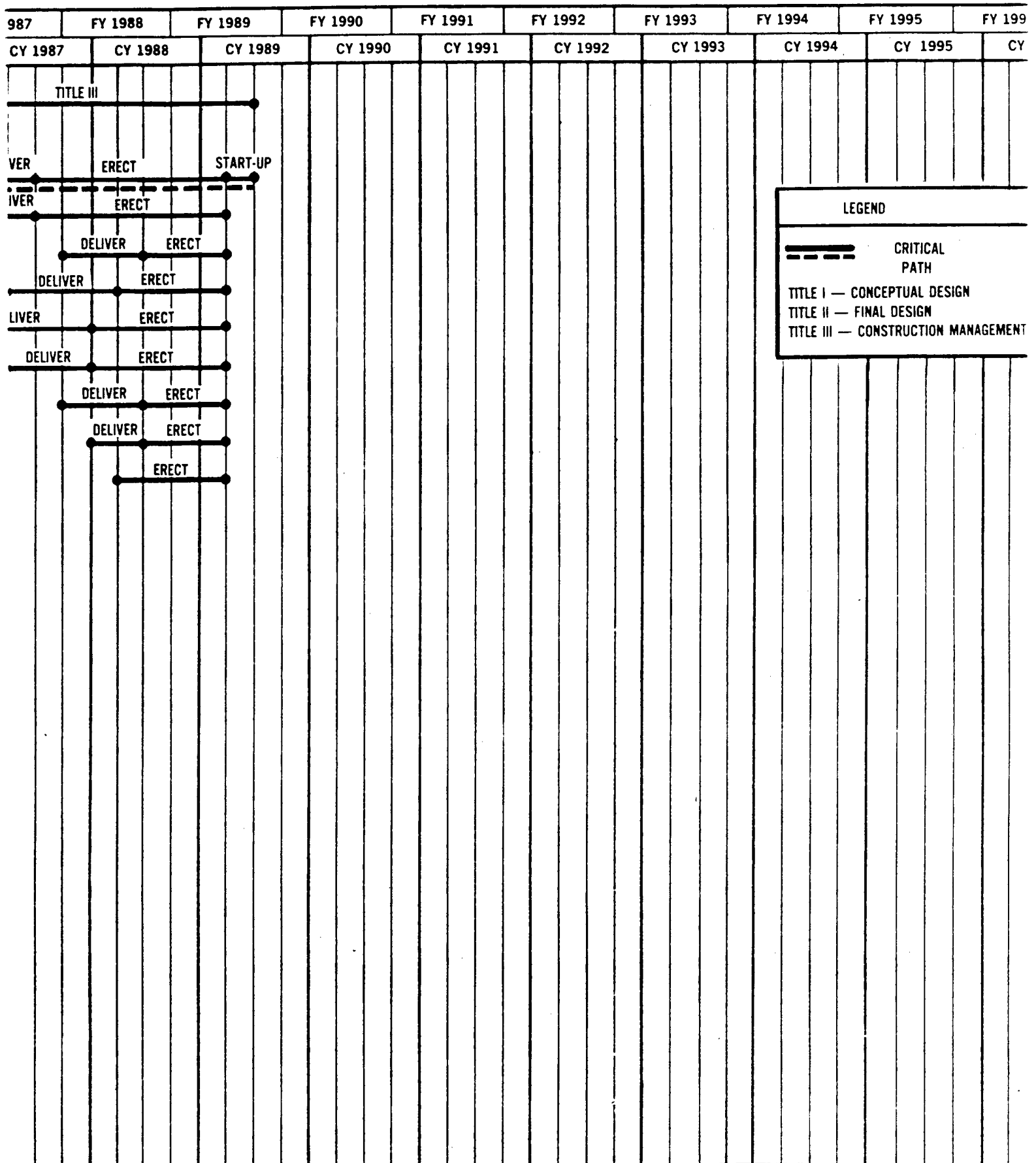
Funding Profile

The funding profile on Figure 6 shows that the total installed cost for the recommended method is about \$59 million in 1982 dollars. In actual dollars the total expenditure is \$69 million.

TASK	FY 1983		FY 1984		FY 1985		FY 1986		FY 1987		FY 1988	
	CY 1983		CY 1984		CY 1985		CY 1986		CY 1987		CY 1988	
ENGINEERING					TITLE I	TITLE II				TITLE III		
CONTRACT												
NEW BOILERS								BID & AWARD				
BOILER REHAB								FAB & DELIVER			ERECT	
STACK								FAB & DELIVER			ERECT	
COAL HANDLING										DELIVER		ERE
POLLUTION CONTROL									DELIVER			ERE
ASH HANDLING									DELIVER			ERE
WATER TREATMENT										DELIVER		
UTILITIES											DELIVER	
LANDFILL												E

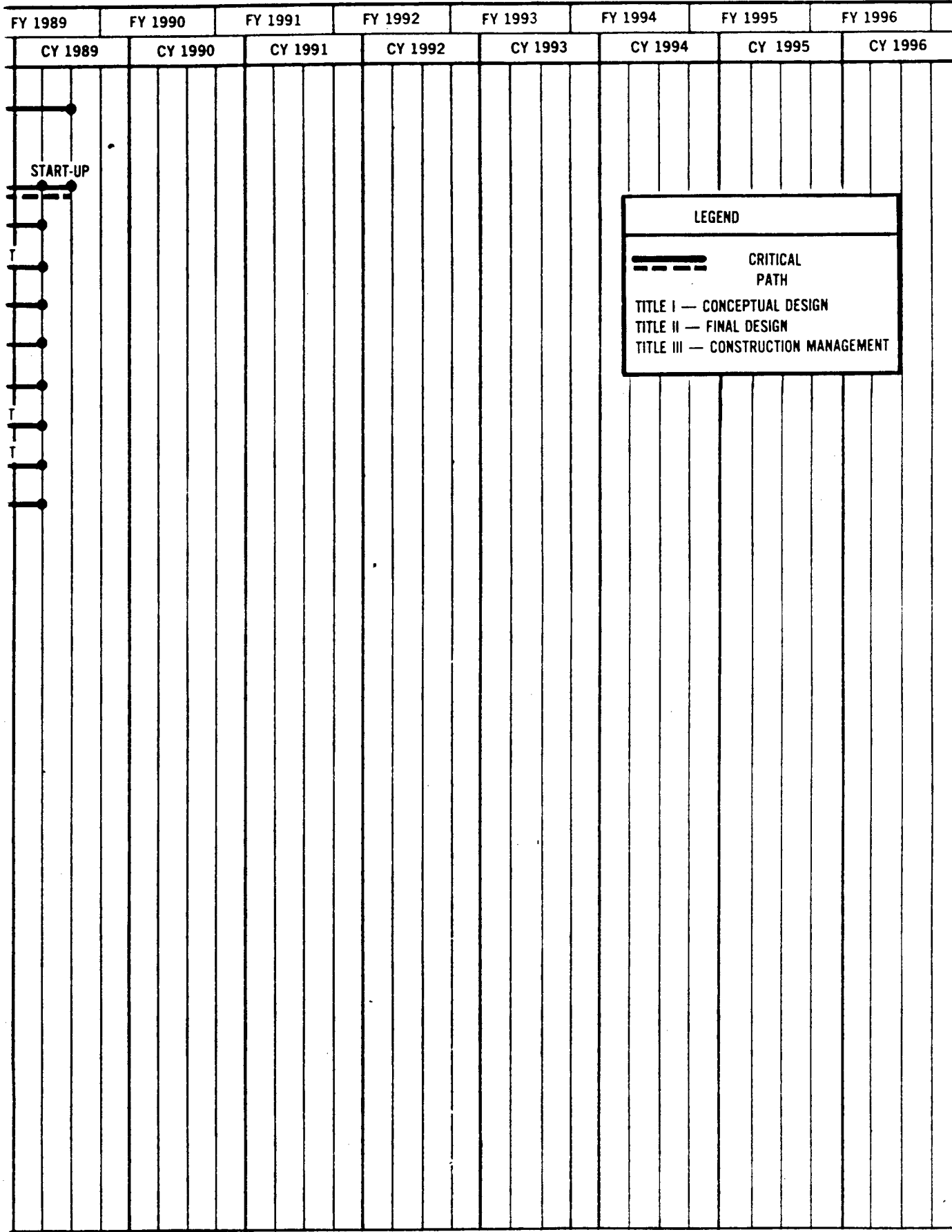
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**FIGURE 5
TWIN CITIES ARMY AMMUNITION PLANT
PROGRAM SCHEDULE**



②

**FIGURE 5
ARMY AMMUNITION PLANT
OGRAM SCHEDULE**



LEGEND	
	CRITICAL PATH
TITLE I — CONCEPTUAL DESIGN	
TITLE II — FINAL DESIGN	
TITLE III — CONSTRUCTION MANAGEMENT	

3

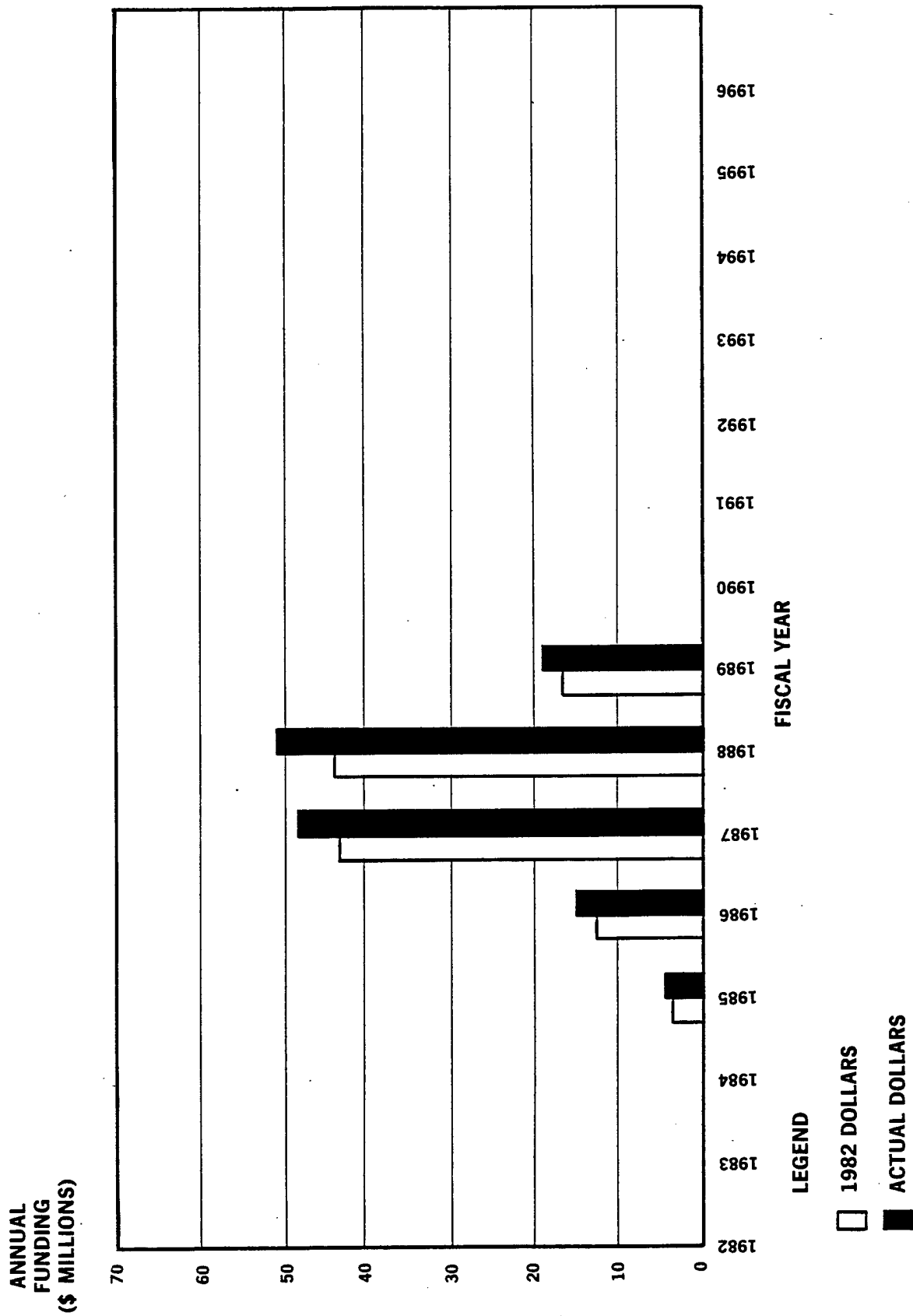
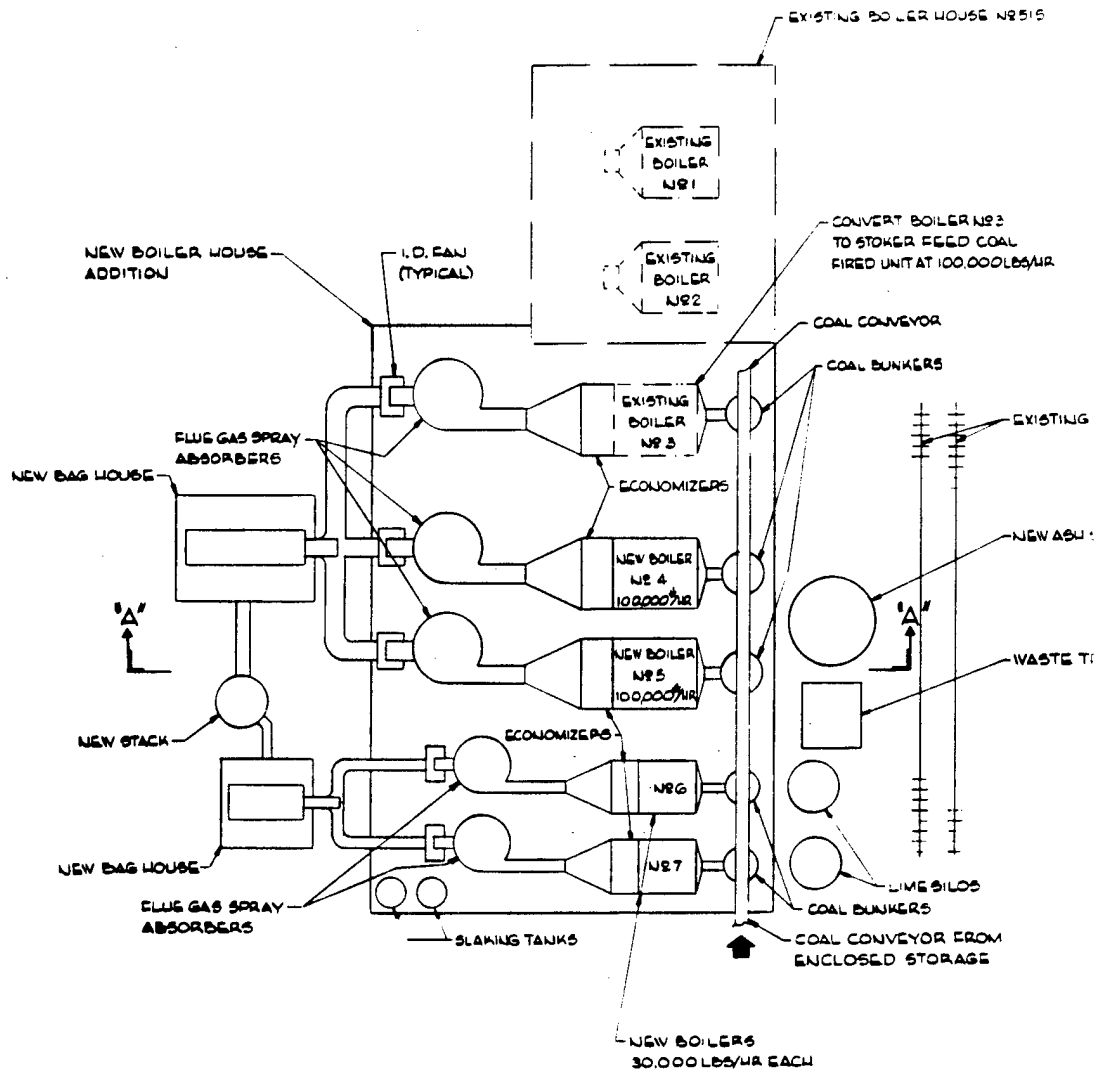
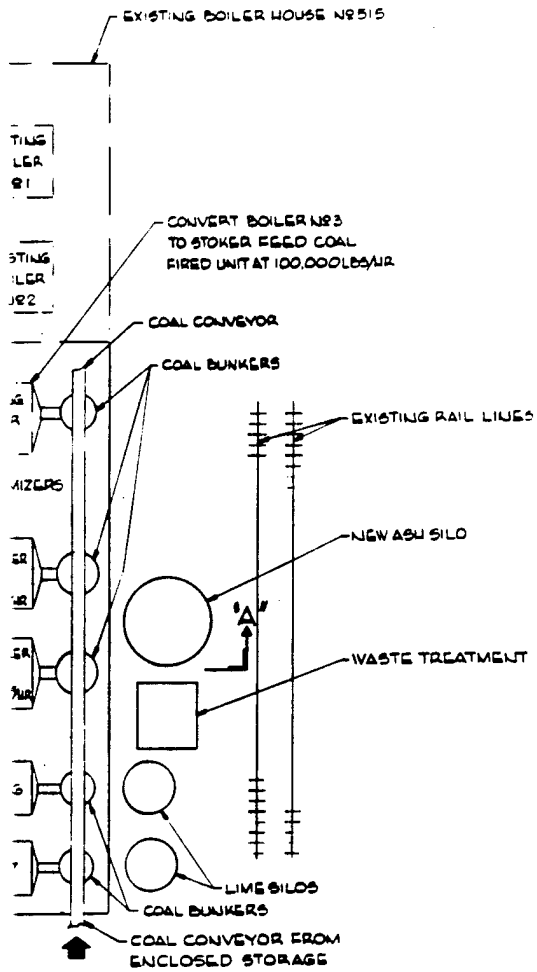


FIGURE 6
FUNDING PROFILE
TWIN CITIES ARMY AMMUNITION PLANT

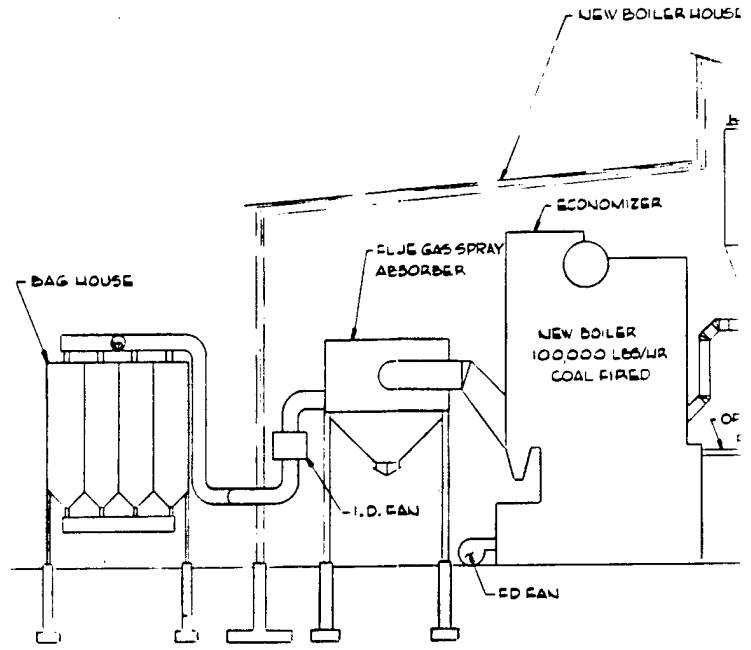


B-515 ADDITION
SCALE: NONE

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BOILERS 6
100,000 LBS/HR EACH



SECTION 'A-A'
SCALE: NONE

METHOD "C"

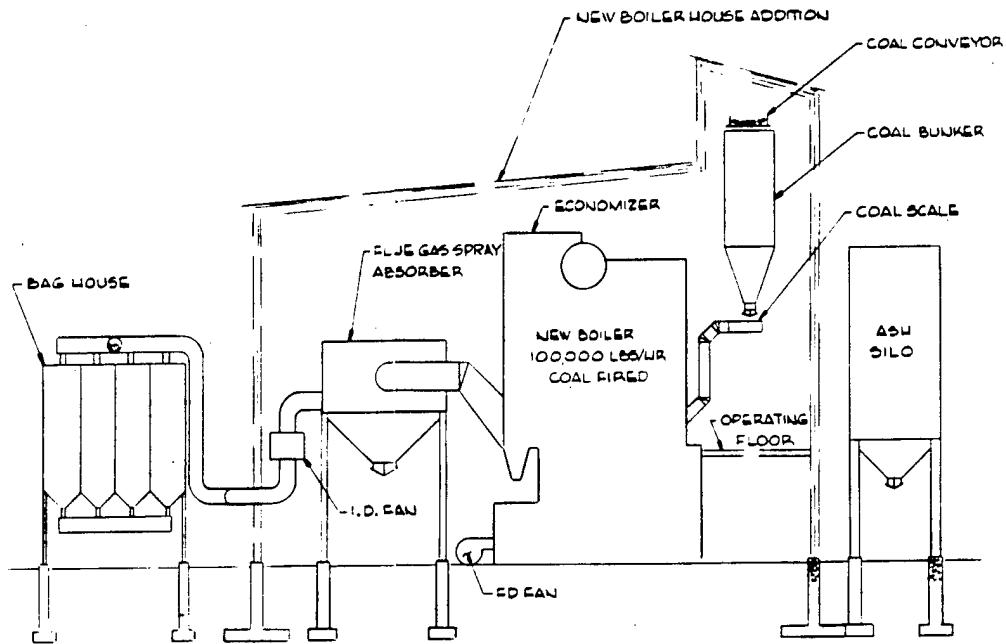
DATE	DESIGNED BY	STEAM PC
	DRAWN BY	TWIN CITIES
	CHECKED BY	PLAN &
	SUBMITTED BY	STEAM
	APPROVED BY	
	CHIEF, DESIGN DEPARTMENT	CHIEF, ENR
	APPROVED	



THIS PLAN ACCOMPANIES CONTRACT NO. DAC445
MODIFICATION NO.

CED. S. E. DISTRICT ENGINEER

9



SECTION 'A-A'
SCALE: NONE

METHOD "C"

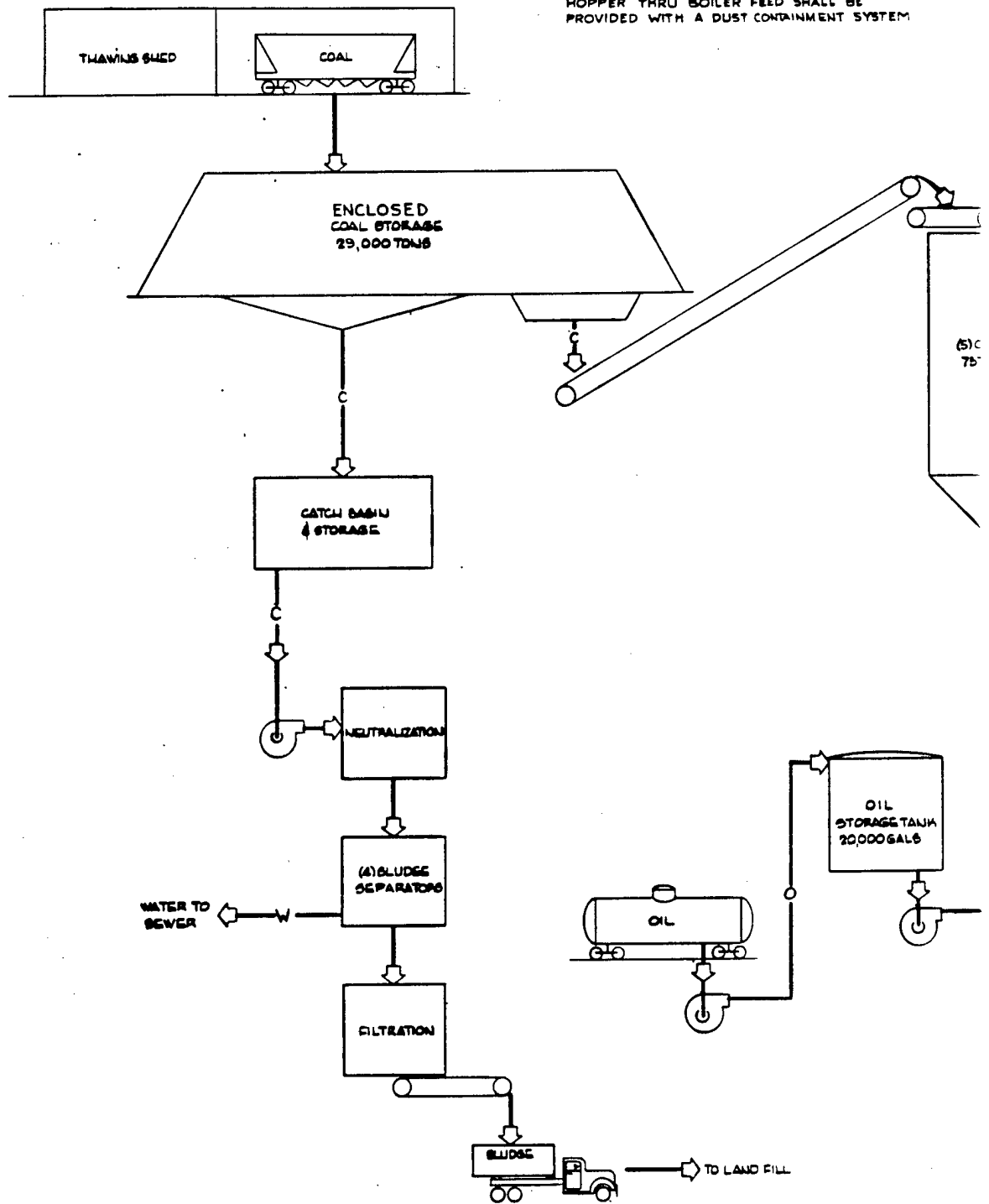
DATE	DESCRIPTION	MADE	APPROV
REVISIONS			
SANDERS & THOMAS, INC. <small>CONSULTING ENGINEERS 1001 S. 10th St., Omaha, Neb. 68102</small>		U. S. ARMY ENGINEER DISTRICT OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
DESIGNED BY: EMJ	STEAM POWER PLANT MODERNIZATION		
DRAWN BY: OT	TWIN CITIES ARMY AMMUNITION PLANT		
CHECKED BY: DPL	PLAN & SECTION NEW COAL FIRED		
SUBMITTED BY:	STEAM PLANT - BUILDING 515		
APPROVED BY:	DATE:	DATE:	
CHIEF DESIGN ENGINEER:	CHIEF ENGINEERING DIVISION:	JULY 14, 1982	
APPROVED:	SCALE: AS SHOWN	SHEET NO. DACA45	
THIS PLAN ACCOMPANIES CONTRACT NO. DACA45		MODIFICATION NO.	
SANDERS & THOMAS, INC.		ENGINEER	
U. S. ARMY DISTRICT ENGINEER		SHEET	



FIGURE 7

3

NOTE:
 COAL HANDLING SYSTEM FROM CAR DUMPING
 HOPPER THRU BOILER FEED SHALL BE
 PROVIDED WITH A DUST CONTAINMENT SYSTEM

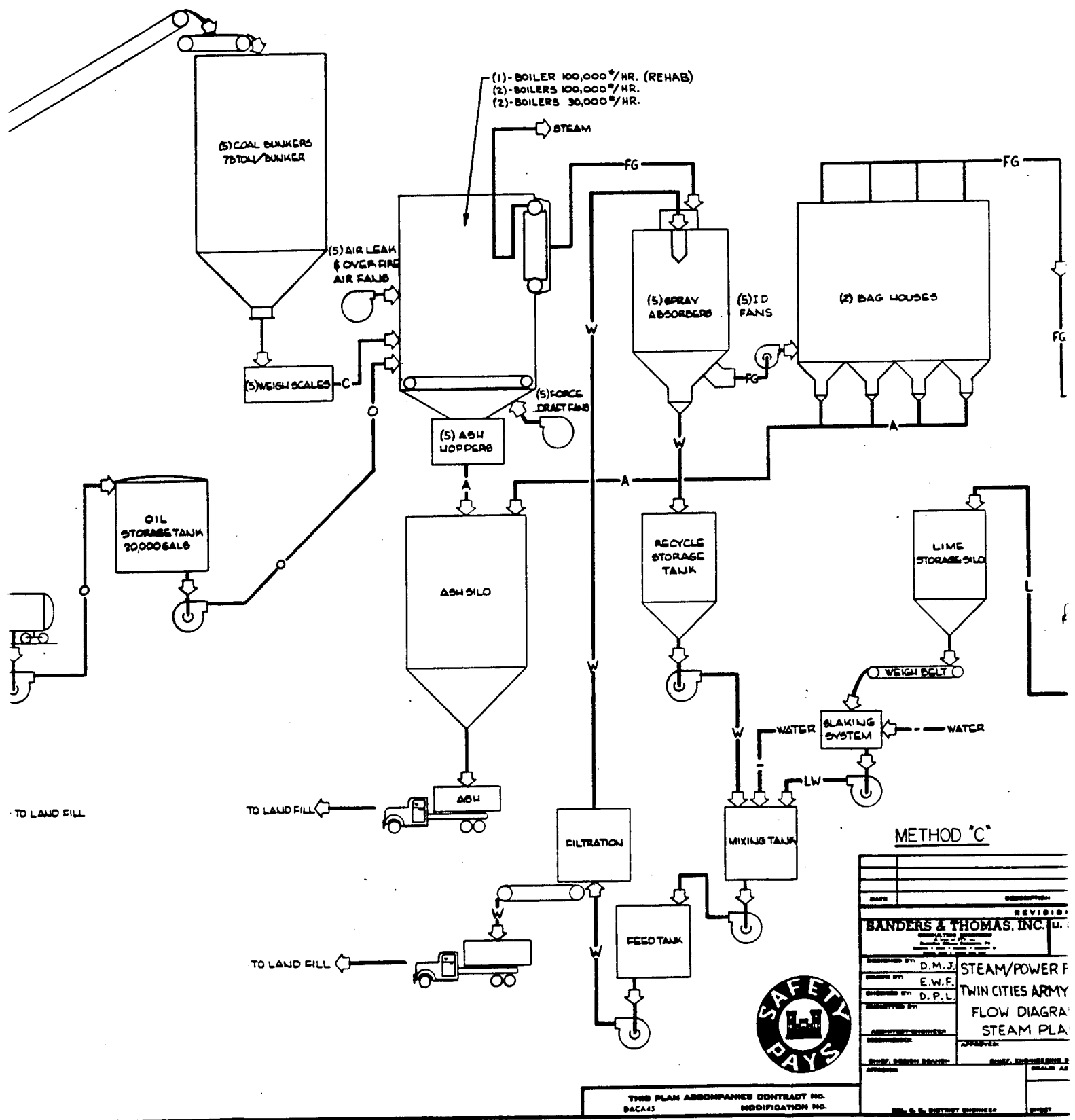


LEGEND:

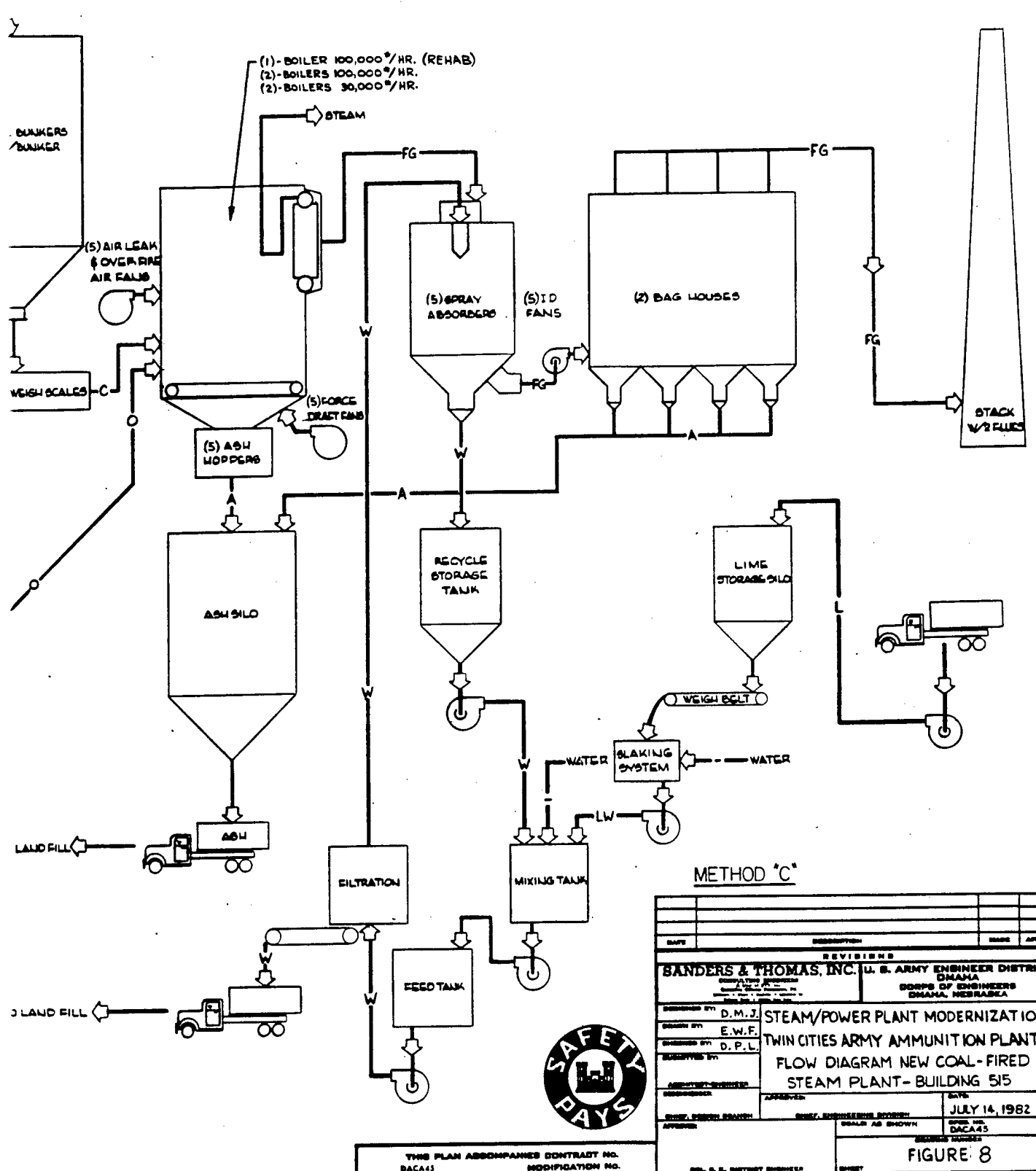
- C — COAL
- O — OIL
- — — WATER
- W — WASTE
- A — ASH
- FG — FLYE GAS
- L — LIME
- LW — LIME (BLAKED)

①

SYSTEM FROM CAR DUMPING
 BOILER FEED SHALL BE
 A DUST CONTAINMENT SYSTEM



2



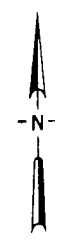
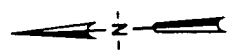
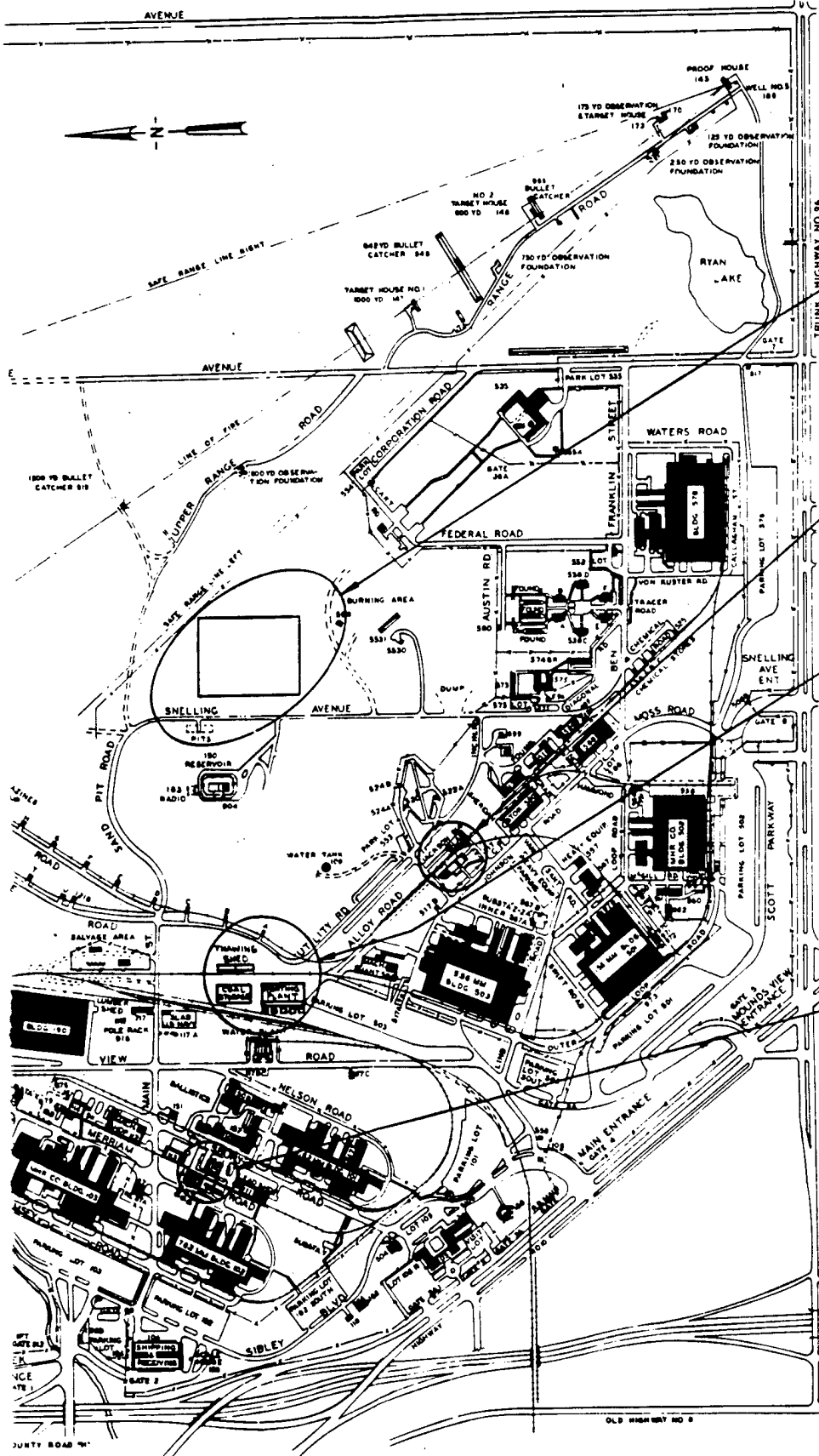
METHOD 'C'

DATE	DESCRIPTION	NAME	APPROV
REVISIONS			
BANDERS & THOMAS, INC.		U. S. ARMY ENGINEER DISTRICT OMAHA	
GENERAL ENGINEER		CORPS OF ENGINEERS OMAHA, NEBRASKA	
DESIGNED BY D. M. J.	STEAM/POWER PLANT MODERNIZATION		
DESIGNED BY E. W. F.	TWIN CITIES ARMY AMMUNITION PLANT		
DESIGNED BY D. P. L.	FLOW DIAGRAM NEW COAL-FIRED STEAM PLANT-BUILDING 515		
APPROVED BY	DATE	JULY 14, 1982	
SCALE AS SHOWN	SCALE AS SHOWN	DRAWING NO. DACA45	
THIS PLAN ACCOMPANIES CONTRACT NO. DACA45		MODIFICATION NO.	



FIGURE 8

3



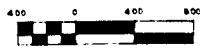
PROPOSED ASH DISPOSAL AREA.

EXISTING HEAT GENERATING PLANT NO 515
LOCATION FOR METHODS B AND C

METHOD A-NEW CENTRAL PLANT LOCATION

EXISTING HEAT GENERATING PLANT NO 115.

SCALE IN FEET

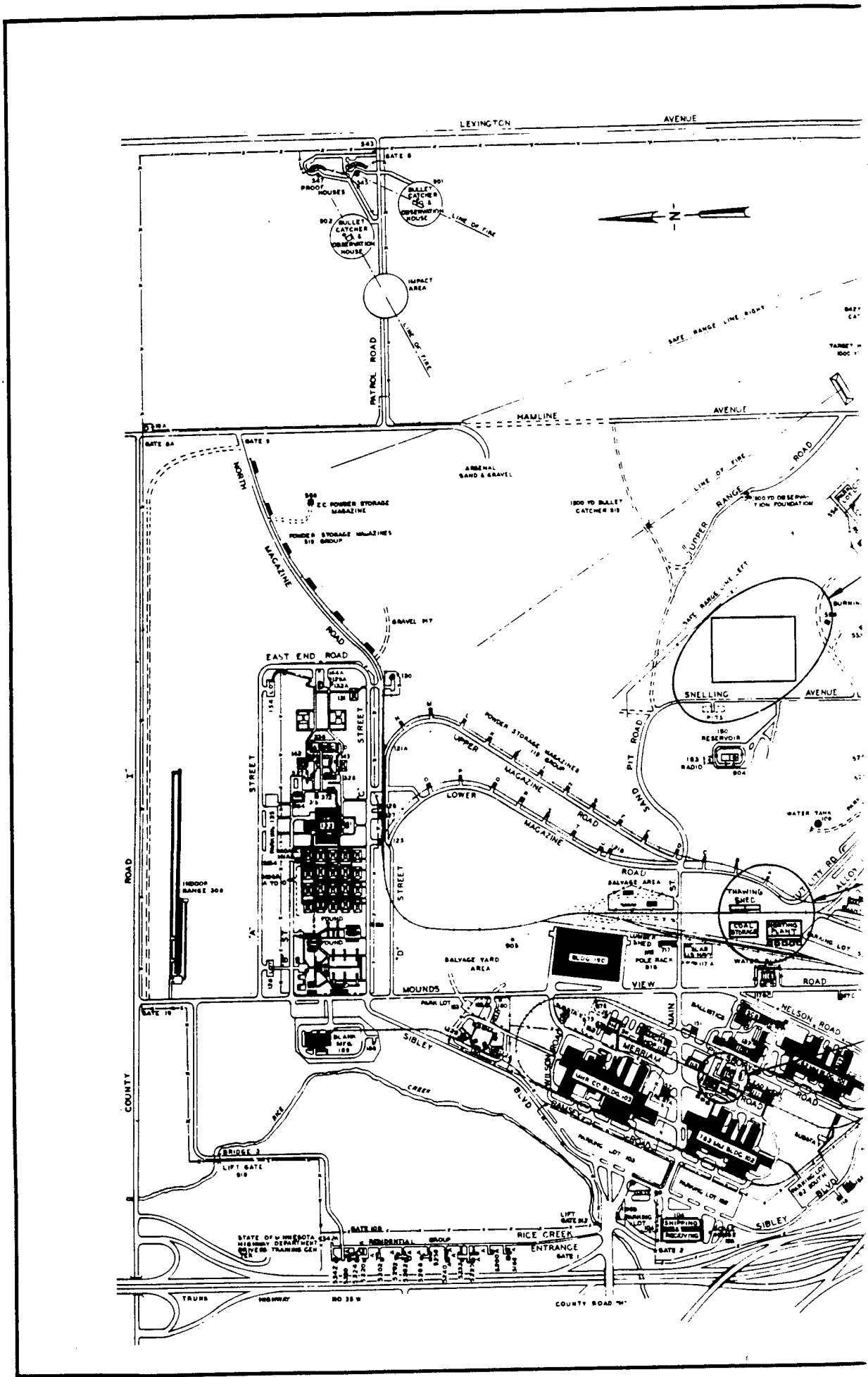


SANDERS & THOMAS, INC.
CONSULTING ENGINEERS
1000 W. 10th Street
Sioux Falls, S.D. 57104

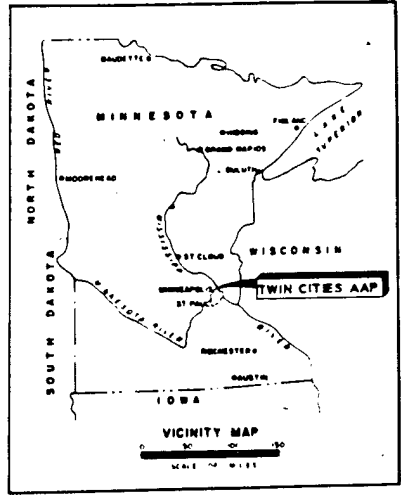
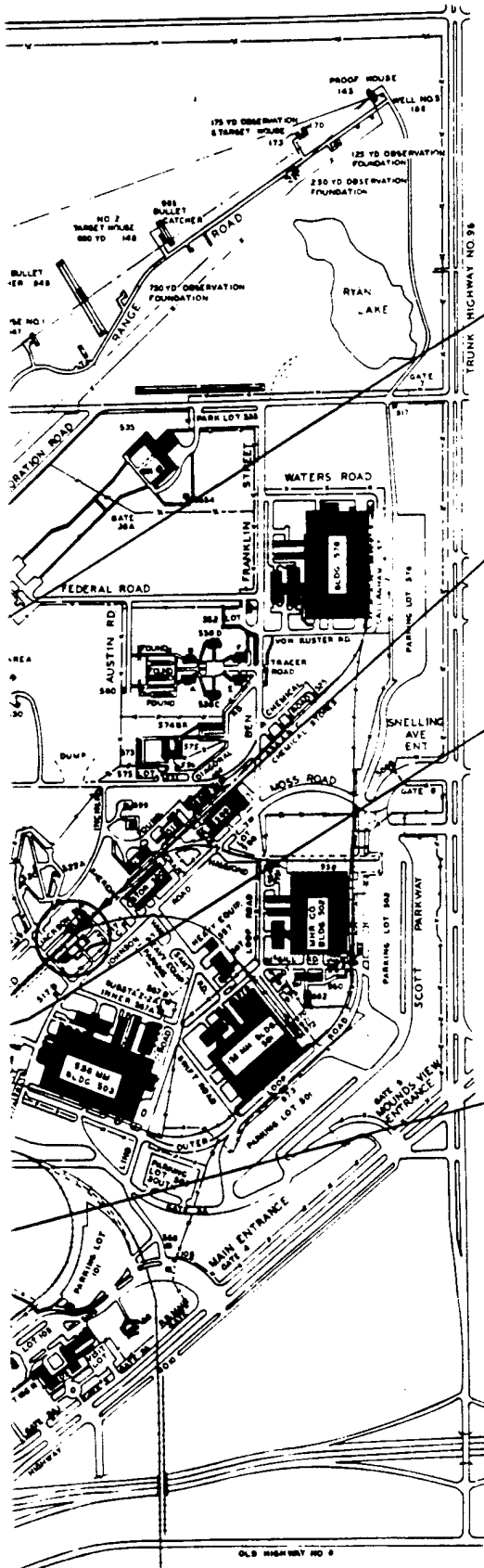
THIS PLAN ACCOMPANIES CONTRACT NO.
DACA 487 CO MODIFICATION NO.

DATE		
U. S. ARMY ENGINEERING CORPS		
DESIGNED BY	D.M.J.	STEAM
DRAWN BY	E.W.F.	
CHECKED BY	D.P.C.	TWIN CITY
APPROVED BY		
DESIGNED	DESIGN	
RECORDED	APPROVED	
DESIGN	DESIGN	
APPROVED	APPROVED	

COL. S. L. BENTLEY DISTRICT



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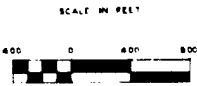


PROPOSED ASH DISPOSAL AREA.

EXISTING HEAT GENERATING PLANT NO 515
LOCATION FOR METHODS B AND C

METHOD A - NEW CENTRAL PLANT LOCATION

EXISTING HEAT GENERATING PLANT NO 115.



SANDERS & THOMAS, INC.
CONSULTING ENGINEERS

THIS PLAN ACCOMPANIES CONTRACT NO. **DACA 487 CO**
MODIFICATION NO.

DATE	DESCRIPTION	MADE	APPROV
REVISIONS			
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
DESIGNED BY	D.M.J.	STEAM/POWER PLANT MODERNIZATION TWIN CITIES ARMY AMMUNITION PLANT SITE PLAN	
DRAWN BY	E.W.F.		
CHECKED BY	D.P.C.		
SUBMITTED BY			
UNIT	SECTION	APPROVED	DATE
RECORDED			DEC 14, 1982
UNIT DESIGN	BRANCH	UNIT ENGINEERING DIVISION	SCALE AS SHOWN
APPROVER			DACA 487 CO
DRIVING FORCE			FIGURE 9

3