

KAISER ENGINEERS, INC.
MIDDLETOWN, OHIO

FINAL PROJECT REPORT

ARMCO STEEL CORPORATION

POLLUTION ABATEMENT - PICKLING WASTE DISPOSAL

PROJECT NO. 7186

MARCH 1, 1970

DISTRIBUTION:

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FROM:

D. B. Watson 3/1/70
D. B. WATSON DATE

APPROVED:

S. G. Imherr 3/1/70
S. G. IMHERR DATE

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FINAL PROJECT REPORT
STEAM DISTRIBUTION SYSTEM

PROJECT NO. 7186

I PROJECT SUMMARY

1.0 General Description

Facilities provided by this project were designed to handle:

- (1) the unloading, storage and transfer of hydrochloric acid to be used in the pickling process at No. 4 and No. 5 Pickle Lines;
- (2) the collection, transfer, storage, filtration, and disposal of spent pickle liquor from the new Pickle Lines; and (3) the collection, transfer, treatment, and disposal of the rinse waters, including fume scrubber water, from the new Pickle Lines.

Three (3) Acid Unloading Pumps are provided to transfer fresh hydrochloric acid from two (2) tank car or truck unloading stations to two (2) 75,000 gallon tanks for storage. Two (2) acid transfer pumps are furnished to transfer the acid from the storage tanks to the pickle building for use in the pickling process.

Spent pickle liquor overflows from the first tanks of No. 4 and No. 5 Pickle Lines and is piped to a 1,000 gallon collection tank at each line. Three (3) pumps are provided at the No. 4 line collection tank area to transfer this spent pickle liquor to two (2) 75,000 gallon storage tanks located in the tank farm at the Pickle Waste Disposal Area. From storage, the spent liquor is pumped by

either one of two pumps through precoat filters for removal of suspended matter and then to one or the other of two disposal wells. At the disposal well, an injection pump housed inside a pump enclosure pumps the spent liquor into the disposal well for disposal into the Mount Simon sandstone strata located at a depth of approximately 3,000 feet below grade.

Pickle rinse waters from No. 4 and No. 5 pickle lines are collected in a 12,000 gallon tank at each line. Three (3) pumps are provided at the No. 4 pickle line collection area to pump the rinse water to two (2) elevated 45,000 gallon surge tanks located in the tank farm at the Pickle Waste Disposal Area from which it flows by gravity through the treatment facilities. Treatment includes neutralization, aeration, flocculation and clarification. Clarified effluent flows into a twenty million gallon holding lagoon before final discharge into Dicks Creek. Clarified slurry is pumped to vacuum filters, dewatered and the filter cake removed by gondola car for ultimate use in the blast furnaces. Design provides 100% expansion capabilities for future pickle lines.

A building is provided to house pumps, filtration equipment, limestone bins, air compressors and a control room. Approximately 6,450 square feet of floor space is under roof.

A more detailed description of this project is included in Engineering Report 7186, dated July 15, 1967.

The need for this facility is required to meet State and Federal Restrictions for adequate lake and stream pollution control.

2.0 Project Authorization

The Engineering Report for this project was issued July 15, 1967 and an Appropriation Request for \$3,340,000 was submitted on August 3, 1967. Armco Corporate Management approved the Appropriation Request on September 28, 1967.

3.0 Project Personnel

Armco Program Engineer	-	T. R. Foley
Armco Project Engineers	-	L. Boehm
	-	T. L. Taubken
Armco Task Force Chairman	-	J. E. Barker
Armco Electrical Engineer	-	D. E. Brunswick
Kaiser Project Engineers	-	R. D. Smith
	-	R. C. Hulseman
	-	D. B. Watson
	-	K. D. Killin

4.0 Project Progress

The issuance of the Engineering Report, Request for Appropriation, and approval of the Request for Appropriation are as outlined in Section 2.0.

Detail design was started August 1, 1967 and was primarily the responsibility of Kaiser Engineers' Chicago Office, except for that portion of the project which falls inside the battery limits of the Pickle Line and was accomplished by Kaiser Engineers' Pittsburgh Office. The efforts of both Design Offices were augmented by the Project Technical Staff. Detail design was essentially complete on November 1, 1968.

The following drawings and specifications were prepared by the Middletown Technical Staff for the Pickling Waste Disposal Project:

Drawings

Scoping	5
Civil	3
Piping	4
Electrical	23
Instrument	2

Specifications

Performance	5
Subcontract	4
Equipment	18

In addition to the above, a Test and Start-Up Manual was also prepared by the Project Technical Staff.

Total design effort of the two Kaiser Engineers' Design Offices
is summarized as follows:

CHICAGO OFFICE

	<u>Manhours</u>		<u>Drawings</u>		
	<u>Actual</u>	<u>Budget</u>	<u>Actual</u>	<u>Budget</u>	<u>Hrs/Dwg</u>
Structural	4,435	4,940	30	38	148
Architectural	774	1,100	5	11	155
Civil	1,226	300	14	3	88
Piping	8,423	4,900	35	36	241
Instrument	2,597	2,240	23	16	113
Electrical	5,663	6,180	54	95	105
Follow-Up	(Included)	2,800	--	--	--
Supervision	1,157	1,000	--	--	--
Steno-Clerical	<u>1,983</u>	<u>1,500</u>	<u>--</u>	<u>--</u>	<u>--</u>
TOTAL	26,258	24,960	161	199	155

PITTSBURGH OFFICE

	<u>Manhours</u>		<u>Drawings</u>		
	<u>Actual</u>	<u>Budget</u>	<u>Actual</u>	<u>Budget</u>	<u>Hrs/Dwg</u>
Structural	212	780	3	6	71
Piping	1,488	1,690	13	13	114
Electrical	386	570	7	6	55
Supervision	143	150	--	--	--
Steno-Clerical	<u>268</u>	<u>225</u>	<u>--</u>	<u>--</u>	<u>--</u>
TOTAL	2,497	3,415	23	25	109

Detail design was completed in April 1969.

Major procurement activity for engineered equipment began in July 1967 and was essentially complete in February 1969. A total of approximately forty (40) purchase orders (excluding field purchase orders) were processed and no major delays in delivery were encountered to affect construction progress.

Construction activity by Kaiser Engineers' Field Forces commenced in August 1969, although there had been some subcontract activity prior to that. A preliminary safety inspection was made on February 25, 1969 and a final inspection was conducted April 28, 1969. Subcontract involvement covered the following areas of construction activity:

<u>Subcontract</u>	<u>Subcontractor</u>
1. Furnish and install clarifier thickener	Walker Process
2. Drill and test No. 1 Injection Well	American Industrial Disposal System
3. Furnish storage and surge tanks	Justin Enterprises
4. Pollution abatement structure masonry	Bilbrey Masonry Construction
5. Heating and ventilating	Norm Woolley Company
6. Furnish structural steel	Dave Steel
7. Drill and test No. 2 Injection Well and hang tubing in No. 1 and No. 2 Well	International Pollution Control

II PROJECT SCHEDULE

The schedule outlining the proposed and actual progress of the Project is shown on the following page.

The extension of the project schedule beyond the original completion date was caused partially by a craft strike during the summer of 1968. Also, in some instances it was necessary to delay tests until the system was complete rather than to test by increments.

ISSUED: 3/1/70
REVISED:

LEGEND

ACTUAL	10/20/68	ACTUAL & COMPLETE	10/20/68	DATE OF ISSUE	10/20/68	FORECAST	10/20/68
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PROJECT SCHEDULE

POLLUTION ABATEMENT - PICKLING WASTE DISPOSAL
ARMCO STEEL CORPORATION, MIDDLETOWN, OHIO

ISSUED: 3/1/70
REVISED:

[illegible]

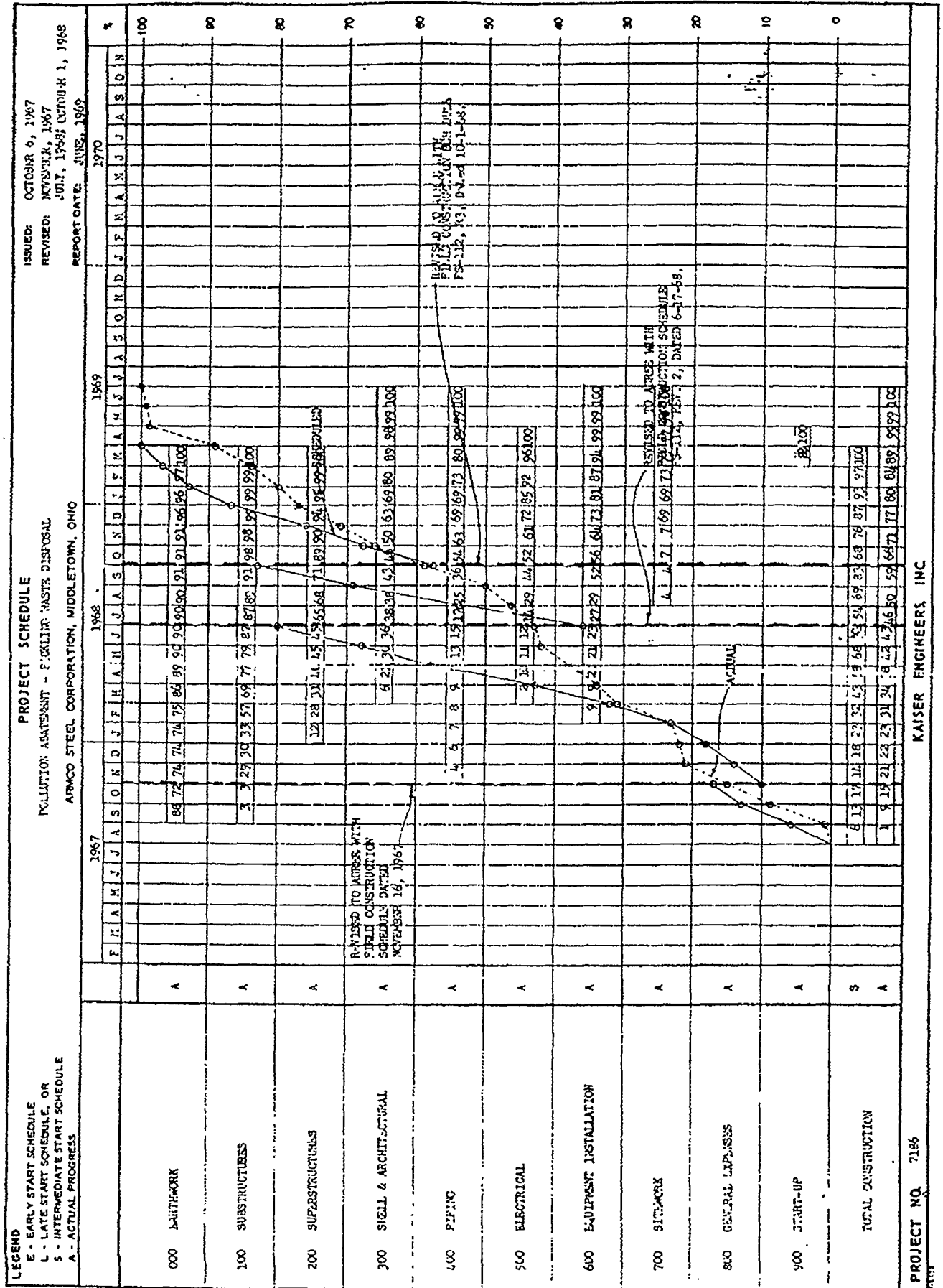
PROJECT NO. 7186

KAISER ENGINEERS, INC.

[illegible]

1 OF 2

LEGEND		DATE OF ISSUE											
ORIGINAL OR ESTIMATED SCHEDULE		FORECAST											
ACTUAL		ESTIMATED & COMPLETE											
ACTUAL & COMPLETE		ESTIMATED & COMPLETE											
ORIGINAL OR ESTIMATED SCHEDULE		FORECAST											
ACTUAL		ESTIMATED & COMPLETE											
ACTUAL & COMPLETE		ESTIMATED & COMPLETE											
PROJECT SCHEDULE		3/1/70											
POLLUTION ABATEMENT - PICKLING WASTE DISPOSAL		ISSUED: 3/1/70											
ARMCO STEEL CORPORATION, MIDDLETOWN, OHIO		REVISION:											
INCREMENTS		1969											
1. PROJ ENG THRU APPRO REQUEST		J F M A M J J A S O N D J F M A M J J A S O N D											
2. PROJ ENG AFTER APPRO REQUEST		J F M A M J J A S O N D J F M A M J J A S O N D											
3. DETAIL DESIGN		J F M A M J J A S O N D J F M A M J J A S O N D											
a. STRUCTURAL		J F M A M J J A S O N D J F M A M J J A S O N D											
b. ARCHITECTURAL		J F M A M J J A S O N D J F M A M J J A S O N D											
c. MECHANICAL		J F M A M J J A S O N D J F M A M J J A S O N D											
d. CIVIL		J F M A M J J A S O N D J F M A M J J A S O N D											
e. PIPING		J F M A M J J A S O N D J F M A M J J A S O N D											
f. INSTR		J F M A M J J A S O N D J F M A M J J A S O N D											
g. ELECTRICAL		J F M A M J J A S O N D J F M A M J J A S O N D											
h. SPECIFICATIONS		J F M A M J J A S O N D J F M A M J J A S O N D											
TOTAL DETAIL DESIGN INCLUDES CHICAGO AND PITTSBURGH		J F M A M J J A S O N D J F M A M J J A S O N D											
PROJECT NO. 7186		KAISER ENGINEERS, INC.											
REPORT DATE FINAL		2 OF 2											



III FINAL SUMMARY COST AND COMPARISON

A tabulation of final cost compared with the official budget is shown on the following page. Following is a list of the accounts with expenditures \$5,000 greater or less than the appropriated budget and the reasons for the variations:

Project Section 201 - A cost in excess of the budget in this project section reflects the decision to extend the height of the structure for the full length of the north bay to totally enclose the limestone bins under roof.

Project Section 202 - A final savings in cost below the original budgeted figure reflects a lower cost for the Armco enclosures than was provided for in the estimate.

Project Section 401 - Costs less than the original estimate in this project section reflect the nature of the entire project; namely research and development. Costs of actual equipment, as finally designed, were less than anticipated during development and scoping.

Project Section 402 - Cost savings in this project section fall into the same category as those for Project Section 401.

Project Section 404 - Costs less than the original budget reflects decision to change from unit substation concept to separate items and also of inexpensive overhead primary conductor routing to air breaker switches and transformers rather than underground routing.

Project Section 405 - A cost saving in this project section is realized due to less outdoor lighting requirements than had been anticipated.

Project Section 406 - Cost savings in this project section result from lower costs on the second well due to intelligence gained from the drilling of the first well.

Project Section 450 - Final design indicated less instrumentation requirements than had been anticipated and thus indicates a cost savings in this section.

Project Section 460 - Costs exceeding the original estimate were recorded in this project section due to the change in foundation and trench concept from that which was originally scoped. The tanks were set on elevated pads rather than making trenches depressed.

Project Section 461 - An overrun was experienced in this project section due to the need for additional pipe supports caused by the extensive use of fibercast and chemtite pipe.

Project Section 462 - Considerable savings were incurred in this section due to the savings in excavation cost realized by using the existing borrow pit as the location of the final lagoon. Construction costs were also less than had been provided for.

Project Section 463 - This project section was deleted due to the decision to proceed with the erection of the clarifier for the Cold Mill Waste Disposal Project at this time, thus making it available and eliminating the need for an emergency lagoon.

Project Section 475 - Development of detail design indicated much less miscellaneous steel requirement than had been provided for and reflects a cost less than the original budget for this project section.

Project Section 625 - An overrun in this project section reflects the extended time required for start-up due to the nature of the schedule. Start-up and construction completion were being accomplished concurrently which minimized efficiency.

Project Section 645 - Some equipment which was originally scoped under the Cold Mill Waste Project was integrated into the Pickling Waste Project and additional costs incurred are reflected in an overrun in this project section.

Project Section 701 - Costs over and beyond those provided for in the original budget were incurred by the addition of the compressed air piping to the aeration tank to augment the aeration mixer.

Project Section 704 - Addition of safety showers over and beyond those that were scoped and the addition at each pickle line collection area of a system for tempering Spent Pickle Liquor temperatures caused an overrun in this project section.

Project Section 706 - Steam piping requirements exceeded those anticipated at the time the original estimate was made. This was partially attributable to the need to provide for the addition of the Cold Mill Waste Disposal at a later date.

Project Section 710 - The use of fibercast pipe and envelope type gaskets created some construction problems and required considerable rework of this piping. Changes during the design period due to the research and development nature of this project also contributed to the cause of the costs in excess of the original budget in this project section.

Project Section 711 - The cost in excess of the estimate for this project section is essentially attributable to the same causes as those for Project Section 710.

Project Section 712 - Costs above the estimate reflect the use of polypropylene lined pipe and fittings for this service which necessitates shop fabrication of all pipe. Again, changes during design also caused additional expense due to the nature of the piping material.

Project Section 730 - Cost savings in this project section over and beyond that which was provided for in the initial budget indicate less underground piping required than anticipated.

Project Section 801 - Overrun in costs in this section indicate additional raceways required due to the addition of the Emergency Motor Control Center, adding one manhole and moving the Control Room and Outdoor Substation.

Project Section 802 - Costs exceeding budgeted figures reflect the added costs incurred due to purchase of an emergency generator larger than the one that was scoped, plus auxiliary equipment for the generator. The purchase of the additional Emergency Motor Control Center, plus costs incurred due to the addition of one manhole, also contributed to an overrun in this project section.

Project Section 803 - Costs in excess of those provided for in the original budget were incurred due to the integration of some of the Cold Mill Waste Disposal equipment into the Pickling Waste process at this time.

Project Section 880 - Cost savings for this project section reflect actual cost less than was provided for in the original estimate.

Project Section 920 - The costs over and beyond the original budget for this section again reflect the nature of the entire project. Time dictated that detail design proceed even though the actual process was in the lab and later, the pilot plant stage. Continued refinements and changes were dictated by findings in research and development.

Project Section 930 - Cost overrun in this project section reflects the extended schedule of the entire project. Due to rescheduling of the Pickle Line construction, the Pickle Waste Disposal Plant was rescheduled to concur with the Pickle Line completion. Additional costs in this project section were incurred due to the crafts' strike during the summer of 1968.

SUMMARY COST & COMPARISON TO ESTIMATE REPORT

FINAL REPORT

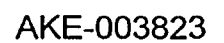
JOB NO. 6471-86 - Pollution Abatement Report Date: 3/1/70
 Period Ending: Final

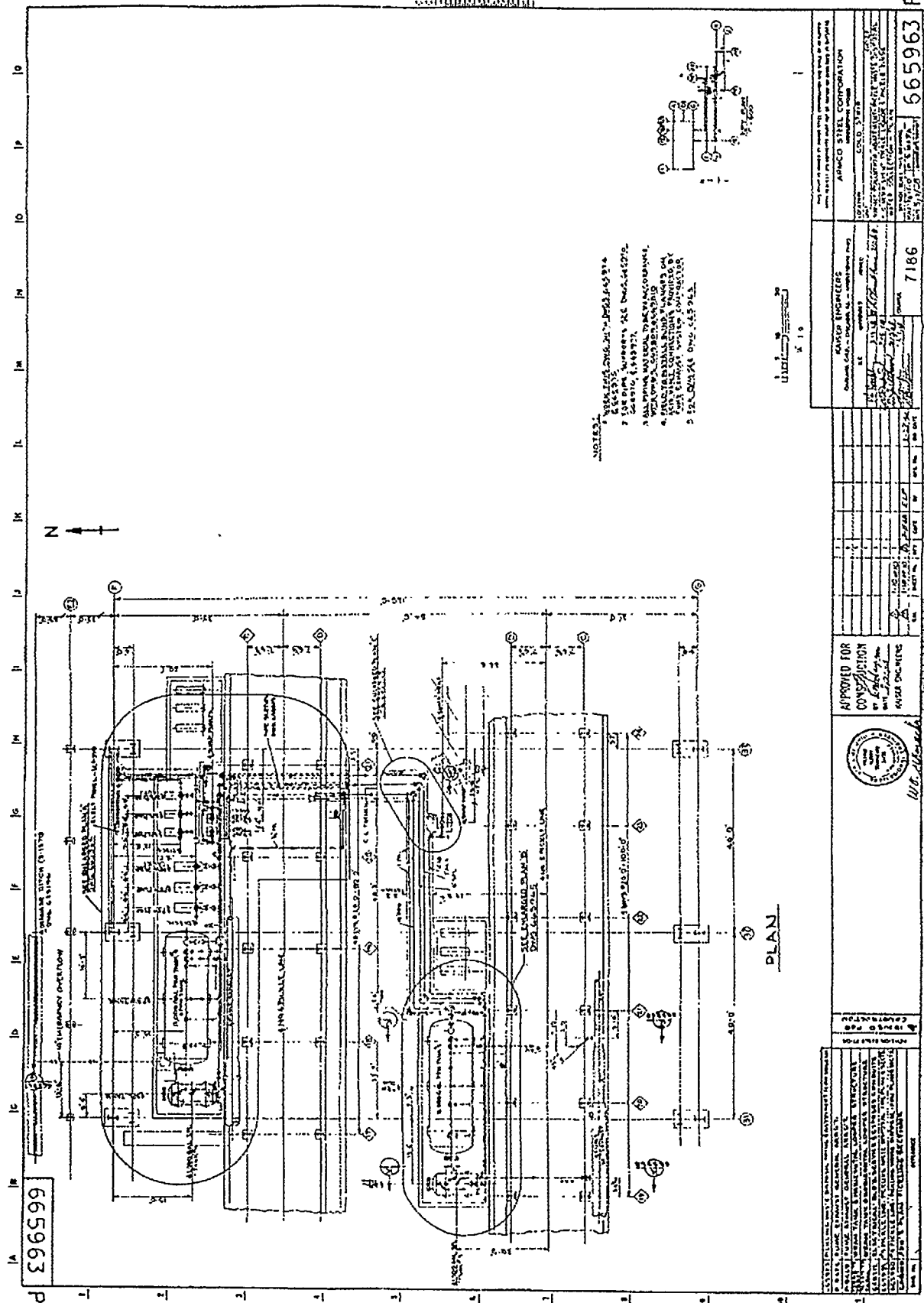
Project Section	Description	Total Recorded & Committed	Appropriated Budget	ESTIMATE AT COMPLETION			Percent Expended
				Current	Previous	Increase (Decrease)	
						(Over) Under Budget	
201	Pickle Waste Disposal Structure	278,020	158,300	278,020	278,020	(119,720)	100
202	Deep Well Pump Enclosure	16,232	40,200	16,232	16,232	23,968	100
203	Process Control Room	22,988	23,000	22,988	22,988	12	100
401	Spent Pickle Liquor Equipment	121,759	148,900	121,759	121,759	27,141	100
402	Pickle Rinse Water Equipment	240,356	264,100	240,356	240,356	23,744	100
403	Acid Handling Equipment	64,873	68,100	64,873	64,873	3,227	100
404	Electrical Equipment	131,725	143,300	131,725	131,725	11,575	100
405	Equipment Lighting	13,681	37,000	13,681	13,681	23,319	100
406	Deep Wells	343,151	352,900	343,151	343,151	9,749	100
450	Instrumentation	102,177	177,100	102,177	102,177	74,923	100
460	Clarifier & Tank Farm	158,029	131,100	158,029	158,029	(26,929)	100
461	Pipe Supports	54,744	35,200	54,744	54,744	(19,544)	100
462	Final Lagoon	90,091	141,600	90,091	90,091	51,509	100
463	Emergency Lagoon	53,400	53,400	53,400	53,400	0	100
475	Misc. Steel for Equipment	95,612	35,400	95,612	95,612	(60,212)	100
480	Paint & Grout Equipment	11,461	8,800	11,461	11,461	(2,661)	100
624	Vendor's Assistance - Mechanical	3,100	6,000	3,100	3,100	2,900	100
625	Contractor Start-Up - Mechanical	56,456	45,000	56,456	56,456	(11,456)	100
644	Vendor's Assistance - Electrical	1,123	3,000	1,123	1,123	1,877	100
645	Contractor Start-Up - Electrical	22,576	15,000	22,576	22,576	(7,576)	100
701	Compressed Air Piping	19,287	6,000	19,287	19,287	(13,287)	100
704	Well Water Piping	30,361	13,200	30,361	30,361	(17,161)	100
706	Steam Piping	33,987	9,700	33,987	33,987	(24,287)	100
710	Spent Pickle Liquor Piping	147,927	118,400	147,927	147,927	(29,527)	100
711	Pickle Rinse Water Piping	193,767	167,900	193,767	193,767	(25,867)	100
712	Acid & Acid Drain Piping	111,428	78,600	111,428	111,428	(32,828)	100
730	Earthwork for Piping	2,889	20,000	2,889	2,889	17,111	100
735	Insulation	9,239	5,600	9,239	9,239	(3,639)	100
740	Paint, Color Code & Tag	3,820	5,500	3,820	3,820	1,680	100
745	Cathodic Protection	934	1,000	934	934	66	100
801	Raceways	147,720	139,100	147,720	147,720	(8,620)	100
802	Power Distribution	41,954	25,300	41,954	41,954	(16,654)	100
803	Power & Control Wiring	37,604	29,500	37,604	37,604	(8,104)	100
804	Communications System Wiring	3,831	2,200	3,831	3,831	(1,631)	100
830	Equipment Grounding	10,552	10,200	10,552	10,552	(352)	100
880	Electric S/C Overhead & Fee	27,092	33,400	27,092	27,092	6,308	100
	TOTAL DIRECT	2,650,546	2,553,000	2,650,546	2,650,546	(97,546)	100

SUMMARY COST & COMPARISON TO ESTIMATE REPORT

FINAL REPORT

JOB NO. 6471-86 - Pollution Abatement		Report Date: 3/1/70					
		Period Ending: Final					
Project Section	Description	Total Recorded & Committed	Appropriated Budget	ESTIMATE AT COMPLETION		(Over) Under Appropriated Budget	Percent Expended
				Current	Previous		
920	Engineering & Staff	451,000	309,000	451,000	451,000	(142,000)	100
930	Construction Overhead	84,500	48,000	84,500	84,500	(36,500)	100
998	Contingency		390,000		390,000	390,000	100
TOTAL INDIRECT		535,500	747,000	535,500	535,500	211,500	100
TOTAL DESIGN & CONSTRUCTION		3,186,046	3,300,000	3,186,046	3,186,046	113,954	100
Other Related Costs (Armo)		(318,600)	40,000	(318,600)	(318,600)	358,600	100
TOTAL APPROPRIATION 6471-86		2,867,446	3,340,000	2,867,446	2,867,446	472,554	100





V PHOTOGRAPHS

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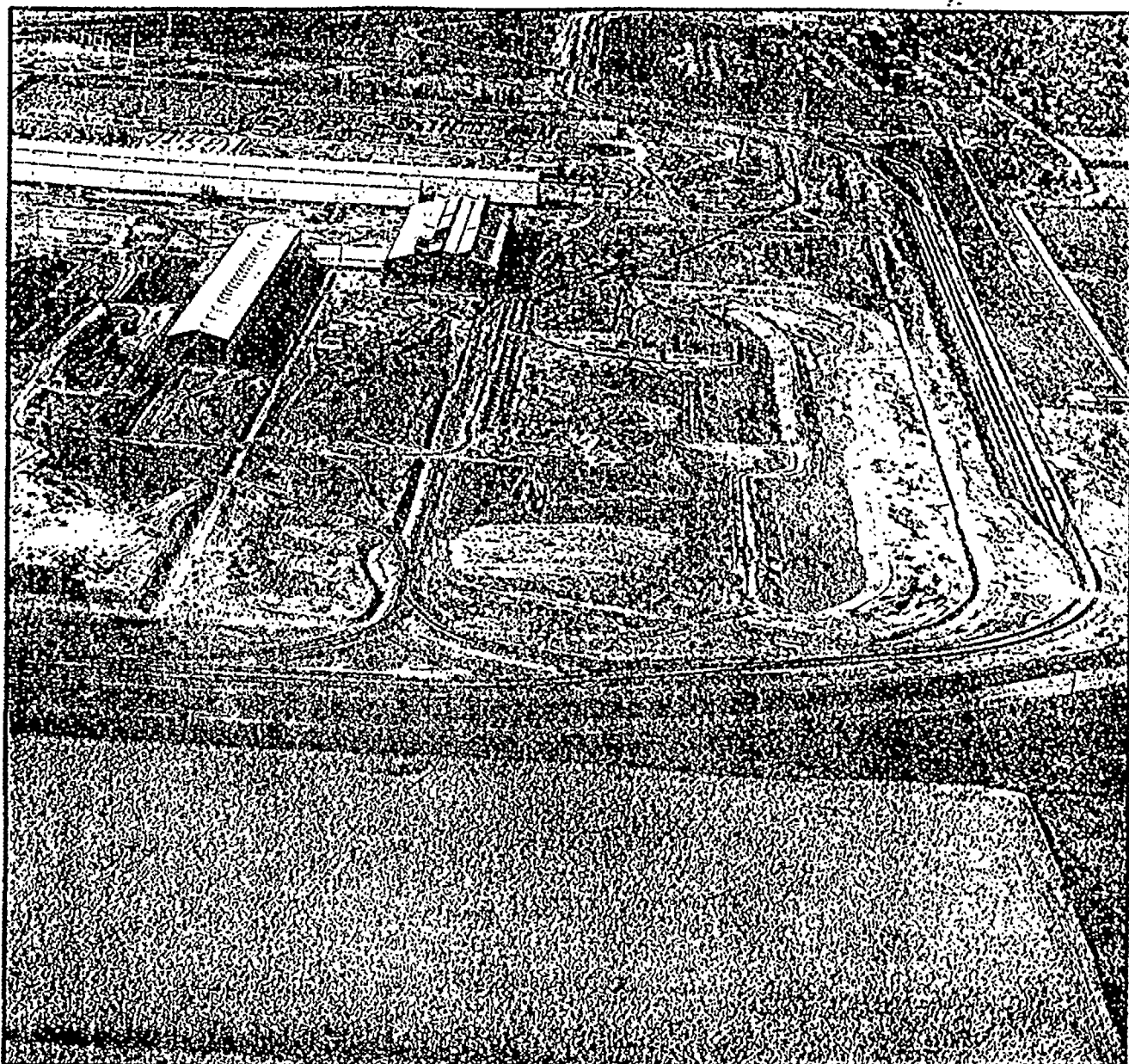


PHOTO NO. 1 - POLLUTION ABATEMENT - PICKLE WASTE DISPOSAL

This photo taken October 1967, looking west, shows the Final Lagoon excavation with Bentonite and Rip-Rap in place. Also shown is plant site prior to start of construction.

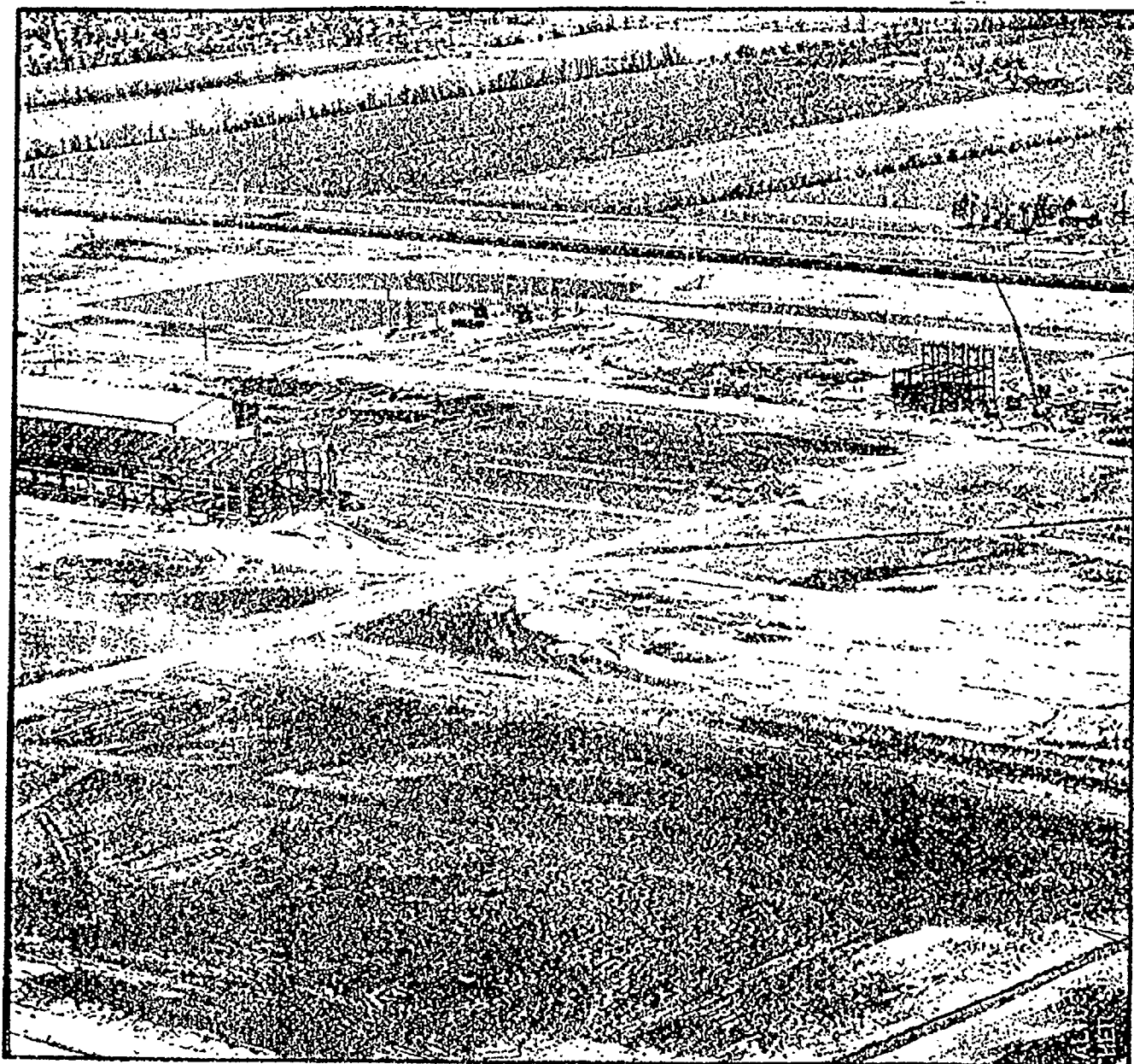


PHOTO NO. 2 - POLLUTION ABATEMENT - PICKLE WASTE DISPOSAL

This photo taken March 1968, looking northwest, shows the building steel essentially complete. Pickle Building and Pickle Coil Storage Building can be seen in left foreground.

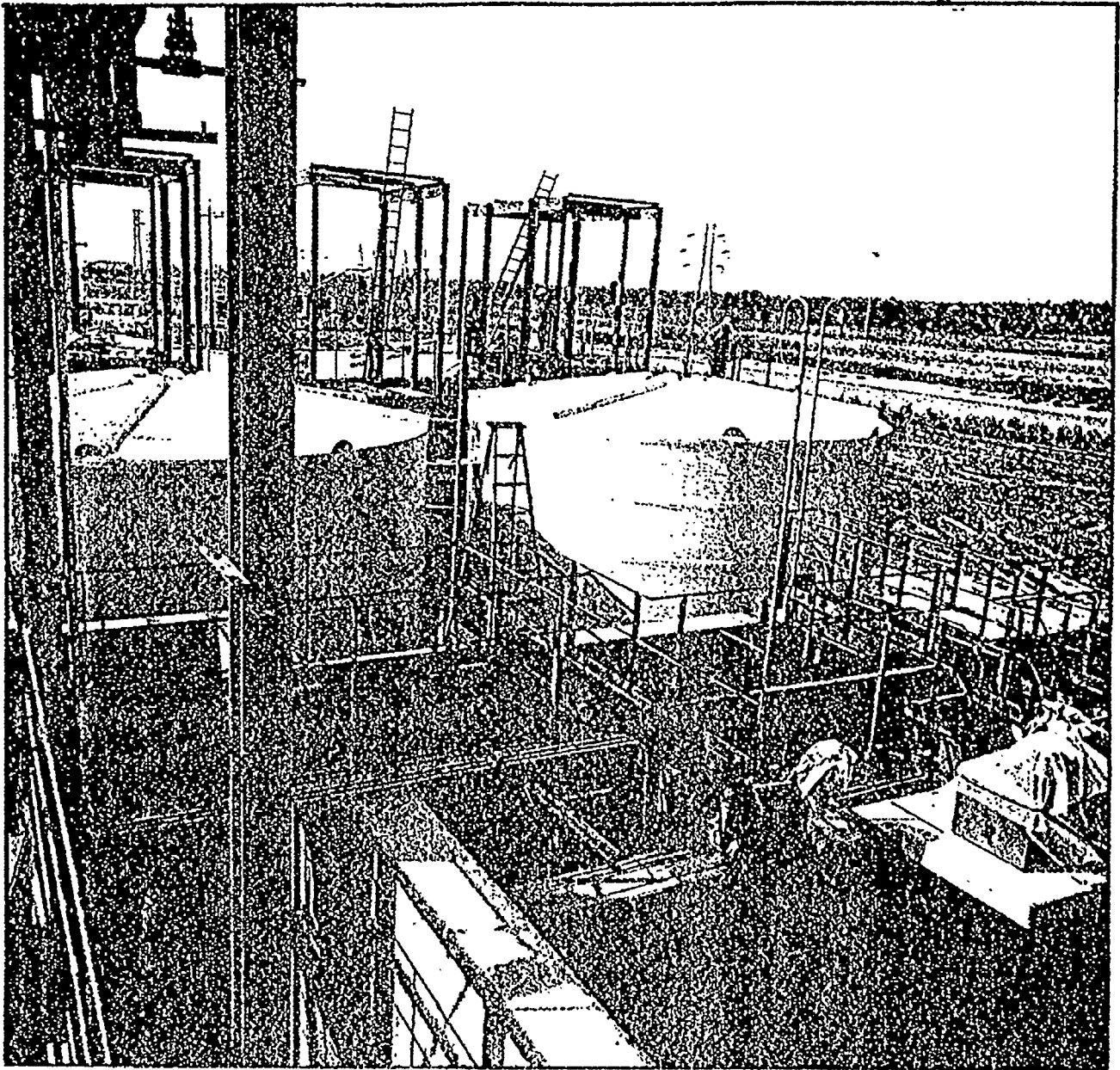


PHOTO NO. 3 - POLLUTION ABATEMENT - PICKLE WASTE DISPOSAL

This photo taken October 1968, looking west, shows the storage tanks in place in tank farm with Flocculator Tank and equipment in foreground. Pipe supports are being erected.

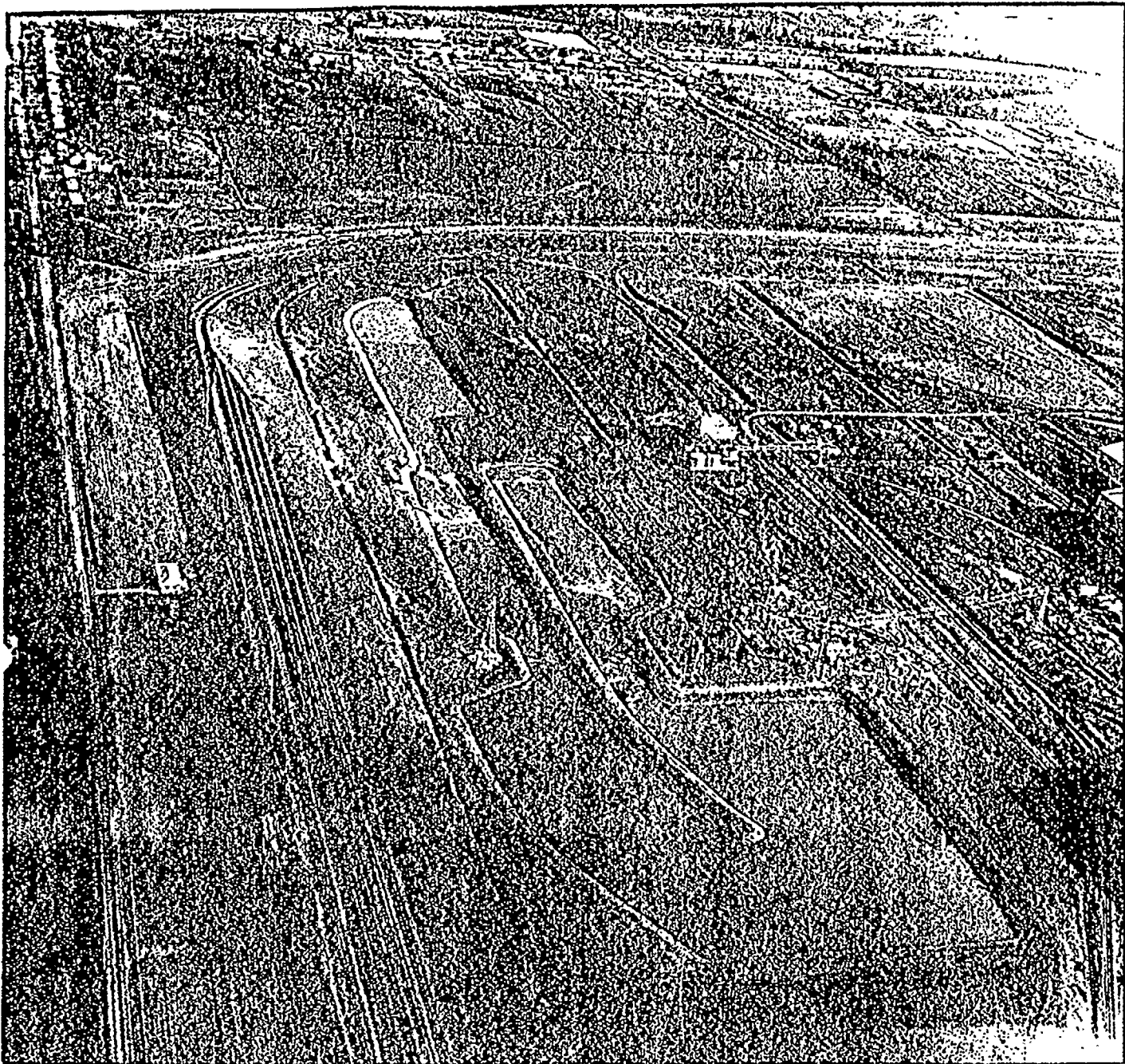


PHOTO NO. 4 - POLLUTION ABATEMENT - PICKLE WASTE DISPOSAL

This aerial view taken January 1969, looking east, shows the completed project. The two well enclosures are shown east and west of the main structure. Supports for pipe runs to and from the Pickle Line located in the right center of the picture.