Attach. 12

UMP000114

STATE OF MINNESOTA

DEPARTMENT Pollution Control

Office Memorandum

TO : Louis J. Breimhurst
Executive Director

DATE: February 12, 1981

THRU : Tim Scherkenbach

FROM : Terrance W. Kasen
Hazardous Waste Site Response Group
Division of Solid Waste

PHONE:

SUBJECT: GOPHER ORDINANCE PLANT DECOMMISSIONING

On Tuesday, February 3, 1981, I met with Dr. Fay Thompson of the Environmental Health Department, University of Minnesota, a former employee of the ordinance plant, and Mr. Bill Cook at the University facilities in Rosemount. The former employee was a fireman for duPont Company and worked on the site during construction, production, and decommissioning of the ordinance plant. The University has detailed plans and specifications of all production and treatment units used for the production of the ordinance. The MPCA received a copy of the New York State Task Report which mentions the Gopher ordinance works in Rosemount. Attached is this reference from the report.

I. Production History

The Gopher ordinance plan was in production for four months in 1946. The plant produced approximately 29 million pounds of smokeless gunpowder before production ended on August 15, 1946. One and one half of the four constructed production lines were used for this short time period. After closing all finished product was shipped to the ordinance facilities in New Brighton. The remaining munitions left on site was salvage taken from sunken ships and brought to the facilities for recycling and unfinished product.

The plant had raw products and facilities for the production of sulfuric acid, nitric acid, ammonia, alcohol, and ether. The plans showed a complete sewer and neutralization system to handle production wastes. These waste consisted mostly of acids which were neutralized with a limestone slurry. The employee stated that there were no major spills or burial of material and the neutralizing system was in operation. Dr. Thompson and I examined the records and found no evidence that recacitrant chemicals were used. The chemistry used for nitrocellulose production is very basic and would not create overtly dangerous byproducts. There was no evidence of any research.

II. Decommissioning/Decontamination

The records mention some decontamination was to take place and the employee stated that it indeed had. However, the definition of decontamination is unclear at this time. There is a Quitclaim Deed which states, "...the grantor (U.S. Government) hereinafter designated is unable to certify that the property has been decontaminated and is unable to state whether or not the same is safe for use;..." The U.S. Government had a contract with the duPont Company to decontaminate the facilities. I have placed request with the Defense Department

and duPont to provide the Agency with their definition of decontamination and a copy of the contract. The records do not show any chemicals were left on site except for a pile of sulfur which caught fire and was property managed by the University.

The employee described in some detail the "decontamination." All buildings used in the direct production of nitrocellulose were torn down and burned. All intermediate products and old munitions were burned in a designated area.

III. Resolution of Investigation

The Agency has received a copy of the New York Task Force report which mentions Rosemount a site of an Army ordinance plant. The report details the contamination problems of a New York ordinance plant. The New York plant produced TNT which requires a different process than production of nitrocellulose. There were many other chemicals produced also.

The Agency, hopefully, will receive the decontamination definition and contract from the Department of Defense and the duPont Company. Dr. Thompson and I do not believe there are chemicals of concern remaining after 34 years. There has not been any soil or ground water monitoring for this specific site. However, the University had created a disposal problem of its own and has been monitored.

Barring any further information from unknown sources the Agency should consider this investigation closed.

TWK/TKS:dc

that expert testimony, if it is taken at the hearing, wi further illuminate the issues raised herein. In addition, it urged that the responsible federal and state officials careful examine the site of the former TNT plant and definitive determine whether any significant contamination remains whi would affect the site's present use.

Residual Contamination at Other Former Army Ordnance Plants

Nine other ordnance plants, in addition to the LOOW sit were publicly offered for sale in December 1947 with the explici warning that:

> "these facilities are heavily contaminated with explosives and acids, and must be decontaminated by the purchaser."[96]

These sites are as follows:

West Virginia Ordnance Works, Point Pleasant, W. Va.;
Plum Brook Ordnance Works, Sandusky, Ohio,;
Kentucky Ordnance Works, Paducah, Ky.;
Oklahoma Ordnance Works, Pryor, Oklahoma;
Weldon Springs Ordnance Works, Weldon Springs, Mo.;
New York Ordnance Works, Baldwinsville, NY.;
Gopher Ordnance Works, Rosemont, Minn.;
Badger Ordnance Works, Baraboo, Wis.;
Keystone Ordnance Works, Meadville, Pa.[97]

The Task Force has not traced the disposal histories of the above plants, nor assessed whether at these sites, in contrast to the LOOW, Army decontamination efforts were more complete. When the Industrial Research Corporation appraised these ten former ordnance works sites in 1948, it discovered that several of the sites were, like the LOOW, insufficiently decontaminated at the time they were declared surplus by the Army.[98] There is much to suggest that the sequence of events at the LOOW, culminating in the public sale of contaminated land, might not have been unique.

UMP000117

UNIVERSITY OF MINNESOTA
TWIN CITIES

Boynton Health Service
410 Church Street S.E.
Minneapolis, Minnesota 55455

February 11, 1981

MEMORANDUM

To: C. Luverne Carlson, Assistant Vice President, Support Services and Operations

From: Fay M. Thompson, Occupational Health Chemist, Department of Environmental Health and Safety Fay Thompson

Recently, a report was released by a New York State legislative task force on toxic wastes which indicated that a number of World War II Army munitions plants could still be contaminated with chemicals used in the production of various types of munitions. This conclusion was drawn only because the investigation team could find no records of decontamination. Among the sites named was the Gopher Ordnance Plant, once located on the site which is now the University's Rosemount Research Center. Immediately upon release of this report, the Minnesota Pollution Control Agency (Terrance Kasen), Rosemount Research Center (Bill Cook), U of M Environmental Health and Safety, and probably several others,were besieged with calls and requests for information.

On Tuesday, February 3, Terry Kasen and I travelled to Rosemount to meet with Bill Cook and check through the records which are still available from World War II operations. Mr. Kasen also brought along Mr. Clarence Chelberg, who was the fire chief for Gopher Ordnance during construction, operation and decommissioning of the plant.

Fortunately the records which were turned over to the University and which have been kept at Rosemount are quite complete. Also, Mr. Chelberg's knowledge and recollection of operations are very good.

The Gopher Ordnance Plant was designed to produce nitrocellulose. Wood pulp and cotton were used as the source of cellulose and nitrating was done with nitric and sulfuric acids. Both nitric and sulfuric acid were produced on site, requiring ammonia and sulfur as starting materials. Alcohol and acetone were used to fluidize the nitrocellulose prior to extrusion. Recovery plants for recycling alcohol and acetone were in operation. A small amount of diphenylamine was added to the nitrocellulose as a stabilizer. A wastewater neutralization plant treated the acid waste before it was discharged to the Vermillion River. There were no radioactive materials at this plant; the plant did not produce TNT and there is no indication that mercury was used in any of the processes.

This plant was designed to have six identical production lines. Only one was finished and was operated for a total of eleven days in 1944.

All of the buildings which were used in production were removed during decommissioning of the plant. Most were made of wood and were burned at the site. Nitrocellulose which could still be used was shipped to the Twin Cities Arsenal. Any off-specification material was burned. Neither the existing records nor Mr. Chelberg's recollections indicate that any chemicals were left at the site. Since the great majority of the structures were removed before 1950, and since our activities at the site since then have not uncovered any disposed materials, it seems very unlikely that there is any contamination problem from WWII munitions activity. MPCA is also convinced of this.

Some of the confusion over the existence of toxic materials at Rosemount may be related to the fact that we do store our hazardous chemical and radioactive materials there prior to shipment out of the state. These materials are all sealed in 55 gallon drums and are held in reinforced concrete buildings. We also, in the 1960's, disposed of chemical waste by open burning at Rosemount. These activities are in no way related to earlier munitions production.

I feel very confident that there is no contamination problem at Rosemount created by the operations of the Gopher Ordnance Plant. If I can answer any other questions, I would be glad to do so.

RESUME OF ACTIVITIES - MATERIALS & SUPPLIES BRANCH - June 1946.

Inventory May 31, 1946	$1,958,444.58
Acquisitions	43,385.21
	$2,001,829.79

Sales No.	Declared Cost	Sales Price	
4272	18.00	9.00	Drum Charge (Paint sold in May)
4425	123.75	68.75	Synthetic Varnish
4426	127.80	107.90	Thinner & Lacquer
4441	1,257.80	1,257.80	Building Materials (V.A.)
4442	44.80	44.80	Plywood (V.A.)
4443	1,414.03	1,414.03	Building Materials (V.A.)
4444	1,215.94	1,215.94	Marinite Board (V.A.)
4445	680.00	680.00	Fire Doors (V.A.)
4446	70.00	80.00	Lumber, rough pine
4447	559.65	819.80	Lumber, rough pine
4448	2,568.05	798.80	Mixed Acid
4455	199.80	108.80	Rope, Sisal 5/16"
4459	1,663.80	1,069.20	Reducer for Enamel
4460	1,163.24	70.00	Glue Fill
4464	1,124.88	710.40	Cobalt Chloride Crystals
4465	109.04	23.80	Pyralin Nitrate
4479	256.58	256.58	Asphalt Paint (V.A.)
4480	151.13	151.13	Asphalt Paint (V.A.)
4481	100.05	100.05	Wood Primer (V.A.)
4482	826.00	180.00	C. B. Dope
4483	15,802.49	4,913.60	Mixed Acids
4484	23,703.73	7,370.40	Mixed Acids
4485	10,535.01	3,275.74	Mixed Acids
4486	15,802.50	4,913.60	Mixed Acids
4487	10,535.01	3,275.74	Mixed Acids
4489	924.73	924.73	Marine Board (V.A.)
4490	107.10	107.10	Glass Sealer (V.A.)
4491	967.21	967.21	Fiber Board, Phenolic (V.A.)
4492	192.89	192.89	Fiber Board, Phenolic (V.A.)
4493	1,189.14	1,189.14	Bakulite Sheets (V.A.)
4494	1,512.15	1,512.15	Formica Sheets (V.A.)
4507	451.80	199.80	Base Gray Enamel
4508	981.35	890.65	Thinner
4522	161.60	80.00	Coal "Screenings"
4523	3,378.10	1,842.60	Barium Chloride Crystals
4532	230.00	137.50	Clear Lacquer
4540	216,884.00	124,708.30	Ethyl Alcohol
4541	1,800.00	800.00	Pentaerythritol-Tetranitrate
4546	2,726.64	2,726.64	Lumber (F.P.E.A.)
4547	1,567.40	328.60	Cleaning Compound
4550	2,303.01	377.38	Ester
4551	194.17	63.00	Barium Peroxide
4552	289.00	289.00	Cosmoline
4553	451.20	168.20	C. D. Paint
4554	132.99	88.00	Rust Preventive Compound
4555	266.80	266.80	Wood Primer (F.P.E.A.)
4556	346.50	346.50	Caulking Compound (F.P.E.A.)
4557	25,036.85	14,903.25	Clear Dope

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RESUME OF ACTIVITIES

Sale No.	Declared Cost	Sales Price	
4665	.25	No Charge	Sample
4666	.28	No Charge	Sample
4667	2.15	No Charge	Sample
4668	209.00	110.00	Gray Lacquer
4669	.08	No Charge	Sample
4670	1.40	No Charge	Sample
4671	3.45	No Charge	Sample
4672	1.15	No Charge	Sample
4673	.09	No Charge	Sample
4683	19.40	No Charge	Sample
4690	1,486.49	715.00	Metal Primer
4692	3,067.88	1,381.70	Red Lacquer
4695	1,264.90	1,264.90	White Lead (P.P.H.A.)
4696	8,539.20	8,539.20	Primer (P.P.H.A.)
4697	405.00	129.60	Caulking Compound
4628	577.50	320.00	Glue
4629	493.73	282.00	Timber Piles
4644	6,515.00	6,515.00	Silica Gel (Navy)
4645	37.62	37.62	Silica Gel (Navy)
4646	6,972.74	6,972.74	Silica Gel (Navy)
4647	1,092.93	1,092.93	Silica Gel (Navy)
4648	384.25	384.25	Silica Gel (Navy)
4649	14,024.40	14.024.40	Silica Gel (Navy)
4651	21.45	21.45	Napico Black (V.A.)
4652	338.80	338.80	Primer (V.A.)
4653	133.06	133.06	Primer (V.A.)
4654	460.46	460.46	Primer (V.A.)
4655	1,283.75	1,283.75	Screen Paint (V.A.)
4656	312.58	312.58	Deck Paint (V.A.)
4657	893.00	893.00	Wood Sealer (V.A.)
4692	24,644.20	16,042.00	Coal
4711	630.00	346.80	Clear Lacquer
4712	2,816.00	1,474.00	Clear Dope
4713	205.20	114.00	Primer
4717	55.00	55.00	Tube Tester
4718	55.00	55.00	Tube Tester
4719	55.00	55.00	Tube Tester
4725	4,739.20	660.00	Coal, Lignite
4726	2.15	No Charge	Sample
4732	250.04	250.04	O. D. Enamel
4733	166.50	166.50	Cosmoline
4745	97.50	67.43	Napico Black
4746	353.78	222.68	Napico Black
4747	1,072.40	675.00	Napico Black
4748	583.00	379.40	Varnish, Insulating
4757	450.01	186.00	Dope (White Pigment)
4761	247.95	130.50	Grey Enamel
4764	4,256.00	1,008.00	Calcium Carbide
4765	2,620.00	790.00	Bakelite Glue & Powder
4766	42,499.10	15,143.20	Bakelite Glue & Catalyst
4767	5,395.00	1,800.00	Bakelite Glue & Powder
4768	1,118.00	1,110.00	Expanded Metal (V.A.)
4770	15.00	No Charge	Sample
4771	4.41	4.41	Ink, Ditto (V.A.)
4772	25,830.42	16,620.00	Ethyl Ether
4795	13.75	11.00	Oil; Cutting
4796	3,249.00	2,394.00	Coke
4808	140.80	89.40	Wood Sealer
4809	4,615.80	1,838.80	Wax, Clear, Sealing
	$26,789.40	$88,794.90*	

UMP000121

Rosemount Alcohol Sold For Rubber

Synthetic rubber will be produced from the surplus denatured ethyl alcohol stored at the Gopher Ordnance Works, Rosemount, it was announced today.

The stock of 271,106 gallons, originally intended for use as a solvent in manufacture of gunpowder, has been sold for processing into butadiene, principal ingredient in synthetic rubber manufacture.

Carlton C. Lockway, chief of the Minneapolis material and supplies division of the War Assets administration, made the announcement of the sale, which brought the government $124,708.

The purchase was made by the Reconstruction Finance Co for allocation to Carbide and Carbon Chemical Corp., which will convert the alcohol into butadiene and sell it to synthetic rubber producers.

Lockway estimated that nearly 3 million pounds of rubber can be produced when the butadiene is mixed with another essential ingredient — styrene. Shipment of the alcohol will begin this week, Lockway said.

ST. PAUL DISPATCH
Friday, June 21, 1946 21

'Wonder' Glue Offered By U. S.

A special glue, which hardens at room temperature into a substance as durable and permanent as bakelite, is being offered for sale by the War Assets administration office in Minneapolis.

Developed during the war, it was used for making laminated wood for gliders and building construction. It is waterproof and resistant to extremes of temperature.

Civilian use possibilities include millwork, prefabricated house construction, wooden toy manufacturing and cabinet work.

Enough of the two compound parts, liquid resin and hardening powder, are stored at Fort Snelling and Rosemount to make 90,000 pounds of glue according to Carlton C. Lockway, chief of the Minneapolis material and supplies division of the WAA.

ST. PAUL DISPATCH

Non-Skid Boat Floors In Offing

Minnesota landlubbers won't have to develop their sea legs to keep their footing on fishing trips if the War Assets administration has its way about it.

According to the WAA, fishermen soon will be able to buy boats with bottoms lined with surplus government "grip tread," a non-slip plastic used during the war on ship decks and on airplane wings as walkways leading to cockpits.

Carlton C. Lockway, chief of the Minneapolis Material and Supplies division of the WAA, said the entire stock of the tread stored at Fort Snelling has been sold to a Twin Cities boat builder for $1,750. The "skid-proof" boats will be on the market this fall, he said.

Landlord, Tenant Nabbed In Stabbing

A Minneapolis landlord and his tenant are held by police today following an argument over rent which ended with the landlord being stabbed and the tenant being clubbed with a

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harles P. Biesanz of alked into the War inistration office in today, he was or a jack hammer to

n he went out, he 140,000 pounds of ng dynamite stored Hills Ordnance De- S. D.

Biesanz, head of a stone company at Winona, entered the materials and supplies branch by mistake when he entered the WAA office, and Carlton C. Lockway, when he learned Biesanz' business, suggeste dynamite as an alternati the jack hammer which partment does not handle.

The sale was complete $5,250.

New Use as Beauty Clay for Army Dehydrating Agent

Minneapolis.—Fifteen tons of a chemical dehydrating agent, purchased from the Minneapolis Regional Office, will appear on the market in the form of a new beauty clay.

When Charles Winokur of Mora, Minn., made the purchase, he did not know what use he would make of the material. But after months of experimentation, he discovered the material would make excellent beauty clay—if he added a little perfume.

The product will appear on the market as Carol Rae Beauty Clay, named after Winokur's 8-month-old daughter.

During the war, the Army Air Forces had used the dehydrating agent for dehumidifying packages earmarked for overseas shipment

Silica Gel To Keep Rust From Guns For Sale By U. S.

If you're worried about corrosion and rust damage to gun cases, tackle boxes, tool boxes or other items, Uncle Sam has the solution.

It's silica gel, a product that absorbs moisture.

Nearly 50,000 pounds of silica gel, stored at Fort Snelling, has been declared surplus and is now for sale in lot quantities on a fixed price basis, Carlton C. Lockway, chief of the Minneapolis Material and Supplies division, announced today.

Packed in nine different-sized bags ranging from one-sixth of an ounce to five-pound bulk bag, it sells for 8 cents a pound. Minimum purchase is in $100 lots.

The sacks contain indicator charts, which by changing color, show when the limit of absorption has been reached. The gel may then be regenerated by heating it in a warm kitchen oven.

Uncle Sam used the product to pack with shipments of delicate equipment going overseas.

1946

Surplus Chemicals Offered In WAA Sale

Industrial chemicals worth 70 million dollars are now on sale by the War Assets administration, Carlton C. Lockway, chief of the Minneapolis materials and supplies division, announced Sunday.

Included in the stockpile are acids, dyes, plastic materials, solvents, synthetic and natural glues, welding fluxes and coal tar. Information can be obtained from the WAA regional office, 504 Metropolitan Life building, Minneapolis.

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MAPS, CHARTS AND DIAGRAMS

UMP000123

PERTINENT DATA ON GOPHER ORDNANCE WORKS

INTRODUCTION

To enable presentation of pertinent information concerning the Gopher Ordnance Works, the following resume has been prepared. The compilation of all information relative to the functioning of all features and the presentation of information on physical features, would involve too much detail and would defeat the purpose in mind. This narrative will, therefore, be limited to a brief description of the functions of the physical features which must be created to enable the manufacture of smokeless powder, and enumeration of the various features developed.

The plant site is composed of approximately 18 square miles, located in the township of Rosemount and the township of Empire. The northwest corner of the site is adjacent to the easterly boundary of the Village of Rosemount in Dakota County, Minnesota.

In addition to the 18 square miles contained in the site proper, there are 1.6 square miles of land contained in the right of way for the water supply lines from Spring Lake (Mississippi River) and land adjacent to Spring Lake upon which the Ranney Wells and pump houses are located. There are also approximately 1,500 acres of land involved in the Vermillion River right of way which is required for process water runoff purposes.

To illustrate the location of the plant site and the other features mentioned, a small scale location map is attached.

E. I. du Pont de Nemours and Company is the architectural engineer, the constructing contractor, and will be the operating contractor when the plant is placed in operation. This company developed and planned the manufacturing processes, the type of structures and the equipment which will be used.

The plant is divided into several subdivisions or Areas. The subdivision is based on functions and is not geographic. All buildings within an Area have similar or relative functions and are named according to their function. In addition to the name, each Area is assigned numbers within a specified range and each unit of an Area is assigned a specific number. The following tabulation gives the classification of the various areas:

Name of Area	Number of Area	Building or Unit Number Range
Nitrocellulose Area	100	101 - 199
Smokeless Powder Manufacturing Area	200	201 - 299
Acid Area	300	301 - 399
Power and Water Supply Area	400	401 - 499
Outside Lines Area	500	501 - 599
General Facilities Area	600	601 - 699
Administrative and Maintenance Facilities Area	700	701 - 799
Organic Area	900	901 - 999
Staff Residence Area	1100	1101 - 1199
Oleum Area	1500	1501 - 1599

The plant is designed so as to provide for carrying on the same operations simultaneously at several different points. To accomplish this, there are six manufacturing Lines or series of buildings necessary for the manufacture of powder. One of these Lines, known as the "A" Line, is equipped to manufacture rifle powder only. The "B" and "C" Lines are so equipped that either rifle powder or cannon powder can be made. The "D", "E", and "F" Lines are for cannon powder manufacture only.

UMP000124

The process for the manufacture of rifle powder and cannon powder are essentially the same except that in rifle powder manufacturing some additional steps are taken. To enable appreciation of the number of buildings required in each Line and the equipment involved, a brief description of a typical cannon powder Line is presented. On the attached flow chart, the various building numbers have been indicated. Each building is treated separately below under the Area in which it falls.

100 AREA - NITROCELLULOSE AREA

The manufacturing Lines are laid out so that the flow of the product in manufacturing is from the north to the south. The 100 Area contains the buildings through which the product passes first.

Building 101 - Cotton Storage House

Any grade of raw cotton or wood pulp can be used for the manufacture of smokeless powder cotton linters. The raw cotton is cooked in a digester for a specified period of time and is treated with caustic soda under pressure at a relatively high temperature. The caustic removes resinous materials and other impurities. The cotton is then bleached and washed free from alkali.

Cotton which has been treated in the above manner is then brought to the plant in paper covered bales and is stored in the cotton storehouse (Building 101). This building is a one story frame structure with concrete floor and contains 23,000 square feet of floor area. It has a storage capacity of 1,900,000 pounds of treated cotton.

Building 104 - Cotton Dry House

The cotton is brought to this building from the cotton storage house via a conveyor. In the cotton dry house the cotton is fed into a picker which consists of a horizontal wooden roll revolving at approximately 1,000 r.p.m., carrying six evenly spaced rows of sharp hooked teeth. The cotton moves along a feed trap and passes under this roller where it is torn apart by the teeth and attains a fluffy state. It is then blown through a duct system into the drier.

The drier is a long rectangular steel chamber through which the cotton is carried on a perforated steel belt. Air is blown into the drier by blowers along the side. The temperature inside is held at 95 to 98 degrees centigrade. Cotton requires about three-quarters of an hour to pass through the drier. It is discharged from the drier into fiber containers in specified amounts by weight. Each container is filled with the correct weight of charge for a dipping pot.

Building 105 - Nitrating House

Each nitrating unit consists of a battery of four stainless steel dipping pots arranged in a square. The dipping pots are each equipped with an impeller at one side which quickly drags the cotton below the surface of the acid. In making the charge, the measured acid is first run into the dipping pot and the cotton, trucked from the drier house in fiber containers, is then dumped in. At the end of the nitration, the contents of the dipping pot is dumped into a centrifugal wringer, one of which is located below each nitrating unit. (Each unit is composed of four dipping pots). When the wringing process is completed, the operator

UMP000125

starts "White Water" flushing through a small sump below the wringer. ("White Water" is waste processed water from washing operations in a subsequent part to the system.) Then the operator opens the bottom of the wringer and forces the nitrocotton into the sump from where it is flushed through a trough into a drowning tub.

In the drowning tub, of which there are two in each 105 Building, the nitrocotton is mixed with more "White Water", to make a slurry of about 1% solids which is pumped to the boiling tub house.

Building 108 - Boiling Tub House

In the boiling tub house, the slurry from the drowning tub is pumped into one of fifty-six wood tanks. The slurry is boiled for a specified time (60 hours for high grade nitrocotton and 30 hours for pyrocotton) followed by two 5 hour boilings, then two cold water washes. Between each boiling or washing, 40% of the liquid is drawn off and replaced by fresh water.

The slurry is heated to boiling by live steam which is admitted to the tubs inside of a hollow vertical wood cylinder in the center. The boiling tubs are provided with two wood floors, the upper one of which is perforated so that liquid can flow into the space below to be drawn off between washes and boilings without drawing off any of the nitrocotton.

Upon completion of the boiling process, the cotton is flushed into one of three wood slurry tubs. The slurry is then pumped to the pulping house.

Building 109 - Pulping House

In the pulping house, the slurry first passes through the initial dewaterer which is a baffle device for removing some of the water. The slurry then runs through the initial stuff tank which is a wooden tub 20 feet in diameter and 16 feet high. Here the slurry can settle and be further concentrated if desired. The slurry is neutralized with soda ash in this tank.

In the pulping house, the high grade nitrocotton slurry is kept separate from the pyrocotton slurry. There is one Line for each grade, each Line having its initial dewaterer, two initial stuff tanks and a series of Jordan engines. The water collected from each Line goes to separate savealls.

From the initial stuff tank, the slurry goes to the first Jordan stuff tank. From this tank it is fed through three Jordan engines in series, between each of which it is further concentrated in dewaterers. In the Jordan engine the cotton fibers are cut up by passing between a set of fixed blades and a set of rotating blades which pass close to them. Each engine contains several sets of fixed and rotating blades through which the slurry passes in series.

From the last Jordan engine, the slurry runs to a slurry tank from which it is pumped to the poacher tub house.

UMP000126

Building 112 - Poacher Tub House

In the poacher tub house, the acid which is still contained in the cotton fibers is washed out and the nitrocotton is boiled in an alkaline solution. The slurry is then pumped to one of thirty-eight wooden poacher tubs which are 13 feet in diameter and 10½ feet in height. Soda ash is added in the ratio of one pound soda ash to 3,000 pounds of nitrocotton. In these tubs the slurry receives one 4 hour boiling, followed by three 1 hour boilings, then eight cold water washes. Again between each boiling and washing the slurry is allowed to settle and 40% of the liquid is removed.

Upon the completion of the poaching process, the slurry is run through a sand trap and a dewaterer and is pumped to the blending tubs.

Building 113 - The Blending Tub House

Each blending tub house contains four wood blending tubs 24 feet in diameter and 20 feet high, painted inside with a protective coat of chlorinated rubber paint. In these tubs, the slurries are mixed in the ratio of about 17,000 pounds of pyrocotton to 33,000 pounds of high grade nitrocotton. The tubs are equipped with agitators in order to thoroughly blend the two slurries. The final blend of slurry is allowed to settle in the tubs and the liquid is decanted from the tubs.

The slurry is then sent to a centrifugal wringer where it is wrung to a moisture content of approximately 30%. The wet nitrocotton is loaded into nitrocellulose cars and is sent to the Powder Area (200) for further treatment.

The buildings mentioned are those in which the main processing functions are carried on. In addition to these buildings, there are several auxiliary or supporting structures. A few of these are: Nitrocellulose Area Tank Farm (102) (this includes facilities for F-83 storage, fuming sulphuric acid storage, acid mixing, acid warming, Spent acid and mixed acid storage), Spent acid filters (106, nitrocellulose slurry tank (111), chilled water house (115), and sawalls (120).

UMP000127

200 AREA - SMOKELESS POWDER MANUFACTURING AREA

Building 202 - Dehydrating Press House

In the dehydrating press house water is removed from the nitrocotton by use of a large vertical press having an upper and lower head. The upper head is raised and 53 pounds of cotton (dry weight) is placed in the cylinder. This head is then lowered and held by 3,000 pounds pressure. The lower head is then brought up and about 66 pounds of alcohol is forced through the mix of cotton. The alcohol added at the top head flows downward through the compressed mix of cotton, displacing water ahead of it and flows out through a screen on the lower head. First water, then weak alcohol, and then strong alcohol are discharged. The pressure on the lower head is then increased and the remaining alcohol is forced out until only the desired amount of strong alcohol is left in the cotton. The amount of alcohol which remains is determined by the solvent ratio established for the powder type involved.

Upon removal from the press, four of the resulting cakes are placed in a steel covered carriage and sent to the mixing house.

Building 208 - The Mixer House

In this building, the nitrocotton from the blending house is charged in a mixer (4 cakes per charge). The blocks are broken in the mixer and the required amount of ether is added from a scale tank to provide a solvent of correct proportions (65% ether and 35% alcohol). The ether and alcohol are thoroughly mixed with the nitrocotton and a colloid results. Diphenylamine is added to all mixes as a powder stabilizer and to preserve the nitrogen content.

The powder is then transferred to a macerator where the mixing process is continued to insure the breaking of all fiber lumps and the external coating of all particles with solvent. From the macerator, the powder is sent to a preliminary blocking press where it is subjected to a pressure of about 3,500 pounds. The resulting blocks are then sent to the horizontal screening and press house.

Building 211 - Horizontal Screening and Press House

In this building, three blocks of the cannon powder from the blocking press are placed end to end in a large horizontal screening press. In front of the blocks are three screens of 12, 24 and 40 mesh, respectively. The head of the press carries a steel plate in which there are a series of small macaroni holes. A pressure of 3,000 pounds per square inch is applied with a brass ram and the powder is forced through the screens and comes out in the form of macaroni. The purpose of this operation is to insure thorough mixing of the colloid and removal of all lumps as well as the removal of extraneous materials. The macaroni is discharged through a tube to one of two vertical blocking presses known as the final blocking press. When the cylinder of this press is full, a pressure of 3,000 pounds is applied and the resulting block slides down a chute to the finishing press or graining press.

UMP000128

This press is a large horizontal graining press which carries dies in the head having either 1, 5, 7, 10 or 19 holes. The number of holes utilized depends upon the caliber of cannon powder to be produced. The powder is forced through the die and comes out in long strings like macaroni. Each string falls into a slowly revolving bucket on a turn table where it coils. In the case of the larger multi-perforated powder, the strings are carried directly to the cutter on a canvas belt.

The buckets containing the coils of powder in string form, are taken to the cutter where the strings are fed into a cutting machine by hand. The cutting machine is so designed that the feeding of the strings is at a consistent rate and the knives are geared at such a speed that the powder is cut off at the proper length. The resulting grains fall into a fiber container which is then dumped into the top of a solvent recovery card. The powder at this point is known as "green" powder and approximately 7,000 pounds of it are in each car.

The solvent recovery process is carried on at the time the car is being loaded in order to minimize the loss of vapor. This process consists of the recirculation of air through the car. Air passes through a copper aerofin air heater under forced circulation and is warmed. This air enters the top of the car through a duct connection and is forced through and around the powder grains and evaporates solvent. The evaporated vapor, both alcohol and ether, then passes out through the screened bottom and through a duct connection at the bottom of the car. This air is saturated with alcohol and ether vapor at a high temperature. The saturated air passes through a brine cooled aerofin condenser where the solvent is condensed out of the air until the dew point at the temperature of the condenser is reached. The condensed solvent is pumped to recovery solvent storage tanks (215-AA, BB, and CC) from which it is pumped to the alcohol rectification house (207). The air coming out of the condenser is still saturated with solvent vapor at the dew point of the condenser. It is reheated and recycled through the car. As soon as the car is loaded, this process is discontinued and the car is closed and sealed and moved immediately to the solvent recovery building.

Building 214 - Solvent Recovery Building

In this building the solvent which still remains in the powder is removed and recovered through a temperature control process. Air is first circulated through the car at 30 degrees centigrade and is increased at the rate of 2 degrees centigrade per hour until a rate of 55 degrees centigrade is reached. When this process has been completed, the temperature is allowed to drop to 25 degrees centigrade before opening and disconnecting the car.

After the cars have been disconnected from the air ducts and removed from the 214 Buildings, they are sent to the unloading and screening house.

UMP000129

200 AREA - SMOKELESS POWDER MANUFACTURING AREA (Cont'd)

Building 218 - Unloading and Screening House

In the unloading and screening house the cars are rolled onto a hydraulic lift which tilts one end of the car. The powder grains are then washed out of the car through a door in the bottom and to a hopper at the bottom of which is a water jet. Water is furnished from a jet pump furnishing 200 gallons per minute and the powder grains are forced up a 4 inch pipe to the feed hopper over the powder screens.

The powder grains are then passed through two shaker screens. The top screen retains any grain clusters which are known as clinkers and the powder or correct grain is retained on the second screen. The clinkers and broken grains, and chips which pass through the second screen are returned to the scrap rework house and are again sent through the process. The good powder passes from the second screen to the production hopper from which it is carried to the water dry house in a 4 inch pipe by a stream of water.

Building 219 - Water Dry House

In this building the powder is discharged into a wooden tank containing a false bottom and a sluice gate. Approximately 50,000 pounds of powder is introduced in the tank and hot water is circulated continuously through the tank and out the false screen bottom. The temperature of the water is kept at 55 degrees centigrade and the powder is allowed to remain in the water dry tanks from 4 to 6 days. The purpose of this process is to remove the remaining three to five per cent of solvent left in the powder.

At the conclusion of this process, the water is removed and the powder is hosed out into a car which transfers it to the controlled circulation drier.

Building 220 - Controlled Circulation Drier

In this building the powder is dumped from the cars into a hopper at the bottom of which there is a water jet which lifts the powder to a series of drying trays or racks, where heated and filtered air is passed through the drier racks until the moisture content becomes low, at which point the air is passed through the powder. Samples of the powder are taken for moisture analysis during this operation and the correct degree of dryness is obtained. The powder is held on the "Christmas Tree" tracks until samples are taken and ballistic tests are made.

The powder is next transferred to the blending tower and packing house.

Building 228 - Ballistic Range and Proving Grounds (Including Storage Buildings)

Here, by actual firing tests and through laboratory methods, the ballistical value of each batch of powder is determined. Records are made of each test made from samples taken from cars held on the "Christmas Tree" tracks and the final blending of powder in the Blending Tower is based on the proportioning of batches in such a manner as to produce a powder of correct, uniform ballistic value for the use for which it is intended.

UMP000130

Building 221 - Blending Tower and Packing House

Here the powder is hauled to a large elevated bin by a conveyer. From this bin it is dropped to two other bins beneath, each bin receiving approximately half of the original amount. From these two bins it is dropped to four smaller bins. It is then removed and transferred to the top where the process is again repeated until the various batches are thoroughly mixed. Generally, approximately 100,000 pounds of cannon powder is blended together to make a load.

When the powder is blended, it is packed in galvanized steel or copper lined wood boxes which have been previously air tested to be sure that they are tight. The powder is then placed in storage in one of the shipping houses (Building 229) in the Shipping Area where it is held for shipment at a future date.

The buildings mentioned are those which are most important to the manufacturing process. There are a myriad of auxiliary buildings, water tanks, acid storage tanks, savealls, etc., which would be too numerous to attempt to enumerate. A few of these are as follows: Alcohol and debutylphthlate storage (203), solvent recovery car washing and drying house (213), box storehouse (223), air test house (224), air rupture test is given box linings, dry ingredients storehouse (227), for K_2SO_4, etc., shipping houses (229), box repair shop (232), screen cleaning house (233), for cleaning screens in screening presses, bag repair and stencil house (255), DNT service house (257), containing a micro-pulverizer to make finely powdered DNT for the sweetie barrels, dry ingredient storehouse (260) (igloo type), and shaker sieve transfer platforms (262).

The small scale maps included show the general layout of the "A", "B" and "C" manufacturing Lines (100 and 200 Areas) and the "D", "E" and "F" Lines, respectively.

UMP000131

300 AREA - ACID AREA

In this Area appropriate acids are manufactured, mixed and stored for use in the nitrocellulose Area. There are two acid Areas in the plant known as the "A" and "B" Areas. The functions and equipment in these two Areas are identical except that the productivity of the "A" Area is greater and hence has more units of equipment. The products made in the "A" Area are intended for use in the "A", "B" and "C" Lines and the production of the "B" Area is used in the "D", "E" and "F" Lines. The buildings in a typical Area are treated below:

Building 301 - Anhydrous Ammonia Storage Building

Here ankydrous liquid ammonia is received in tank cars (each holding about 50,000 pounds) and is transferred to storage tanks. To facilitate the transfer, this building is equipped with an unloading platform with facilities enabling the unloading of two cars at a time. The transfer of liquid ammonia from the tank car to the storage tanks is accomplished by a Frick ammonia compresser which exhausts gas from the storage tank and applies pressure to the tank car, forcing the liquid ammonia through a stand-pipe to the storage tank.

At this plant there are 8 such storage tanks in the "A" Area and 6 in the "B" Area. Each tank has a storage capacity of 30,400 gallons and usually one is left empty for emergency filling. All pipe lines into this building are very heavily insulated.

From this storage the liquid ammonia is next transferred via pipe line to the ammonia oxidation plant.

Building 302 - Ammonia Oxidation Plant

Liquid ammonia is forced to a vaporiser by ammonia gas pressure through heavily insulated pipes. The vaporiser is approximately 10' high and 4' in diameter and contains a double coil of 2" steel pipe through which 150 pound steam is passed to produce sufficient heat to vaporize the ammonia as it enters the bottom of the vaporiser tank. The gaseous ammonia then passes through a series of screens and Spence valves and is mixed with oxygen in the form of compressed air. This mixed gas is then transferred to a converter composed of two conical stainless steel sections 24" high and 10" in diameter at the head. In this converter, there are 33 sets of 60 mesh screens made from platinum containing 10% rhodium. In the converter the oxidation of ammonia occurs and nitrous oxide and water are produced.

From this point, quite an involved process is carried on in which absorption towers, 40' high and 64" in diameter, are utilized. There are 6 absorption towers in the "A" ammonia oxidation plant and 5 in the "B" plant. The resulting product of this process is 61% nitric acid.

Building 303 - Nitric and Sulphuric Acid Concentrators

In this building the concentration of sulphuric acid and nitric acid is accomplished.

UMP000132

Nitric Acid Concentration

In order to concentrate weak (50 - 60%) nitric acid to about 95% HNO_3, it is necessary to use a dehydrating agent for removing the water. The general procedure is to mix the diluted nitric acid with a strong dehydrating agent and then distill off the strong nitric acid. Substantially all of the water remains with the dehydrating agent.

In concentrating nitric acid by the Tower and Cascade process, mixtures of weak nitric acid and strong sulphuric acid, and mixtures of weak nitric and certain weak acids, are used. These are blended in definite proportions so that the resulting mix will meet certain predetermined specifications.

The complete plant for concentrating nitric acid is composed of the Tower and Cascade unit proper, equipment for preparing concentrating mix from strong sulphuric and weak nitric, equipment for condensing, cooling and receiving the strong nitric, storage tanks, pumps and piping for concentrating mix and residual sulphuric and an absorption system for recovering oxides of nitrogen.

The process produces (when operating with the regular concentrating mixture of 92% sulphuric and 60% nitric acids) concentrated nitric acid (95%), recovered weak nitric (50 - 60%) and residual sulphuric acid (70 - 71%).

Sulphuric Acid Concentration

The concentration of sulphuric acid from 71% to 93.2% is accomplished in this unit. The concentrators are fed from the storage tanks of the 90 series holding cooled residual acid (71%) from the nitric acid concentrators. The plant is equipped with three concentrators and two coolers. These concentrators can be operated batchwise, each concentrator operating separately or in continuous series flow in which the acid will be concentrated as follows: In No. 1 from 71% to 78%, in No. 2 from 78% to 87.5%, and in No. 3 from 87.5% to 93.2%.

The plant is equipped to operate at a rated output of 500 tons of acid per day when using all three concentrators. The entire area process is intended to accomplish the evaporation of water contained in the weak acid, thus producing a concentrated acid as required.

Building 305 - Acid Area Tank Farm (Including Acid Mixing, Fuming Sulphuric Acid Storage, Residual Acid Storage, Mixed Acid Storage and Waste Acid Storage)

The function of the acid mixing plant or Tank Farm is to prepare mixes of sulphuric and nitric acid for the nitric acid concentrating plant and for the nitrocotton Area. The three principal kinds of mixed acids made are:

1. Concentrating mixed acid - made by mixing 93% sulphuric acid with 61% nitric acid from the ammonia oxidation plant;
2. Spent mixed acid - made by mixing 61% nitric acid with Spent acid resulting from the manufacture of nitrocotton; and
3. Fortifying mixed acid - made by mixing 95% nitric acid from the nitric acid concentrators with 93% sulphuric acid.

UMP000133

The tanks in the Tank Farm are as follows:

5 high chrome iron tanks where storage is 61% nitric acid;
4 high chrome iron tanks where storage is 95% nitric acid;
2 steel tanks for storage of Spent mixed acid;
2 steel tanks for storage of concentrating mixed acid;
2 steel tanks for storage of Spent acid from the 100 Area;
2 steel tanks for storage of fuming sulphuric acid from the Oleum Plant;
2 steel tanks for storage of 93% sulphuric acid from the sulphuric acid concentrators;
2 steel tanks for storage of weak nitric acid produced in the nitric acid concentrators;
2 steel tanks for storage of residual sulphuric acid;
2 steel tanks known as Spent acid mix scale tanks;
2 steel tanks known as concentrating mix scale tanks; and
3 tanks known as fortifying mixed acid scale tanks.

Plot plans showing the general layout in both the "A" and "B" Acid Areas are included. There is also included a flow chart of a typical Acid Area.

UMP000134

400 AREA - POWER AND WATER SUPPLY

Water Supply System

The water supply used for manufacturing and fire protection at the Gopher Ordnance Works is obtained from two different sources. That water which actually enters into contact with the product is secured from a battery of four Ranney Wells which are located on the bank of the Mississippi River and the adjacent Spring Lake. Water used for condenser cooling purposes is obtained directly from the Mississippi River. Both supplies of water are carried from the river to the plant, a distance of about three miles, through a pair of 42" concrete and steel pipes.

Upon reaching the plant site, each of the pipe lines is split, delivering approximately half of the water to each of two reservoirs. The one reservoir is located adjacent to the "A" Power House which serves the "A", "B" and "C" Lines, and the other reservoir is located adjacent to the "B" Power House which serves the "D", "E" and "F" Lines. Each reservoir is divided into two sections of approximately equal size, one for well water, the other for river water.

The greater portion of the well water is pumped from the reservoir into a 30" main which carries it to the manufacturing Areas. A portion of the water is taken off from this main to supply the boilers in the Power House. Water for fire protection is also taken from the well water reservoir. The river water, also termed raw water, is pumped into a 30" main and thence to the manufacturing Areas.

404 - Process Wells and Pumps

The Ranney Wells consist of a reinforced concrete caisson with a wall thickness of 18" and an inside diameter of 13'. The caissons are sunk into the ground to a depth sufficient to reach a stratum of water bearing sand and gravel. Test borings were made in advance of the construction work to determine the extent of the water bearing stratum and the most desirable locations for the wells. Two of the caissons have been constructed with an inside depth of 64'. The other two caissons will have an inside depth of approximately 115'.

Near the bottom of each caisson and parallel to the bottom slab, there are constructed two rows of portholes through which are projected lateral collector pipes. These pipes are 8" in diameter and have slots in their walls through which water may flow into the pipe and thence through a control valve attached to the porthole assembly and so into the caisson. The collector pipes are projected out from the caisson to a distance varying from about 50' to almost 200'. The number of slots in the collector pipe is such as to result in an area of openings of not less than 18% of the area of the pipe. The size of the slots is determined from samples of the sand and gravel obtained from the preliminary test borings.

During the operation of projecting the collector pipe, the finer sand in the path of the digging head attached to the pipe is removed by flowing along with the water into the pipe. The result is that a layer of coarser gravel is left surrounding the pipe. This serves to arch over the slots in such a manner that water is able to enter freely through the slots.

UMP000135

Ranney Wells Nos. 1 and 2 will each be equipped with a pump having a capacity of 5,000 gallons per minute at 485' head and an 800 h.p. motor. These pumps will pump directly from the caissons into 24" lateral pipe lines which connect with the main 42" line to the plant. The 24" lines leading from the caissons are Universal joint cast iron for a distance of about 1,055' and 795', respectively. A section of the lateral line to Well No. 2, 1,812' in length and connecting the Universal joint pipe with the 42" main, is constructed of bell and spigot cast iron pipe. From the junction of these laterals, the 42" main is constructed of 5/8" steel pipe for a distance of about 1,000' up the bluff from the river bottoms.

Ranney Wells No. 3 and 4 will each be equipped with two 8,000 gallons per minute pumps, 175' head and two 400 h.p. motors. These pumps will pump from the caisson into 30" Lock Joint reinforced concrete pipe laterals and their combined flow will be carried in a 36" Lock Joint concrete pipe to an auxiliary reservoir located near the river pump house. This auxiliary reservoir will be approximately 50' x 80' in size and will be equipped with 6 pumps each having a capacity of 5,000 gallons per minute at 485' head. The water will be pumped directly from the auxiliary reservoir into the 42" line leading to the plant.

This 42" pipe is constructed of steel plate surrounded by spiral reinforcing bars covered with a shell of gunite concrete. The inside of the pipe is lined with a shell of centrifugally spun concrete. The pipe was manufactured by the American Pipe and Construction Company at a temporary plant which was erected for this purpose at South St. Paul, Minnesota.

414 - River Pump Houses

The river water is obtained from the Mississippi River through a channel which was dredged from the bank of the river across Spring Lake to the bank of the bluff bordering the Mississippi valley. This channel is approximately 2,700' long, has a minimum depth of 12' below normal water elevation and has a bottom width of 50'. The channel leads to a pump house which is a reinforced concrete and tile structure having overall dimensions of 63' by approximately 73' and a height of 45'.

The pump house will be equipped with 5 pumps having a capacity of 7,500 gallons per minute each at 415' head. Five 1,000 h.p. motors are provided for operating the pumps. The water is pumped directly into a 42" main leading to the plant site. This main is constructed of the same pipe used for the well water main, except that the first section leading from the pump house up over the bluff is constructed of 5/8" steel pipe for a distance of 380'.

402 - Reservoir Settling Basins

The reservoirs at the plant site are each constructed with overall dimensions of about 242' x 242' and 240' x 242', respectively. The "A" Reservoir has a capacity of 3,075,000 gallons for the well water, and 3,275,000 for the river water. The water from each pipe line, before entering the reservoir proper, passes through the chemical inlet house where there is introduced a charge of Calgon which acts as a stabiliser. This reservoir is a reinforced concrete structure with a timber roof supported on timber posts. The concrete structure has a depth of 17'.

UMP000136

400 AREA - POWER AND WATER SUPPLY (Cont'd)

412 - Pump House for Filter Plant and Reservoir

Constructed adjacent to one end of the "A" Reservoir is a reinforced concrete pump house with overall dimensions of 169' x 19½'. On the well water side of the pump house, there are 4 pumps, each with a capacity of 6,500 gallons per minute and each operated by a 350 h.p. motor. These four pumps are the ones which deliver the water to the process water mains. Provision is made for two future pumps. The water for fire protection is delivered by two steam driven pumps each with a capacity of 1,000 gallons per minute and one motor driven pump of the same capacity. The river water is delivered by means of four 6,500 gallon per minute pumps operated by 350 h.p. motors. Provision is made for one future pump.

The "B" Reservoir has a well water capacity of 3,000,000 gallons and river water capacity of 3,200,000 gallons. This structure differs from the "A" Reservoir in that it is constructed of plain concrete with gravity section walls. The roof is of timber construction similar to that in the "A" Reservoir.

The pump house at the "B" Reservoir is of reinforced concrete and the same dimensions as the "A" structure.

Process water is delivered by four 6,500 gallon per minute pumps with provision for two future pumps. Fire protection water pump equipment is the same as in the "A" Reservoir. The river water is delivered by five 6,500 gallon per minute pumps in contrast to the four pumps used in the "A" Reservoir. There is no provision made for any future pumps for the river water.

413 - Filter Plant, Including Softeners

At each of the reservoirs, water for the boilers is taken off the well water main in a 10" line which leads to the flash mixer tank. Here the water is mixed with chemicals in a 20'6" diameter by 22' high concrete mixing chamber. The detention time in this tank is 20 minutes. The water then flows to two precipitater tanks, operating in parallel. These tanks are 42' in diameter by 22' high. The total detention period in these tanks is 176 minutes. Both the flash mixer and the precipitator tanks are constructed of gunite concrete reinforced with wire mesh and steel bars. From the precipitator tanks, the water flows through a battery of 6 wood gravity filters into the clearwell in the softener room which is a part of the power house. The filtered water in the clearwell is given an acid treatment to reduce the pH value to approximately 7.5. The water is then pumped from the clearwell through a battery of 6 softeners for hardness removal and thence to the boilers.

411-A and B - Drinking Water Supply

Drinking water will be supplied from two deep wells as described below.

411-A - McCarthy Well - This well is a 24" cased well, 418' deep. At the present time, the well is being used as a temporary source of supply for drinking water and is equipped with a 200 h.p. deep well turbine pump rated at 2,000 gallons per minute. Water is pumped to a 200,000 gallon steel tank from which it is distributed to the temporary system by two booster pumps. Ultimately, this temporary system will be discarded and a 200 h.p. turbine pump will be hooked up to pump directly into the drinking water supply system.

UMP000137

411-B - Layne Western Well - This well is also a 24" cased well, 386' deep. The well will be equipped with a vertical turbine deep well pump rated at 2,000 gallons per minute and powered by a 200 h.p. motor. Water will be pumped from this well directly into the distribution system with a provision being made for surplus water unconsumed in the system to be stored in an elevated steel tank 115' high, having a capacity of 55,000 gallons. When the elevated tank is full, surplus water will be discharged from the drinking water supply system to the Ranney well water portion of the "A" Reservoir in the 400-A Area. It is anticipated that the pumps on this well and the McCarthy well will be run more or less continuously. It will be possible, however, to shut the pumps down for short periods and supply by gravity from the 55,000 gallon storage tank.

The drinking water supply distribution system is an independent system and will furnish all drinking water in the Administration Area, 100 Areas, 200 Areas, 300 Areas, and 400 Areas. In view of the fact that only a limited amount of water is used for manufacturing in the latter stages of the 200 Areas, this drinking water system will be the only one run through those Areas.

There is included a diagram which shows the general plan for water supply, treatment and distribution as outlined. This diagram is not to scale and is intended to show the general arrangement only.

401 - Power House

There are five steam generating units in power house 401-A and four units in 401-B. Each steam generating unit is practically complete in itself, and by this arrangement it will be possible to operate one or more boilers in either power house.

Each steam generating unit consists essentially of the following items:

a. Boiler - One Combustion Engineering Company's 4 drum bent water tube boiler with water cooled walls and water screen grates. Boiler operating pressure is approximately 450 pounds per square inch. Steam temperature at 450 pounds per square inch is 460° F. No superheaters are furnished on this installation. Capacity of boiler is 190,000 pounds of steam per hour with an average peak capacity of 200,000 pounds of steam per hour, but only for short periods. Feed water temperature is approximately 240° F.

b. Pulverizers - Two Raymond Coal Pulverizers, each with a capacity of approximately eight tons per hour. Total capacity of pulverizers is 16 tons. The actual coal consumption at 190,000 pound per hour boiler capacity will be approximately ten and one-half tons per hour.

c. Pulverized Coal Burners - Four pulverized coal burners per boiler. Each pulverizer supplies two burners. Forced draft (from air preheater) is supplied to each burner through a wind box surrounding the burner nozzle. Under normal operating conditions the boiler load must be in excess of 35,000 pounds of steam per hour before pulverized coal can be safely used.

d. Oil Burners - Four oil burner nozzles per boiler. These oil burner nozzles are placed in the same location as the pulverized coal burners. Oil will be used for starting the boilers prior to cutting in with pulverized coal. Each nozzle will have the capacity to produce 40,000 pounds of steam per hour. In an emergency, oil burners will produce 160,000 pounds of steam per hour. Heated air for oil combustion is supplied by the same wind boxes as those used for the pulverized fuel burners.

UMP000138

g. Forced and Induced Draft Fans - One Buffalo Forge forced draft fan with a capacity of 58,000 C.F.M. at 13 inches static pressure. One Buffalo Forge induced draft fan with a capacity of 112,000 C.F.M. at six inches static pressure. These fans are so connected that they are driven by a single Westinghouse 365 h.p. steam turbine.

f. Air Preheater - One Combustion Engineering air preheater located at the boiler flue gas outlet. Boiler flue gases enter the preheater at approximately 770° F. and leave at a temperature of approximately 400° F. Flue gases pass through the air preheater to the induced draft fan which in turn, forces the gases through the boiler breeching and out the smoke stack. The forced draft fan forces room air at approximately 80° F. to 100° F. through the various passes of the air preheater where it is heated to approximately 600° F. before being discharged to the burners (either coal or oil).

All feed water for the boilers will be chemically treated to eliminate iron, to lower the silica content, and to reduce the water to zero hardness. In addition the feed water will be passed through deaerating water heaters where the dissolved gases will be removed from the feed water. Continuous blow-down of the boilers (approximately 10 per cent of the boiler feed) will be required in order that the total soluble solids in the boiler water will not exceed 2,500 parts per million. The waste heat in the continuous blow-down will be utilized to preheat the boiler feed water.

Coal delivered at the boiler plants will be Illinois bituminous, 3/4 inch size, with average heat values of 11,300 to 12,000 BTU per pound as fired. After pulverizing, 70 per cent of the coal will pass through a 200 mesh screen.

An Allen-Sherman-Hoff System will be used for removing ashes from the boilers. This system employs the use of water for removal and conveyance of the ashes.

Boiler feed pumps will be Allis-Chalmers' five stage centrifugal pumps, driven by Westinghouse 310 h.p. steam turbines. Each pump will have a capacity of 625 G.P.M. at 1,450 feet head which is the equivalent of 640 pounds per square inch.

A drying period of approximately one to two weeks (with a wood fire) will be required for each boiler after the brick setting is complete.

The predicted performances on each boiler as outlined by the Combustion Engineering Company are as follows:

UMP000139

a. Boiler:

Evaporation, lbs./hr.	100,000	160,000	190,000
Pressure at header outlet, lbs./sq. in.	450	450	450
Saturation steam temperature, degrees F.	460	460	460
Draft loss, boiler, "w.g.	.36	1.02	1.28
Feedwater temperature entering boiler, degrees F.	240	240	240
Total fuel, as fired, lbs./hr.	11,000	17,400	20,900
CO_2 at boiler outlet, per cent	13.2	14.4	14.5
Furnace temperature, degrees F.	1,700	1,950	2,000
Combustion rate, BTU/cu. ft./hr.	10,100	14,500	19,100
Weight of gas through heater, lbs./hr.	135,000	203,000	244,000
Weight of air through heater, lbs./hr.	84,200	134,000	170,000
Temperature of gas entering heater, degrees F.	630	710	770
Temperature of gas leaving heater, degrees F.	353	386	405
Temperature of air entering heater, degrees F.	80	80	80
Temperature of air leaving heater, degrees F.	545	585	615
Draft loss, gas side, "w.g.	.52	1.12	1.60
Draft loss, air side, "w.g.	.73	1.79	2.83
Overall efficiency, per cent	82.0	83.1	82.5
Maximum air pressure drop through burners and windbox		2.80	3.50
Pressure loss through ducts - air		.40	.50
Pressure loss through ducts - gas		.20	.25
Gas temperature entering boiler tubes, degrees F.		1,860	1,990
Gas Temperature leaving boiler tubes, degrees F.		710	770

b. Pulverizer:

(1) Air capacity of pulverizer exhauster - 450 pounds of air per minute at 100% of pulverizer capacity.

(2) Air temperature required to pulverize 16,000 pounds per hour per mill of specification coal with 13% moisture and 70% through 200 mesh - 525° F.

(3) Power consumption of two mills at 190,000 pounds per hour evaporation (motor input) - 16.2 K.W. per ton based on 13% moisture.

(4) Per cent coal through 50 mesh screen under above conditions - 99%.

(5) Stable minimum load carried on (a) two burners - 35,000 pounds per hour, (b) four burners - 70,000 pounds per hour.

There are plot plans of the "A" and "B" Areas attached which show the general layout and some details.

405-L - Purchased Power Incoming Transmission Line

To facilitate following the outline of the electric power distribution system contained in the next few pages (405-L, 405-S, 501-S and 501-L) the attached diagram has been prepared and is attached.

The Northern States Power Company will install switching equipment at Rogers Lake Substation and build a 110 KV Line from Rogers Lake to the Gopher Ordnance Works site at Gopher Ordnance Works coordinates E 11,900, 5880, one span inside the Gopher Ordnance Works site. At this point a meter house and metering equipment will be installed. The line will be four wire, star connected, using #4/0 ACSR wire, suspension type insulators, with wood poles (generally 65' poles), H type construction, prevailing spans approximately 500'.

The du Pont Company will continue the 110 KV Line from this point to substation 405-A, tapping off the same type of line to substation 405-B and a 110 KV Line to substation 405-C for the river and Ranney Well pumping.

UMP000140

The lines to 405-A and 405-B will be similar to Northern States Power Company construction except that #2/0 Copperweld Copper will be used and prevailing span will be approximately 485'. The line to 405-C will be the same except that one-half inch low resistivity galvanized iron wire will be used for the conductors.

405-S - Purchased Power Substations

At substation 405-A and 405-B, two 12,500 KVA, three phase 110 KV/13.8 KV transformers will be installed in parallel with air break switch, 600 ampere circuit breaker and lightning protection on the 100 KV side of transformers. The 13.8 KV circuits go into the Power House 401-A and 401-B where the control is located. Four 13.8 KV radial feeders arranged with emergency ties and sectionalizing switches go to:

From 405-A - 401-A:

1. Substations 501A-1, 501B-1 and 501C-1
2. Substation 501F-1
3. Substation 501E-1
4. Substation 501D-1

From 405-B:

1. Substations 501A-2, 501B-2 and 501C-2
2. Substation 501F-2
3. Substation 501E-2
4. Substation 501D-2 and 501FLS (fence lighting switch) then to 501FL-1, 501FL-2 and 501FL-3 (fence lighting)

These feeders are #2/0 MHD copper.

At substation 405-C there are three 3,333 KVA single phase 115/6.9 KV transformers, delta connected, with air break and lighting protection on the primary side and 600 ampere oil breakers on the secondary feeders. The river and Ranney pumps are 6.9 KV fed from four feeders. Three 15 KVA 6900/490 volt transformers and one 69/115/230 volt transformer are connected to the lines for incidental power and light.

UMP000141

500 AREA - OUTSIDE LINES

501-S and 501-L - Electric Power and Light Distribution Lines and Substations

Substations 501A-1, A-2, B-1, B-2, C-1 and C-2 have three single phase 13.8 KV delta transformers for power, with six feeders from each. In 501B-1 and 501A-2, three 1500 KVA, 13.8 KV delta to 2300 volt delta connected transformers have three 2300 volt power feeders and one 2300 volt lighting feeder.

Substation 501D-1 and 501D-2 have three 1500 KVA 13.8/2.3 KV delta connected transformers with three 2300 volt feeders for power, one 2300 volt feeder for lighting, and one 2300 volt feeder for constant current street lighting and fence lighting regulators.

Substations 501E-1 and 501E-2 have three 1500 KVA, 13.8 KV/2.3 KV delta connected transformers with two 2300 volt feeders for power.

Substations 501F-1 and 501F-2 have three 1500 KVA, 13.8 KV/2.3 KV delta connected transformers with three 2300 volt feeders for power and one 2300 volt feeder for light.

From switch 501FLS three 13.8, single phase lines, go to substations 501FL-1, FL-2 and FL-3 each of which has one 150 KVA, 13.8 KV/2.3 KV transformer, and two 30 KVA 6.6 ampere constant current regulators for series fence lighting. One 2300 volt feeder for guard tower lighting comes off the 2300 volt lines.

All 2300 volt lighting feeders except for guard towers are three phase. The single phase lighting transformers are 2300/115/230 volt.

Lightning arrestors are installed at each transformer bank and every 1000 feet on the primary lines.

The schematic diagram on the following page illustrates the electrical distribution system.

502 - Steam Lines

All steam on the area will be generated in one of the two power houses. Power House 401-A will furnish steam required for heating and process purposes in the "A", "B" and "C" Lines, the 300 Area and the Administration Area; the 401-B Power House Area will service the "D", "E" and "F" Lines, 900 Area and the 300-B Area. All steam lines are overhead pipe lines and are covered with standard 1" pipe insulation materials. There will be a total of 17,700 lineal feet of such lines.

The steam distributed to the mains will be high pressure steam. The mains distributing steam for process purposes will carry 300 pounds per square inch and mains distributing steam for heating purposes will carry 150 pounds per square inch. Pressure will be reduced through the use of pressure reduction valves at all buildings where required.

503 - Water Lines

All water lines are installed underground. There are four different types of water lines. These are fire water lines, drinking water lines, raw water lines, and process water lines. There will be a total of 419,000 lineal feet of underground water lines of all different sizes.

UMP000142

500 AREA - OUTSIDE LINES (Cont'd)

504 - Air Lines

Air lines are installed over head and are used for the distribution of air to the various manufacturing buildings from the Power House Area and throughout the Acid Area from building 302-A and B. There will be a total of 97,800 lineal feet of such lines.

505 - Sewer Lines

This includes disposal lines for all operations and functions in the plant. In general, sewers fall in two categories - process and sanitary.

Sanitary sewers are all vitrified tile, ball and spigot pipe. All sizes of pipe will be used and a total of 42,156 lineal feet will be placed.

Process sewers are for the most part vitrified tile bell and spigot pipe, and 63,374 lineal feet of tile pipe will be placed. The main trunk sewer is constructed of Laminex box culvert sections. These sections are pressure treated wood with laminated sides, bottom and top. The sections vary according to the load anticipated. The maximum section is a double box 7' x 8' and the minimum is a single box 3½' x 4'; 11,160 lineal feet of Laminex trunk sewer will be placed.

506 - Brine Lines

These lines carry brine for cooling purposes and for condensers. They are installed over head and are of varying size; 44,320 lineal feet of such lines will be installed.

507 - Process Lines

These lines carry the various items required in the preparation and manufacture of powder. They are installed overhead. The items carried include acids, ether, alcohol, solvent and stuff. There will be a total of 259,940 lineal feet installed in the plant.

508 - Hydraulic Lines

These lines are underground and carry high pressure water supply. Pressures of 3,500 pounds per square inch and 500 pounds per square inch are carried. The return lines carry 150 pounds per square inch. These lines supply hydraulic pressure for the operation of hoists, presses and other operating equipment. There will be a total of 37,000 lineal feet of such lines.

509 - Pipe Supports

All overhead lines are supported on pole structures of appropriate design. Some supports carry several different lines and are appropriately designed. Others carrying one or two lines only are, of course, much lighter. A total of 10,000 pipe supports must be placed.

510 - Fire Protection

Water for fire protection purposes is furnished from the two reservoirs 402-A and B. For this purpose there are two 1,000 gallon per minute steam powered pumps and one pump 1,000 gallons per minute capacity powered by a 150 h.p. motor in the pump house at each reservoir. Distribution of water is direct

UMP000143

from the reservoir with a 100,000 gallon elevated tank 115' high in the center of the area to insure a supply at all times. Sprinkler systems are provided in all buildings where fire hazards warrant. A total of 223 buildings contain such systems. A total of approximately 105,000 lineal feet of underground cast iron pipe Class 250 bell and spigot will be laid for fire protection.

511 - Open Drainage Ditches (Vermillion River Work)

The process wastes from the plant will be acid in nature. The degree of acidity appears to be an unknown quantity. It is sure that it will be sufficiently acid to be unfit for consumption by farm livestock and will have deteriorating effects on concrete and steel structures.

There will be 160 second feet of process runoff for which provision must be made. The only logical disposition is drainage to the Vermillion River channel and thence to the Mississippi River. As a large portion of the surface runoff from the plant will be drained the same way, the facilities must be increased to carry approximately 240 second feet more or a total of 400 second feet.

It is proposed that a small detention reservoir will be created in the southeast corner of the site and that process waters (plus surface runoff involved) will be held for a period of at least 18 hours. This will then be released through the access channel to the Vermillion River.

To insure sufficient capacity for the normal flow of the river, plus the increased flow created by the plant process runoff, it was found necessary to deepen and widen the river channel, place drop structures to reduce velocity, reconstruct several bridges to increase cross sectional area of opening, protect structures against acid and revise the dams in the Mississippi River Pool #3 into which the Vermillion River empties.

The following is a summary of the work to be done:

A - EXCAVATION - Total yardage involved 327,503 cubic yards:

(a) Outfall ditch from the end of the Laminar culvert trunk sewer to the detention reservoir
This work includes the excavation of 124,135 cubic yards of dirt.

(b) Access Channel. Work on this includes the excavation of a channel from the detention reservoir to the Vermillion River, a distance of approximately 9,000'. The channel excavated has a bottom width varying from 18' to 20', with side slope of 2 to 1. The average cut is approximately 5'. The total yardage of excavation involved totals 74,272 cubic yards.

(c) River Channel. This work includes the deepening, widening and straightening of the existing Vermillion River channel from the point of intersection of channel by the access channel and to the Mississippi River for a distance of 12.7 miles. This includes the excavation of 129,096 cubic yards. All of this dredging work has not been continuous dredging but has included spot dredging as required.

B - HIGHWAY BRIDGES

There are three highway bridges which had to be reconstructed in order that the cross section area of the opening might be sufficient to carry the increased flow brought about by the introduction of process waste from the plant.

UMP000144

(a) New bridge on State Highway No. 52 - Ordinarily the small water course which was enlarged to provide a portion of the access channel passed through a small concrete culvert. The culvert could not be economically enlarged so it was decided that a new bridge would be constructed to augment it. The new bridge constructed was a two-span concrete deck bridge supported on treated wood piling. The cost of construction of this bridge, including material and labor, was $7,377.00.

(b) Bridge on State Aid Road No. 24 - Here again the original drainage facilities were inadequate to take the increased flow in the water course and a new bridge was required. A single span bridge with reinforced concrete deck supported on treated wood piling was constructed at a cost of $4,331.00.

(c) Bridge at the Village of Empire - At the point at which this bridge was constructed, drainage facilities for the existing water course had never been sufficient. To care for the increased flow, a two-span timber deck bridge supported on wood piling was constructed. The wood deck is to be treated with a bituminous wearing surface. Cost figures on the construction of this structure are not available.

C - FARM BRIDGES

(a) To enable farmers to have access to their property, it may be necessary to construct two bridge structures as farm crossings. There is some possibility that through further negotiations, an arrangement may be worked out whereby the lower farm crossing which is proposed to enable access to Hubert Gore's property may be eliminated. At this time, a definite statement in this respect is impossible.

The bridge to be placed to facilitate access to Jacob Hiniker's property has not as yet been definitely designed. Soil conditions and the existance of bed rock at a maximum depth of 5' seem to prohibit the use of a structure supported upon wood piling bents. In the event that a structure has to be built, it will undoubtedly be composed of piers constructed of wood cribbing filled with rock. Negotiations are being carried on for the construction of a new road enabling the elimination of this bridge but a definite statement of the action which will be taken is impossible.

D - DROP STRUCTURES

(a) To minimize erosion and channel maintenance work, it has been deemed necessary that suitable structures be provided to reduce the velocity of the stream's flow by taking care of the drop in elevation at two different points. Two structures are, therefore, being constructed at Stations 14 + 00 and 69 + 00. These structures will be constructed of timber and appropriate rock riprap. Due to the anticipated acid content of the river flow, steel bolts and other materials ordinarily used in timber construction cannot be utilized. All the timber will, therefore, be held by the use of wood dowels.

UMP000145

E - DAMS

(a) Prior to the construction of the various dams in the Mississippi River, the flow from the Vermillion River emptied into Vermillion Slough and flowed either north or south into the Mississippi as water levels permitted. When the dam in the Mississippi River was constructed below the Village of Hastings, a closing dam across Vermillion Slough was constructed north of the point at which the Vermillion River emptied into the Slough, thereby providing that the flow from the Vermillion River would empty into the Mississippi River via the Vermillion Slough at a point below Dam No. 3. Under these circumstances, the acid water from the Vermillion River would flow the entire length of the Slough and would presumably materially affect vegetation and the utility of lands adjoining the Slough. Plans, therefore, call for the removal of the closing dam originally constructed north of the discharge of the Vermillion River, and construction of a similar dam south of the discharge point of the Vermillion River. This will insure the discharge of the acid water directly into the Mississippi River through the utilization of but a short stretch of the Slough. The construction of this new closing dam will reverse the direction of flow of the discharge of the Vermillion River.

Between the new closing dam and the Mississippi River channel, Lake Isabel discharges into the Slough. To prevent the infiltration of the acid water into this lake, it will be necessary that a small earth filled dam be constructed across the discharge of the lake. This work, being quite removed from the project area, would require the transportation of a considerable amount of equipment some distance; it would also require a great deal of cost in transporting men and materials. It has, therefore, been decided that a bid solicitation will be made for the work and that it will be accomplished as a subcontract.

(b) Detention Reservoir Dam - Present plans call for the neutralization of the process discharge from the plant to a point where it will approach 100% theoretical neutralization. Apparently, there is some difference of opinion as to whether or not this degree of neutralization can be effected. A detention reservoir is, therefore, proposed on the site where process runoff will be retained for a period of 18 hours and then gradually released. A small dam will be required in the water course in the southeast corner of the project property. According to present plans, this dam will be of simple construction with an overflow spillway sufficient width to care for the automatic release of water in direct proportion to that water taken in. There will also be provided a gate arrangement whereby the detention reservoir basin can be completely drained if required.

UMP000146

F - RIPRAP AND CHANNEL PROTECTION

(a) Due to the acid content of the runoff from the plant, all existing structures, drop structures and dams, including the dam at the King Midas Mill at Hastings, Minnesota, must be adequately protected. It is proposed that this protection be provided by the placing of riprap rock having acid resisting qualities. Some tests have been run on Dresser Junction rock and granite from Jasper, Minnesota, and Duluth, Minnesota. Apparently, all of the rock tested will suffice and the procurement of suitable quantities for the work to be done is underway. In addition to the riprap work, it will be necessary to apply some acid resisting Mastic material to existing concrete bridge abutments, etc.

G - FENCING OF RIGHT OF WAY BOUNDARIES

(a) The entire right of way boundary will be fenced and the total amount of fencing involved will be approximately 27 miles. As the larger portion of the right of way passes through farm and pasture lands, it will be necessary to erect fence of a nature suitable to exclude all livestock from the right of way. The farmers occupying adjacent lands have been consulted and insofar as possible, fencing conforming to their requirements will be erected.

There is a small scale diagram attached showing the general layout of the work on the Vermillion River. The locationsof the various structures and items of work are indicated.

UMP000147

600 AREA - GENERAL FACILITIES

601 - Broad Gauge Railroad Track

Railroad trackage within the plant site is of two different types - heavy rail trackage and light rail trackage.

Heavy Rail Trackage - In this type of trackage the minimum weight rail used is 75 pounds. This trackage is primarily for the facilitating of the receipt and distribution of materials, equipment and supplies necessary for construction and operation. Receipts go to the classification yard and are distributed from there. The trackage connects with the Chicago, Milwaukee, St. Paul and Pacific and the Rock Island Railroads on the west boundary, and with the Chicago, Great Western Railroad on the east. There are twenty-six miles of trackage of this type.

Light Rail Trackage - In this type of trackage the minimum weight rail used is 40 pounds. This trackage is intended for use in distributing supplies throughout the plant from the classification yard, and to facilitate the manufacturing process by transporting the materials in process from one building or Area to another. There are fifty miles of this to be constructed.

603 - Roads and Walks

Roads on the Area fall in one of two categories. They are either patrol roads or service roads required for the facilitating of manufacturing operations. There are 62.6 miles of road on the Area including patrol roads and service roads. All are crushed rock roads composed of a 5" base course of large sized (2½" maximum) crushed rock topped with a layer of 2" of fine crushed rock (3/4" maximum). In most cases calcium chloride has been used to assist in compaction and to minimize dust conditions. Water has also been used for compaction and bond.

There will be 2.5 miles of concrete road or wheeling walk in the 200 Areas. This road or walk will be 8' and 12' in width and is to facilitate transportation of the process materials.

There is attached a small scale map showing the road layout within the manufacturing Area.

The patrol roads extend entirely around the manufacturing area fence and the entire length of the river pipe line right of way.

With the exception of the walks in the Administration Area, all walks are crushed stone. There is no set figure as to the amount of walk which will be required but it is not anticipated that there will be any large amount, however.

In the administration Area, concrete walks were deemed necessary where continuous travel of personnel between buildings is necessary. Eight hundred and fifty lineal feet of 6' walk and 275 lineal feet of 10' walk were placed.

605 - Fences

Fencing in the Area proper is of two types. The fence around the outside perimeter of the boundary consists of wood posts 16' on centers, carrying two strands of #9 barbed wire. Seventeen miles are required.

The fence around the manufacturing Area consists of wood posts 15' center to center, carrying 9 strands of #9 barbed wire. Eleven miles will be required.

UMP000148

Along the Vermillion River right of way, the type of fencing varies. All will be carried on wood posts and there will be a total of 27 miles of fencing of all types involved. The type of fencing will be determined by the adjoining farmer's needs.

At the river water supply setup, it is anticipated that approximately 40,000 lineal feet of chain link fencing on steel posts will be erected around the River Pump House and the four Ranney Wells. (These materials were secured through transfer.)

610 - Sewage Pumping Station

In laying out the sanitary sewage system, it was found that it would be impossible to carry sewage from the "D", "E" and "F" Lines by gravity to the sewage treatment plant which is located west of the "A", "B" and "C" Lines. Rather than install a treatment plant for this sewage, a pumping plant was installed to force the sewage to the treatment plant. The pumping plant is composed of a reinforced concrete well 14' I.D. 24.5' below ground level. Approximately one-third of this is wet well where the sewage is received and from which it is pumped. The remainder of the well houses two Chicago Pump Company sump pumps, 500 gallon per minute capacity, and powered by a 7½ h.p. motor.

612 - Sewage Acid Neutralization Plants

There are two such plants on the Area. The plants are identical and are so placed that one acts to neutralize the process runoff from the "A", "B" and "C" Lines and the 300 Area, and the other acts on the runoff from the "D", "E" and "F" Lines and the 300-B Area.

The plant provides for delivery in carload lots of pulverized limestone. This stone is elevated by a bucket conveyor and screw conveyor to a concrete silo. This silo is 20' I.D. and 49'7" high and is made by covering a solid wood frame with gunite concrete in which appropriate reinforcing has been placed. There is a storage capacity for 450 tons of limestone. The bottom of the silo is pitched to the center where limestone is discharged through a slide gate to a controlled feeder, which feeds powdered stone to a small hopper over an injector. Raw water is introduced through the injector and at the point of zero pressure the lime powder is mixed with it. The resulting mixture passes through an agitator and the lime slurry therefrom is introduced into the acid runoff water in the trunk sewer.

Just before the process trunk sewer reaches the detention basin, a pH recorder station is installed where a sample is pumped from the sewer and through a pH recorder. This station acts as a basis of control over the amount of limestone introduced in the neutralization plant.

613 - Permanent Parking Areas

To facilitate parking of private automotive equipment belonging to operating employees, a total of 493,722 square yards of parking areas have been created. These parking areas are surfaced with a layer of approximately 6" of coarse crushed rock (2½" maximum) covered with a layer of 2" of fine crushed rock (3/4" maximum). The areas are located adjacent to the gatehouse and clock area servicing the "A", "B" and "C" Lines, and gatehouse and clock area servicing the "D", "E" and "F" Lines, and at the main office in the Administration Area.

UMP000149

614 - Guard Towers

At strategic points around the entire fence line inclosing the manufacturing Area, there have been constructed wooden guard towers. These towers are 14' high to a floor of a small inclosure 6'4" x 6'4". Each inclosure is equipped with an electric heater and is completely inclosed by glass windows. Access to the inclosure is gained through use of a series of stairs. On top of each tower, there is mounted a 1,000 watt search light which can be directed up or down and in a complete circle. There are 30 such towers within the manufacturing area proper. There is one such tower on top of the River Pump House (Building 414) and there will be four such towers on top of the pump house at each Ranney Well (404). It is anticipated that there will also be one of these towers on the hillside above the entire river water supply layout.

615 - Fence Lighting

At intervals of 125' around the fence line inclosing the manufacturing area, appropriate lights have been installed. These lights are 300 watts each and are mounted with suitable reflectors on a 35' pole. There are 10.8 miles of fence lighting circuit.

617 - Sewage Treatment Plant

This plant is designed to care for the treatment of the sanitary sewage from the several change houses, offices, shops, etc., in the manufacturing area. It is anticipated that 7,500 employees will frequent the area served.

Sewage is received in the plant from the sewer system through a bar screen to a wet well from which it is pumped, via a chlorinating chamber, to the settling tank by three 500 gallon per minute sewage pumps operated by 5 h.p. motors. The chlorinating chamber is small and serves only as a means of introducing Cl_2 by means of a semi-automatic vacuum type chlorinator. The sewage enters the settling tanks from the chlorinating chamber over a small weir. The settling tank is concrete and is divided into two sections each 48' long and 8' wide. Each section is equipped with a Link Belt sludge collector (endless chain cross flight type) driven by a $\frac{1}{2}$ h.p. electric motor.

The effulent is discharged from the far end of the settling chamber over a weir and into the process trunk sewer. There is another weir set slightly higher than the effulent weir over which grease is discharged to a grease trap. The sludge which settles out on the bottom of the settling tank is propelled by the sludge collector to a small chamber from which it is pumped to the primary digestion tank by a 4" sludge pump powered by a $1\frac{1}{2}$ h.p. motor. The primary digestion tank is 24' I.D. and 17' deep and is equipped with pipe coils for circulating hot water for heating the sludge to accelerate bacterial action. There is an overflow between the primary and secondary digestion tanks (30' I.D. x 17') and remaining effulent and surplus sludge can be drained to the secondary tank to a limited level. The sludge not consumed in the primary tank is pumped to the secondary digestion tank for holding during periods when the sludge drying beds can not be used.

Under ordinary circumstances, sludge not consumed by bacterial action is pumped directly to the sludge drying beds. There are five beds constructed of sand and gravel with tile underdrains. The overall dimensions of the drying beds are 165' long and 60' wide.

UMP000150

700 AREA - ADMINISTRATIVE AND MAINTENANCE FACILITIES

The items contained in this area are as indicated in the area name, facilities provided for administrative and maintenance purposes. Due to their functions, the various buildings are scattered throughout the several manufacturing areas or are located in the service and administration area.

The facilitating buildings in the manufacturing areas vary but each area is supplied with a sufficient number of four main types to enable efficient operations. The four main types are 704 - Supervisors' Offices, 706 - Laboratories, 707 - Change Houses, and 722 - Area Shops.

For the most part, the 704 Buildings, or supervisors' offices, are for the purpose of housing clerical personnel required for the compilation of records, statistics, etc. Each one of the various manufacturing stages is supplied with sufficient Change Houses to care for all manufacturing personnel on a three-shift basis. These houses contain lockers for each employee, shower and bath facilities, and ordinary toilet facilities. Each manufacturing stage is also provided with an area shop. This shop is equipped to make minor repairs on the manufacturing equipment utilized in the stage. Major repairs are accomplished in the service area.

In addition to the four main types of facilitating buildings, there are, at strategical points, fire headquarters, medical buildings, laundries, and comfort stations.

The Service Area contains a building complement sufficient to provide for the accomplishment of all service and maintenance functions. In this Area, there are general storage facilities, car repair shops, salvage buildings and storage facilities for spare equipment. There is also a combined shop which is a building 540' long and 80' wide containing shop facilities for all crafts. This includes blacksmith shop, pipe shop, millwright shop, carpenter shop, etc.

In the main administration area, buildings are provided for all administrative and control functions. For the most part the title of the buildings involved are selfexplanatory.

The following tabulation shows the number of administrative and facilitating buildings which are located within each area:

100 Area:
- 4 - 704 Supervisors' Office
- 2 - 706 Cotton Drying Laboratory
- 8 - 707 Change Houses
- 4 - 722 Area Shops

Service Area:
- 5 - 707 Change Houses
- 2 - 713 General Store House
- 1 - 714 Material Shed
- 2 - 715 Oil and Paint Storage
- 2 - 716 Car Wash and Repair Shops
- 2 - 717 Combined Shops and Sand Blasters House
- 1 - 718 Locomotive House and Sand Dryer House
- 2 - 722 Area Paint Shop and Riggers' Shop
- 3 - 725 Parking Garage
- 1 - 726 Acetylene Storage
- 4 - 729 Span Machinery Storage
- 1 - 731 Salvage Building
- 1 - 733 Service House
- 1 - 742 Lumber Storage House

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700 AREA - ADMINISTRATIVE AND MAINTENANCE FACILITIES (Cont'd)

200 Area:
- 11 - 704 Supervisors' Offices
- 2 - 706 Laboratories
- 18 - 707 Change Houses
- 1 - 709 Fire Headquarters
- 1 - 721 Inspectors' Office
- 6 - 722 Area Shops and Checking Stations
- 1 - 727 Comfort Stations
- 1 - 731 Salvage Building

300 Area:
- 1 - 704 Safety and Fire Inspectors' Office
- 2 - 706 Acid Area Laboratory and Supervisors' Offices
- 2 - 707 Change Houses
- 1 - 709 Fire Headquarters
- 4 - 722 Area Shops

400 Area:
- 2 - 704 Supervisors' Offices
- 3 - 707 Change Houses
- 1 - 709 Fire Headquarters
- 2 - 719 Medical Buildings
- 1 - 722 Area Shops
- 1 - 723 Laundry

900 Area:
- 1 - 707 Change House
- 1 - 722 Area Shop

Administration Area:
- 3 - 701 Gate Houses and Clock Alleys
- 1 - 702 Communications Building
- 1 - 703 Main Office
- 1 - 705 Employment and Examination Building
- 1 - 707 Change House
- 1 - 708 Cafeteria
- 1 - 720 Guard Headquarters
- 1 - 728 Staff Car Garage
- 1 - 730 Garage for Guard Highways

Also included in the 700 Area are communication facilities and alarm systems. The plant is serviced by a complete telephone system which has been constructed and which will be operated and maintained by the Northwestern Bell Telephone Company.

Construction of this system was accomplished as per the agreement between the Chief Signal Officer and the various telephone companies as pertaining to communication systems on temporary war projects. The responsibility for such construction work is delegated by the Chief Signal Officer to the Signal Officer of the Service Command involved who, in turn, delegates the responsibility to a Signal Officer on the particular post or project. Captain F. E. Mullen has been designated as Signal Officer for this project.

All telephone service required at the plant has been procured from the Northwestern Bell Telephone Company on a rental basis. This system is composed of an 8 position multiple manual switchboard system, providing for 800 lines and a guard reporting magneto switchboard system. Plans for the general plan were prepared by the du Pont Engineering Division in Wilmington and received the approval of the Wilmington District Office of the Army Engineers. Subsequent to approval by higher authority, the plans were turned over to the telephone company which provided working details and which accomplished the actual construction work. There is attached a small scale diagram of the system which is being installed.

UMP000152

900 AREA - ORGANIC AREA

When the plant was originally proposed, the plans included the construction of facilities for the manufacture of materials required in the production of diphenylamine. Since the original considerations, the proposed plan has been amended and aniline required for the manufacture of this product will be shipped to the plant via tank car. The buildings in the 900 Area which would be required for the production of aniline have been discontinued. The object of the operation is to produce D.P.A. which is used as a stabilizer to prevent deterioration in smokeless powder.

Crude D.P.A. is formed by autoclaving aniline in the presence of ammonium chloride and ferrous chloride as catalysts. The reaction is carried out in an autoclave equipped with a reflux column and is controlled to 150 pounds pressure for a period of 24 hours. During the period, by-product ammonia is given off and tends to collect in the upper section of the reflux column. To prevent reaction equilibrium, this ammonia is continuously released by a temperature controlled valve. The released ammonia is then stripped of entrained aniline and impurities and collected in water tanks known as absorbers.

At the end of 24 hours reflux period some unconverted aniline remains in the autoclave. This aniline is manually released from the top of the reflux column, condensed and sent to a reuse aniline storage tank for recharging the autoclaves.

The remainder of the autoclave charge, which consists of crude D.P.A. and aniline, is then processed through a packed column fractioning still. In this process, carried on under vacuum, the main purpose is to produce refined D.P.A. for graining. Aniline recovered from the distillation is sent back to the autoclave feed. After the refined D.P.A. leaves the still, it is grained or crystallized in a batch type graining kettle and then packed in barrels for storage and future use.

The following buildings and equipment are required for the process outlined.

Building 924 - Car Spot for Refined Aniline, Including Pump House

This building is to be complete with all equipment necessary for the unloading of refined aniline. From the car spot, the aniline will be pumped to the aniline storage tanks.

Building 909 - Aniline Storage

This structure will be composed of four horizontal aniline storage tanks, 9' in diameter and 36' long, each having a capacity of 17,700 gallons. As a safety and protective measure, tanks will be installed in dikes; they will be equipped with one La Bour pump and will be steam heated.

Building 910 - Autoclave Charge House

1 Aniline storage tank - 8' x 20' horizontal w/ scale tank charging pump.

1 Autoclave charging scale tank - 4' x 7'6" vertical steel w/2 autoclave charging pump.

1 Recovered aniline storage tank - 6' x 12' horizontal steel.

1 Barrel storage bin 7'2" x 3' x 2'9" steel, steam heated.

UMP000153

900 AREA - ORGANIC AREA (CONT'D)

Building 911 - D.P.A. Autoclave House

In this building provision for the installation of 12 autoclaves will be made. Only 10 autoclaves will be installed and if future production requires it, 2 additional units will be provided. The structure will be steel framing with corrugated asbestos siding and roofed with brick fire walls and steel barricades.

Building 912 - Ammonia Recovery Building

The equipment in this building will be as follows:

1 Aniline catch tank, 4' x 10' horizontal, steel
2 Ammonia scrubbers, 4' x 10' horizontal, steel
3 Ammonia absorbers, 8' x 20' horizontal, steel

Building 913 - D.P.A. Vacuum Still House

In this building, there will be two D.P.A. vacuum stills and two graining kettles. In addition to these items, the following equipment will be required:

1 Crude D.P.A. storage 8' x 20' scale and condenser
1 emergency D.P.A. receiving tank 8' x 20'
1 Crude D.P.A. pump
2 Aniline water tanks, 4' x 4' horizontal, steel
2 Recovery aniline tanks, 4' x 10' horizontal, steel
2 Hexite aniline tanks with coils
2 Refined D.P.A. tanks with coils
1 Caustic Tank, 2 compartments each, 4'5-3/4" x 4' x 4'
2 Vacuum systems, 2 stage and single stage
1 Separating tank, 6' x 6' vertical steel
1 Topping still reflux column and condenser
1 Topping still pump
2 Oil system expansion tanks
1 Topping still vacuum system - 2 stage
1 Scrap D.P.A. tank, 4'6" x 3' vertical steel
1 Caustic feed tank
1 Scale
1 Lemonade cooler

Building 914-A - Oil Superheater House

The equipment in this building willconsist of two Merrill absorbers complete with Kinney pumps, expansion tanks, two fuel oil pumps, 1 fuel oil tank, and 1 circulating oil tank in pit.

Building 915 - Fuel Oil Storage

This will consist of 1 fuel oil storage tank 22' in diameter and 20' high, having a storage capacity of 55,000 gallons.

Building 920 - D.P.A. Storehouses

There will be two such buildings. Each building will be 30' wide and 150' long, and will be frame construction with concrete floor.

Building 921 - Chemical Storage

This building will be 30' wide and 50' long, frame construction and will contain a Dry sprinkler system.

UMP000154

1100 AREA - STAFF RESIDENTIAL AREA

In this Area, there are located 25 houses which are intended to provide living quarters for the families of key members of the operating staff (both du Pont Operating and Ordnance Department).

1101 - Residences, Including Garage

There will be 10 two-story, 6 room houses constructed at a maximum cost of $7,200.00 (this figure includes the cost of all facilities within 5' of the building line). The rooms included are one livingroom 12' x 12', one diningroom 11' x 12', one kitchen 10' x 11', complete with electric range and refrigerator, two bedrooms 12' x 15', one bedroom 10' x 12', and one bathroom 6' x 9'.

Attached to each house there will be a one stall garage 11'6" x 12'6", and a screened porch 8' x 12'.

There will also be 14 five room bungalows, constructed at a maximum cost of $5,700 each (this figure includes the cost of all facilities within 5' of the building line). These buildings will include a livingroom 12' x 18', a diningroom 10' x 12', a kitchen 8' x 12', complete with electric range and refrigerator, a bedroom 11' x 13', a bedroom 11' x 12', and a bathroom 6' x 8'.

Attached to these buildings, there will be a one-car garage 11' x 21', and between the garage and building proper a screened porch 8' x 11'.

1102 - Roads and Grading

The general layout of the staff residential area is illustrated on a plot plan attached. This plot plan adequately illustrates the layout of the road and drainage system and also includes a section of the road showing the type of construction used.

1103 - Water Mains and Fire Protection

The water supply for the residences is secured from the supply system for the Village of Rosemount. To procure the water supply, 2,200' of 8" cast iron water main will be laid to the Village pump house and storage tank. The storage capacity of the Village water tank is 75,000 gallons which insures adequate fire protection.

1104 - Sewers

The sewer system being installed for these houses is very simple and is composed of a concrete cess pool 4' x 4' x 20' deep, located in front of each house. The location of the cess pool in the front rather than the rear of the houses was deemed advisable as there is every possibility that the sewage facilities of the Village of Rosemount may be utilized at some future date.

1105 - Electric Lines

The source of power for the houses is still under consideration. There are three alternatives but it appears most likely that the power will be procured from a Northern States Power Company substation which services the Village of Rosemount. Negotiations are under way with this company whereby they will construct the necessary line to bring power to a point on our west boundary directly opposite the location of the residences. The overhead distribution system required from that point will be constructed by the prime contractor.

UMP000155

1500 AREA - OLEUM PLANT

The Oleum Plant is for the manufacture of sulphuric acid in oleum form. The plant is designed to produce 200 tons per day of 100% sulphuric acid in the form of 40% oleum (109% sulphuric acid equivalent) when obtained entirely by the burning of sulphur. Among the various items of equipment contained in the plant are the following:

a. A waste head boiler for the generation of steam at 300 pounds per square inch gauge pressure, including feed water heater, steam driven steam water pumps, feed water regulator and continuous manual blowdown equipment.

b. Sulphur storage facilities capable of storing sufficient sulphur for a 30 days supply. This storage is to include suitable weighing and loading apparatus.

c. Two riveted steel storage tanks for furnishing 40% oleum with each tank to have a capacity of 1,800 tons.

d. Two riveted steel storage tanks 24' in diameter and 20' high, for storage of 93.2% or 73% sulphuric drip acid.

e. Two horizontal steel storage tanks 9' in diameter and 36' long, for anti-freeze acid mix.

The operating building will be complete with a control room blower, starting equipment and all other items of equipment necessary for the successful operation of the plant.

ACKNOWLEDGMENT

This data has been collected and assembled at the direction of Captain J. O. Ackerman, Area Engineer, Gopher Ordnance Works, Saint Paul, Minnesota, by Walter E. Vroman, Associate Engineer.

UMP000156

STATISTICS ON IMPORTANT PHASES OF THE PROJECT INCLUDING ACCOMPLISHMENT

Description of Particular Phase	Quantity Involved	Accomplishment as of
BUILDINGS - STRUCTURAL STATUS		
Number of permanent buildings to be constructed	784	
BUILDINGS - MECHANICAL INSTALLATION STATUS		
Number of permanent buildings having mechanical installations including plumbing and drainage; sprinkler systems; equipment; process piping; heating and duct work	568	
BUILDINGS - ELECTRICAL INSTALLATION STATUS		
Number of buildings requiring wiring for power and lighting	646	
OTHER PERMANENT STRUCTURES		
Number of other structures including tank farms, conveyors, guard towers, etc.	127	
OVERHEAD LINES		
Pipe Lines - Including steam, air, brine and process lines	580,000 lin. ft.	
Poles for carrying overhead pipe lines	10,000	
Electric Lines - Including lines of the following voltages:		
110,000 volts		
13,800 "		
2,300 "		
440 "		
220 "		
Miscellaneous voltages and control circuits		
UNDERGROUND INSTALLATIONS		
Including all water lines and high pressure hydraulic lines	421,600 lin. ft.	
RIVER WATER SUPPLY SYSTEM		
Pipe Line - 42" concrete pipe	31,050 lin. ft.	
36" concrete pipe	19,844 lin. ft.	
30" concrete pipe	6,415 lin. ft.	
42" steel pipe	1,377 lin. ft.	
24" Universal Joint C. I. pipe	1,858 lin. ft.	
24" Bell and spigot C. I. pipe	1,795 lin. ft.	
42" Lock-Joint concrete pipe	8,000 lin. ft.	
30" Lock-Joint concrete pipe	3,000 lin. ft.	
Ranney Wells	4 wells	
Well #1 - Concrete caisson	65 lin. ft.	
Collector pipe	1,000 lin. ft.(min.)	
Pump house and equipment	1	
Well #2 - Concrete caisson	65 lin. ft.	
Collector pipe	1,000 lin. ft.(min.)	
Pump house and equipment	1	
Well #3 - Concrete caisson	115 lin. ft.	
Collector pipe	1,000 lin. ft.(min.)	
Pump house and equipment	1	
Well #4 - Concrete caisson	115 lin. ft.	
Collector pipe	1,000 lin. ft.(min.)	
Pump house and equipment	1	
River Pump House -		
Structure only	1	
Equipment installation		
Intake channel dredging	2,700 lin. ft.	

UMP000157

STATISTICS ON IMPORTANT PHASES OF THE PROJECT INCLUDING ACCOMPLISHMENT (Cont'd)

Description of Particular Phase	Quantity Involved	Accomplishment as of
POWER AREAS	2	
"A" Area - Reservoir, pump house and chemical house	1	
Coal silos and stacks	5	
Boilers	5	
Equipment installation		
"B" Area - Reservoir, pump house and chemical house	1	
Coal silos and stacks	4	
Boilers	4	
Equipment installation		
ROADS AND WHEELING WALKS		
Roads - Includes all roads in the manufacturing Area, Patrol roads around the manufacturing Area and to the river water supply setup	62.6 miles	
Wheeling Walks - 8' and 12' wide	2.5 miles	
FENCES		
Vermillion River (woven wire and barbed wire)	30 miles	
River water supply system (chain link)	8 miles	
River water pipe line (woven and barbed wire)	Unknown	
Around project boundary (2 strand barbed wire)	17 miles	
Around manufacturing area (9 strand barbed wire)	12 miles	
SEWER LINES		
Vitrified clay pipe (process and sanitary)	20.3 miles	
Laminex wood culvert (process trunk sewer)	11,160 lin. ft.	
RAILROADS		
Heavy weight (75# min.) trackage	26 miles	
Light weight (40# min.) trackage	50 miles	
Rails and ties placed		
Ballast placed		
Light rail allocated	518,810 lin. ft.	
SANITARY SEWAGE FACILITIES		
Sewage pumping station (610)	1	
Structural status		
Equipment installation status		
Sewage treatment plant (617)	1	
Structural status		
Equipment installation status		
PROCESS SEWER FACILITIES		
Acid Neutralization Plant (612A)	1	
Structural status		
Equipment installation status		
Acid Neutralization Plant (612B)	1	
Structural status		
Equipment installation status		
pH Recorder Station (612C)	1	
Structural status		
Equipment installation status		
GUARD TOWERS - Towers on manufacturing Area	30	
Towers at River Water Supply setup	6	
CONCRETE (Estimated total of all types required)	162,000 cu. yds.	
STAFF RESIDENCES	25	

UMP000158

STATISTICS ON IMPORTANT PHASE OF THE PROJECT INCLUDING ACCOMPLISHMENT (Cont'd)

Description of Particular Phase	Quantity Involved	Accomplishment as of
VERMILLION RIVER WORK		
Excavation - Outfall ditch	124,135 cu. yds.	
Access channel	9,730 cu. yds.	
River channel	135,000 cu. yds.	
Highway Bridges - State Highway #52	1	
State Aid Road #24	1	
Empire	1	
Farm bridges	2	
Drop structures - Station 14 + 00	1	
Station 69 + 50	1	
Dams - Closing dam - Vermillion Slough	1	
Outlet dam - Lake Isabel	1	
Removal - existing slough closing dam	1	
Settling basin dam	1	
Fencing - Right of way		
Post erection	30 miles	
Wire erection	28 miles	

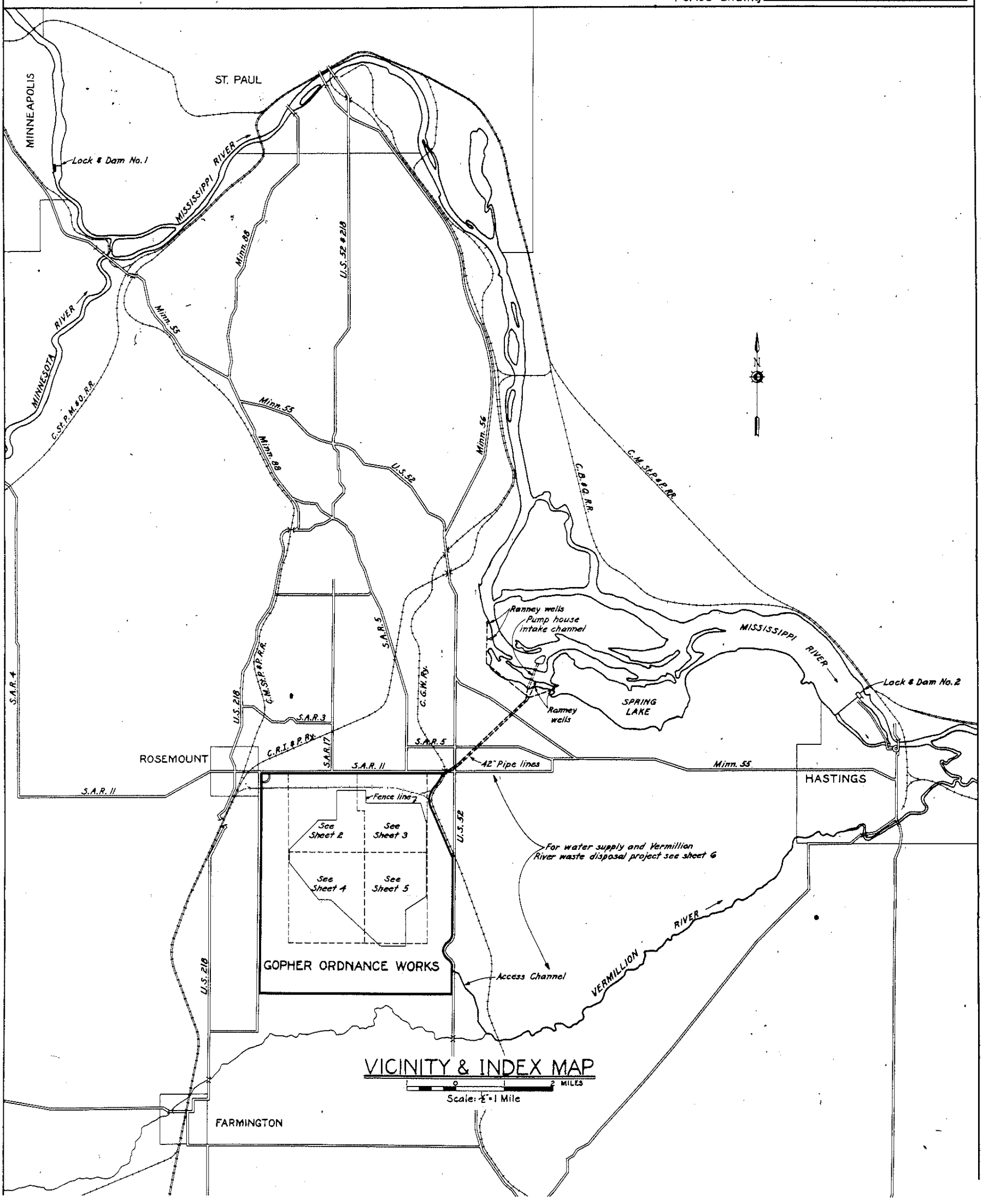
UMP000159

Sheet 12 of 17 sheets

Job No. M1-1

FIELD PROGRESS REPORT
PART E
SHEET 1 OF 6

Job Name Gopher Ordnance Works
Location Near Rosemount, Minn.
P.O. Box 3391, St. Paul, Minn.
U.S.E.D. District Omaha, Nebraska
U.S.E.D. Division Missouri River
Period Ending 30 June 1943.



VICINITY & INDEX MAP

Scale: 2" = 1 Mile

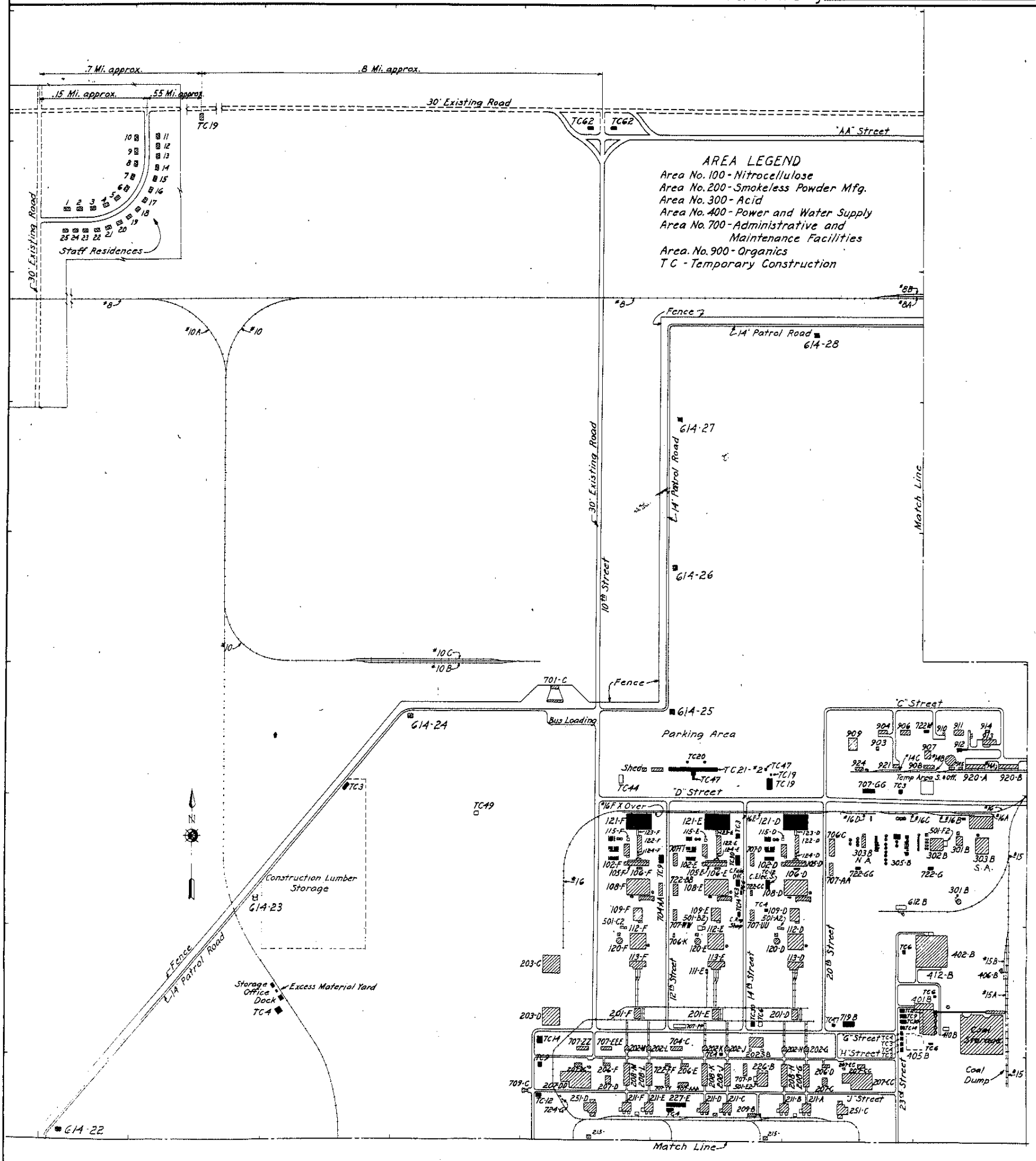
UMP000160

Sheet 13 of 17 sheets

Job No. MI-1

FIELD PROGRESS REPORT
PART E
SHEET 2 OF 6

Job Name Gopher Ordnance Works
Location Near Rosemount, Minn.
P.O. Box 3391, St. Paul, Minn.
U.S.E.D. District Omaha, Nebraska
U.S.E.D. Division Missouri River
Period Ending 30 June 1943.



PARTIAL DETAIL PLOT PLAN

0 100 200 300 400 500 1000 FEET
Scale 1" = 800'

Note:-
Information as of 30 June 1943.
Additions will be made as data become available.

UMP000161

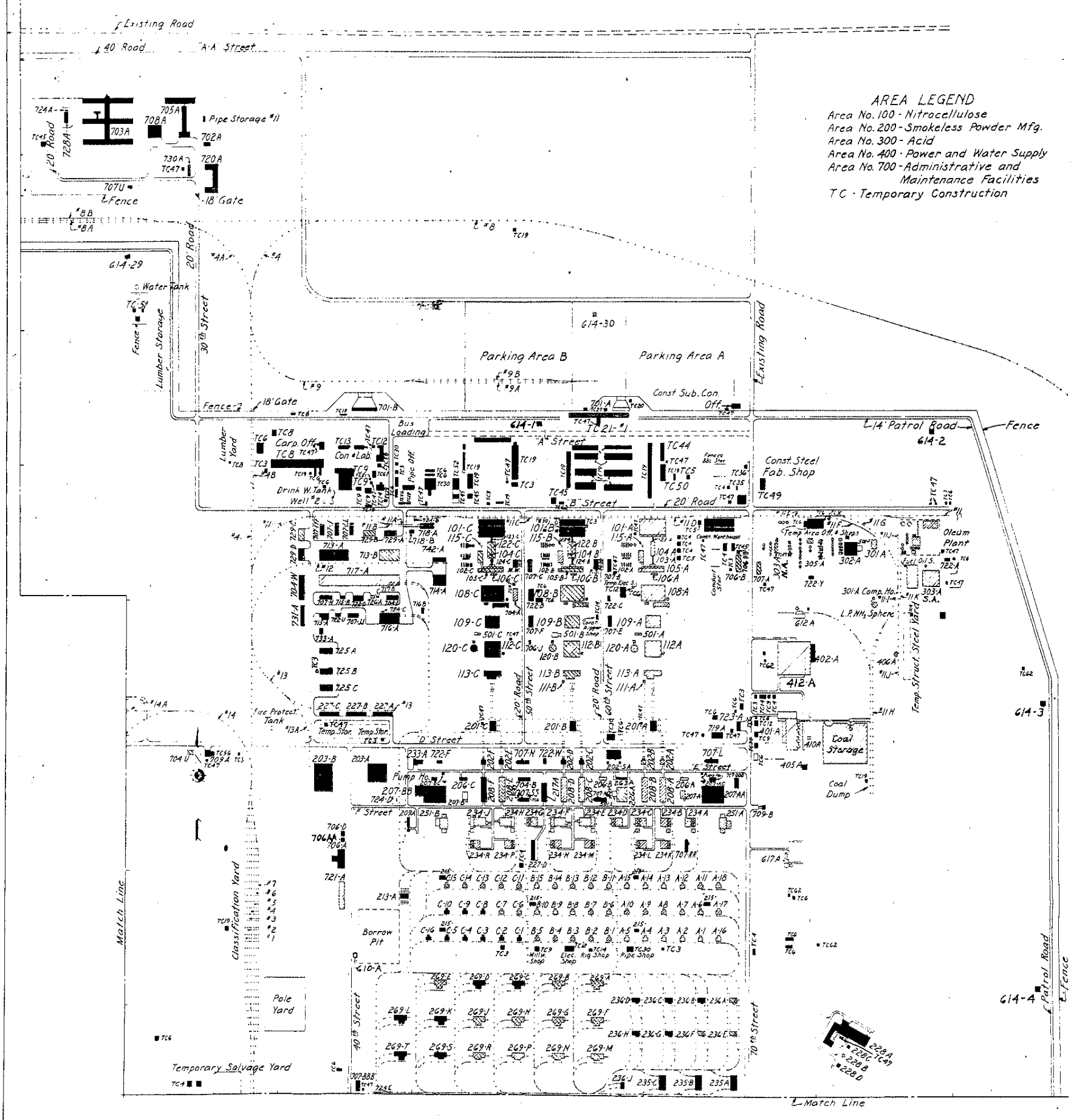
Final

Sheet 14 of 17 sheets

Job No. M1-1

FIELD PROGRESS REPORT
PART E
SHEET 3 OF 6

Job Name Gopher Ordnance Works
Location Near Rosemount, Minn.
P.O. Box 3391, St. Paul, Minn.
U.S.E.D. District Omaha, Nebraska
U.S.E.D. Division Missouri River
Period Ending 30 June 1943.



PARTIAL DETAIL PLOT PLAN

0 100 200 300 400 500 1000 FEET
Scale 1" = 800'

Note -
Information as of 30 June 1943.
Additions will be made as data become available.

UMP000162

Trim Line

Sheet 15 of 17 sheets

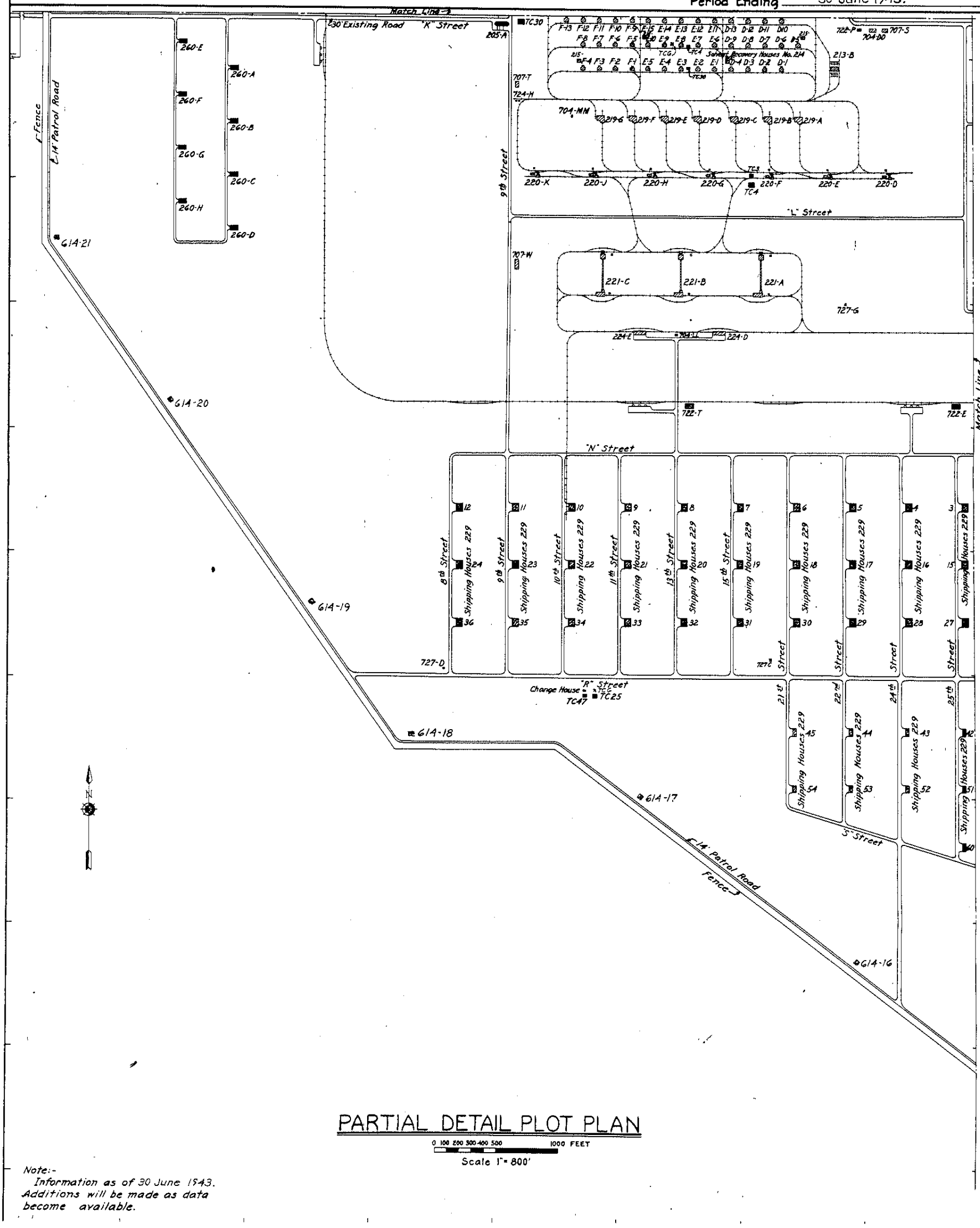
Job No. MI-1

FIELD PROGRESS REPORT

PART E

SHEET 4 OF 6

Job Name Gopher Ordnance Works
Location Near Rosemount, Minn.
P.O. Box 3391, St. Paul, Minn.
U.S.E.D. District Omaha, Nebraska
U.S.E.D. Division Missouri River
Period Ending 30 June 1943.



PARTIAL DETAIL PLOT PLAN

0 100 200 300 400 500 1000 FEET

Scale 1" = 800'

Note:-
Information as of 30 June 1943.
Additions will be made as data become available.

UMP000163

Trim Line 2

Sheet 16 of 17 sheets

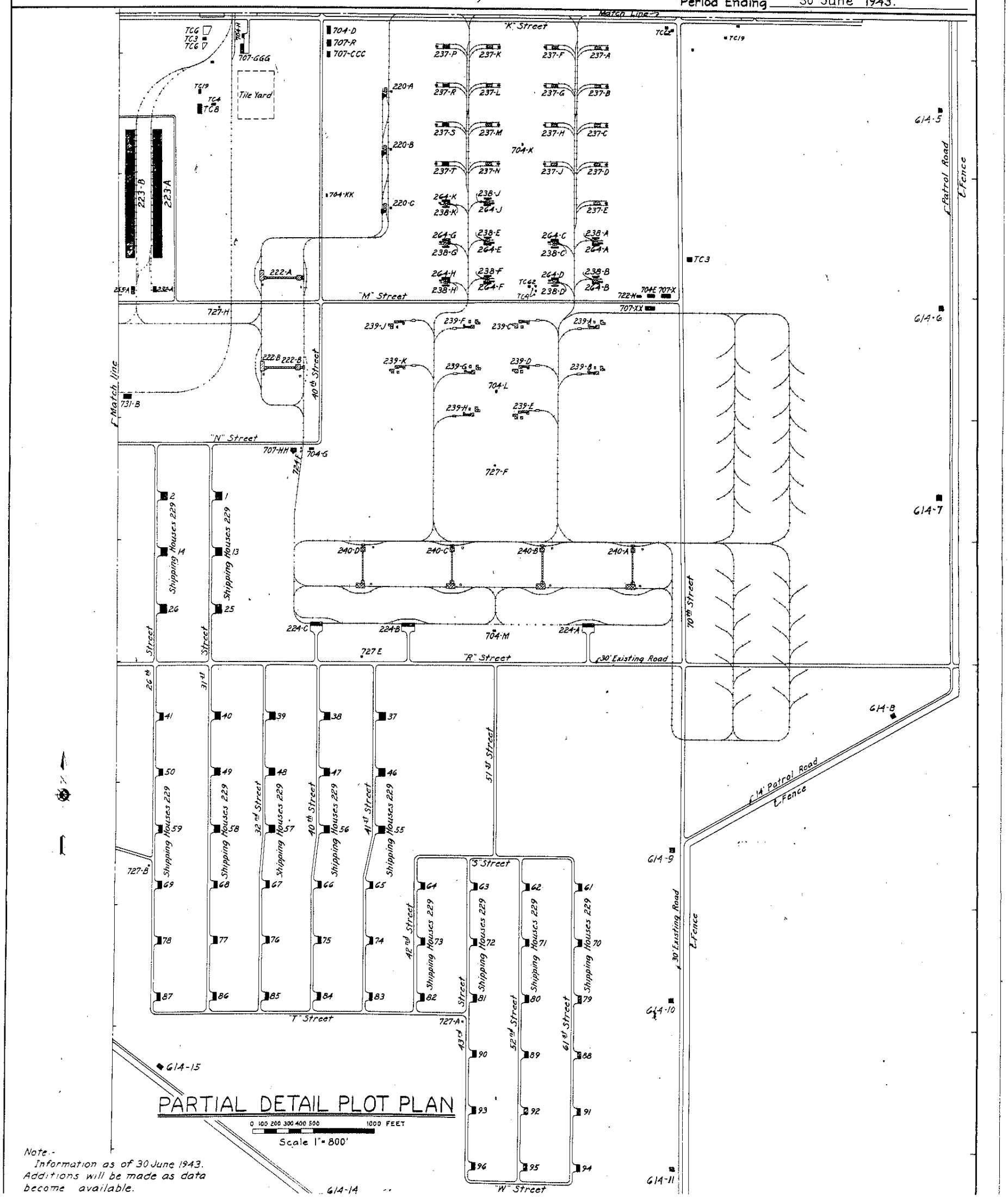
Job No. M1-1

FIELD PROGRESS REPORT

PART E

SHEET 5 OF 6

Job Name Gopher Ordnance Works
Location Near Rosemount, Minn.
P.O. Box 3391, St. Paul, Minn.
U.S.E.D. District Omaha, Nebraska
U.S.E.D. Division Missouri River
Period Ending 30 June 1943.



PARTIAL DETAIL PLOT PLAN

0 100 200 300 400 500 1000 FEET

Scale 1" = 800'

Note.-
Information as of 30 June 1943.
Additions will be made as data become available.

UMP000164

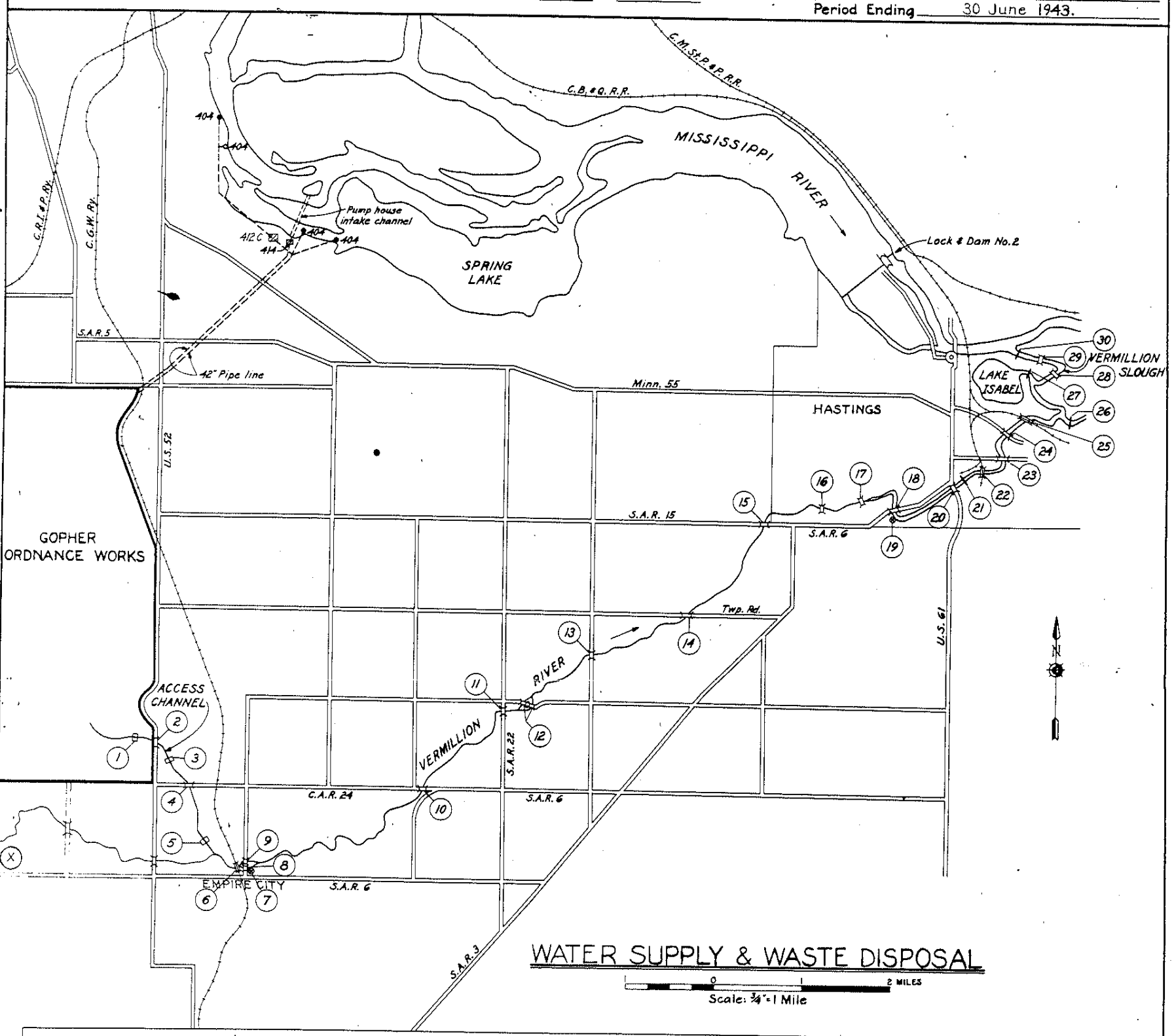
Trim Line 2

Job No. MI-1

Sheet 17 of 17 sheets

FIELD PROGRESS REPORT
PART E
SHEET 6 OF 6

Job Name Gopher Ordnance Works
Location Near Rosemount, Minn.
P.O. Box 3391, St. Paul, Minn.
U.S.E.D. District Omaha, Nebraska
U.S.E.D. Division Missouri River
Period Ending 30 June 1943.



WATER SUPPLY & WASTE DISPOSAL

Scale: ¾" = 1 Mile

VERMILLION RIVER WASTE DISPOSAL PROJECT

NO	STATION	DESCRIPTION	REMARKS
X		Existing U.S. Geological Survey Stream Gage Station	
1	9+75 A	New Detension Reservoir Dam	90% Complete
2	0+00	New 2-span Concrete Deck Bridge & Riprap Highway U.S. 52	100% Complete
3	14+00	New Drop Structure & Riprap	100% Complete
4	33+40	Rebuild Single-span Concrete Deck Bridge & Riprap. C.A.R. #24	100% Complete
5	69+50	New Drop Structure & Riprap	10% Complete
6	97+50	Existing Chicago & Great Western Ry. Bridge	
7	99+65	Existing U.S. Geological Survey Stream Gage Station	
8	99+65	Existing Single-span Bridge	
9	99+77	New 2-span Timber Bridge with Approaches & Riprap	100% Complete
10	281+60	Existing Single-span Pony Truss Bridge on Concrete Abutments, C.A.R. #24 - Riprap Abutments.	100% Complete
11	370+60	Existing Single-span Pony Truss Bridge on Concrete Abutments, S.A.R. #22 - Riprap Abutments.	100% Complete
12	388+90	Two existing Single-span Steel beam & Concrete Deck Bridges - Riprap	100% Complete
13	446+30	Existing Single-span Steel beam & Concrete Deck Bridge, M.H.D. #1022	
14	523+50	Existing Single-span Pony Truss Bridge on Masonry Abutments, C.A.R. #2 - Riprap	100% Complete
15	609+10	Existing 2-span Concrete Girder & Deck Bridge on Concrete Pier & Abutments, M.H.D. #4406, S.A.R. #15 - Riprap	100% Complete
16	661+90	Existing Single-span Bridge	
17	695+00	Existing Concrete Culverts	
18	717+20	Existing 2-span Concrete Girder & Deck Bridge on Concrete Pier & Abutments, M.H.D. #3851, S.A.R. #6	
19	720+00	Existing U.S. Geological Survey Stream Gage Station	
20	768+70	Existing 3-span Reinforced Concrete Bridge on Concrete Piers & Abutments, M.H.D. #4653	
21	774+70	Existing King Midas Milling Co. Mill Foundations & Dam	
22	789+50	Existing C.M.St.P.&P.R.R. High Deck Bridge	
23	804+90	Existing High Deck Type Bridge	
24		Existing Single-span Pony Truss Bridge on Steel Cylinder Piers	
25		Existing C.M.St.P.&P.R.R. 3-span Plate Girder Bridge on Concrete Piers & Abutments	
26		New Closing Dam #1	75% Complete
27		New Lake Isabel Outlet Dam	15% Complete
28		Existing Single-span Timber Deck & Stringer Bridge - Riprap Channel bed & Abutment wings	
29		Existing 2-span Timber Deck & Stringer Bridge Farm Road - Riprap Channel bed & Abut. wings	
30		Existing Closing Dam - To be removed	
		Project Boundary Fencing	100% Complete

Note:-
Continous dredging, including access channel and Vermillion River to bridge at (13), is completed.
Spot dredging from bridge at (13) to Vermillion Slough is completed.

UMP000165