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REPORT ON PROPOSED FRAC-SAND PROJECT
NEAR HOUCK, ARIZONA

This report will describe the occurrence of a deposit of sand available for use in fractionating equipment in the oil industry and will make recommendations for the location of a plant to process such sand, describe such plant and estimate the cost thereof.

The sand deposit is in Apache County, Arizona, and is distributed on a low range of hills along the north side of the valley of Puerco River some 40 miles, more or less, southwest of Gallup, New Mexico. Most of this area is within the Navaho Indian Reservation, but the particular property from which sand is proposed to be taken in the immediate future is Sect. 16, T. 22N., R. 29E., which section is patented land owned by Mr. Smith. The section was patented before the surrounding land was included in the Indian Reservation, so the owner is free to deal without having to obtain permission from the Bureau of Indian Affairs.

While the west half of Smith's Sect. 16 is covered by a deposit of from 6 to 18 ft. of sand of very good grade, it must be recognized that this deposit of very good sand extends in a belt to the northwest and southwest, extending for some miles both ways from Sect. 16.

The sand is a residual deposit that appears to be the result of the breaking down of an underlying sandstone formation. Where the sand was near the shore of an old lake it was rolled around by wave action, scrubbed, polished and well rounded. This rounded, relatively clean sand, that is also closely sized, is what is wanted for "frac-sand". The clean rounded sand extends out from the old

shore line an undetermined distance but the peculiar well rounded character becomes less marked as the distance increases.

The particular advantage Smith has over the surrounding sand areas is due to his ownership in fee simple, giving him the right to sell or lease without the necessity of waiting for tribal authority or permission from the Bureau of Indian Affairs. For this reason the parties interested in this project have obtained a mining lease to Sect. 18 from Mr. Smith and propose to begin operations at this point.

The specifications for "frac-sand" call for everything over 10 mesh to be wasted, also everything under 60 mesh is to be wasted. The -10 +60 mesh is to be separated into three sizes which will be shipped separately. These are -10 +20 mesh, -20 +40 mesh and -40 +60 mesh. The cut-offs must be quite sharp as not more than 10% undersize is permitted in each classification. Also, all lime and clay must be eliminated.

This will require a treatment plant that will first screen out all +10 mesh sand and all trash, which will be trucked to a waste dump. This will be wet screening, using approximately 80 g.p.m. water for spray washing. The slurry will have approximately 41% solids.

The fines, all minus 10 mesh, will be dewatered in a cone to approximately 76% solids, scrubbed in an attrition machine, the water added from the cone overflow and the pulp run into a screw classifier where most of the fine material (minus 60 mesh) will be washed out. The fines and surplus water will flow into a sump and be evacuated by a sand pump into a pipe line for delivery to a waste pile. The coarse sand, all unclassified +60m, will be raked over the classifier lip directly into a hopper feeding a combination filter-dryer that will deliver a sand product having less than $\frac{1}{2}$ of 1% of moisture.

The water removed in the filter will be delivered to the sump taking the classifier overflow, to be pumped to waste. The filtered sand will leave the filter-dryer hot, probably between 150° to 200° F and will be elevated in a chain-bucket elevator to a triple deck vibrating sifter where the separation into the required sizes will be made. Any additional fine product (-60 mesh) that may result from handling the sand after the classifier, or that may be raked over with the coarse classifier product, will be largely screened out at this point. This will give a very clean product, dewatered within the required limit, and separated into the three required sizes.

There are two suggested locations for the proposed washing plant, each of which has some advantages. One is on the Smith Sect. 18, the other is at the railroad loading at Houck on the A.T. & S.F. RR.

The site at Sect. 18 is alongside the source of material, so there is no requirement for stockpiling or any surge bin allowance. Since approximately 32% of the material as excavated is expected to be wasted, this location will save the cost of hauling this 32%, or about 36 tons per day some 8 miles. The sand to be shipped must be brought down the 8 miles from Sect. 18 to the highway near Houck, so there is no difference regarding that.

It will be more difficult and more expensive to build a plant at Smith's than at Houck. At Smith's adequate water is a problem. Mr. Crawford of Phoenix has stated it as his opinion that 5 g.p.m. is all that can reasonably be counted on at Smith's at low water time. This will not only force the construction of expensive water reclamation facilities but it will also preclude using enough water to do a good job of washing or classifying. At Houck, which is close to the bed of the Puerco River, there is an ample supply of ground

water for all prospective use for a long time to come.

Two water tanks, each about 25' diameter x about 55' high, are erect in place. They belong to the railroad and can be acquired for sand bins. A third bin, somewhat smaller, should be added to provide for the third size of sand. Electric power can be brought to Houck for a fraction of the cost required for Smith's.

The most important factor, however, lies in the fact that if and when any other source of sand is opened up southwest or west of Smith's section, it must be hauled up grade if it is to be treated at Smith's, then the finished sand must be hauled back down grade to start toward market. If done on existing roads this would necessitate a double dead haul for a total of from 2 to 8 miles. If the plant is located at Houck, all other sand than Smith's would have to pass within a quarter of a mile of the plant on its way to market.

The gross tonnage of acceptable grade sand on the Smith section is conservatively estimated at 3,360,000 tons. The presently proposed production rate is 14 TPH for an 8 hr. day or 112 tons per day. At 68% of this, the saleable product will be 76 tons per day. The sand on the Smith section should supply this plant with raw material for approximately 125 years, so no further source of sand is needed for this plant. However, if it appears that a good profit is being made on Smith's sand, then it is reasonable to expect that the Navaho tribe will want to have someone treat their sand and competition will develop. If the plant is located at Smith's, it would be an invitation to some one else to build another plant near the railroad but if this plant is built at Houck, it will discourage any other plant from being built.

For all these stated factors, it is strongly recommended that the proposed plant be built at Houck.

The present market is in northern New Mexico and is now being supplied by shipments from Illinois. The reported price for this sand at the market point is $12.00 per ton. Without going into details it can be stated that on this basis it is reasonable to expect that an operating profit of approximately $4.00 should be realized per ton of sand shipped. This is at the rate of about $304.00 per day or about $79,000.00 per year.

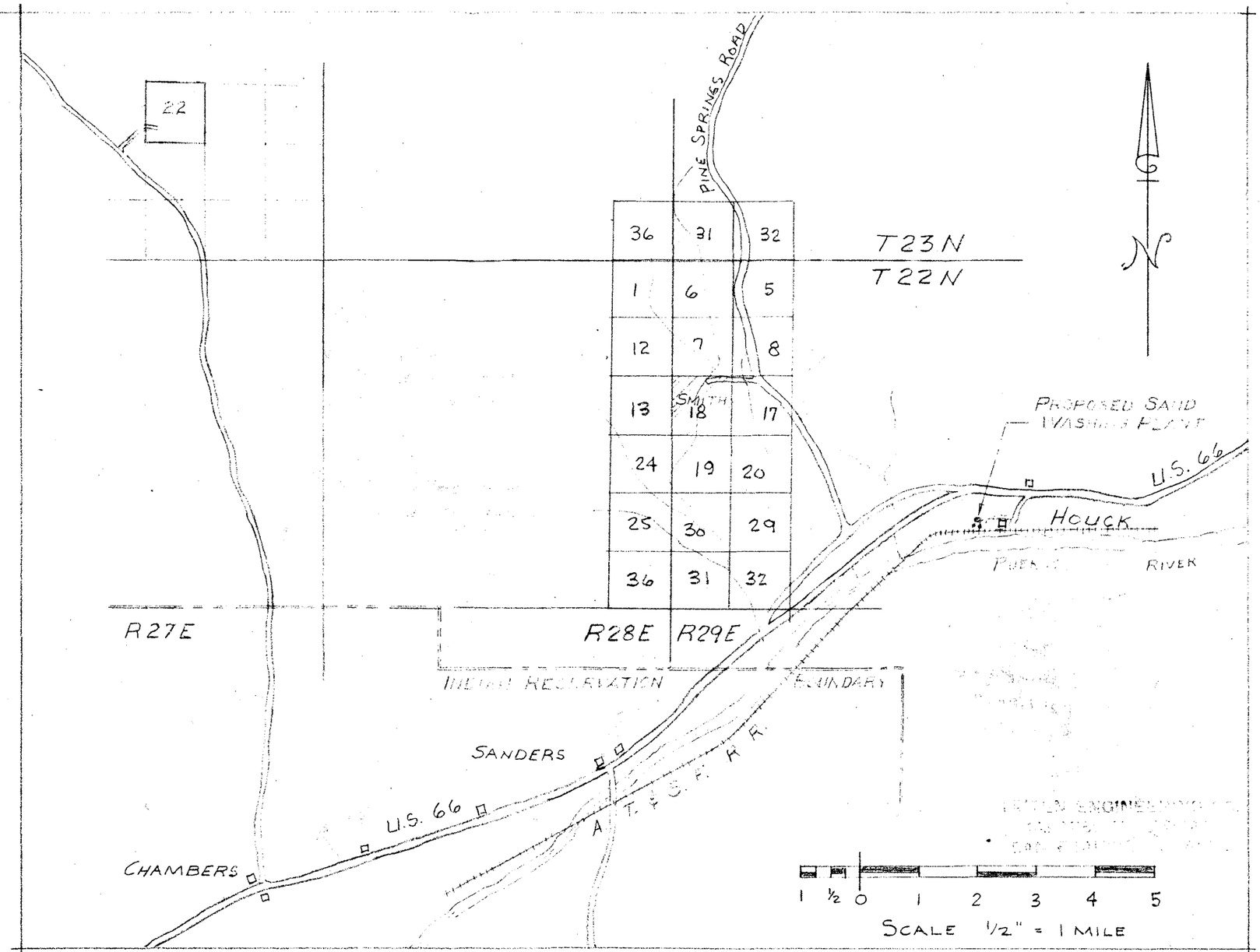
Appended hereto is an estimate of the cost of building the proposed plant, which is approximately $208,000.00. At the expected annual operating profit, the entire cost of the plant, plus interest at 6%, should be amortised within three years. Tax.

The cost estimates do not take into consideration any truck scales or weightometer for weighing incoming sand, and no small tractor for scraping sand that has been stockpiled into the truck hopper (3). Neither do the estimates cover any cost of moving the spur track of the railroad over close enough to the bins to enable R.R. cars to be loaded by chute directly from the bins.

George S. Kearney

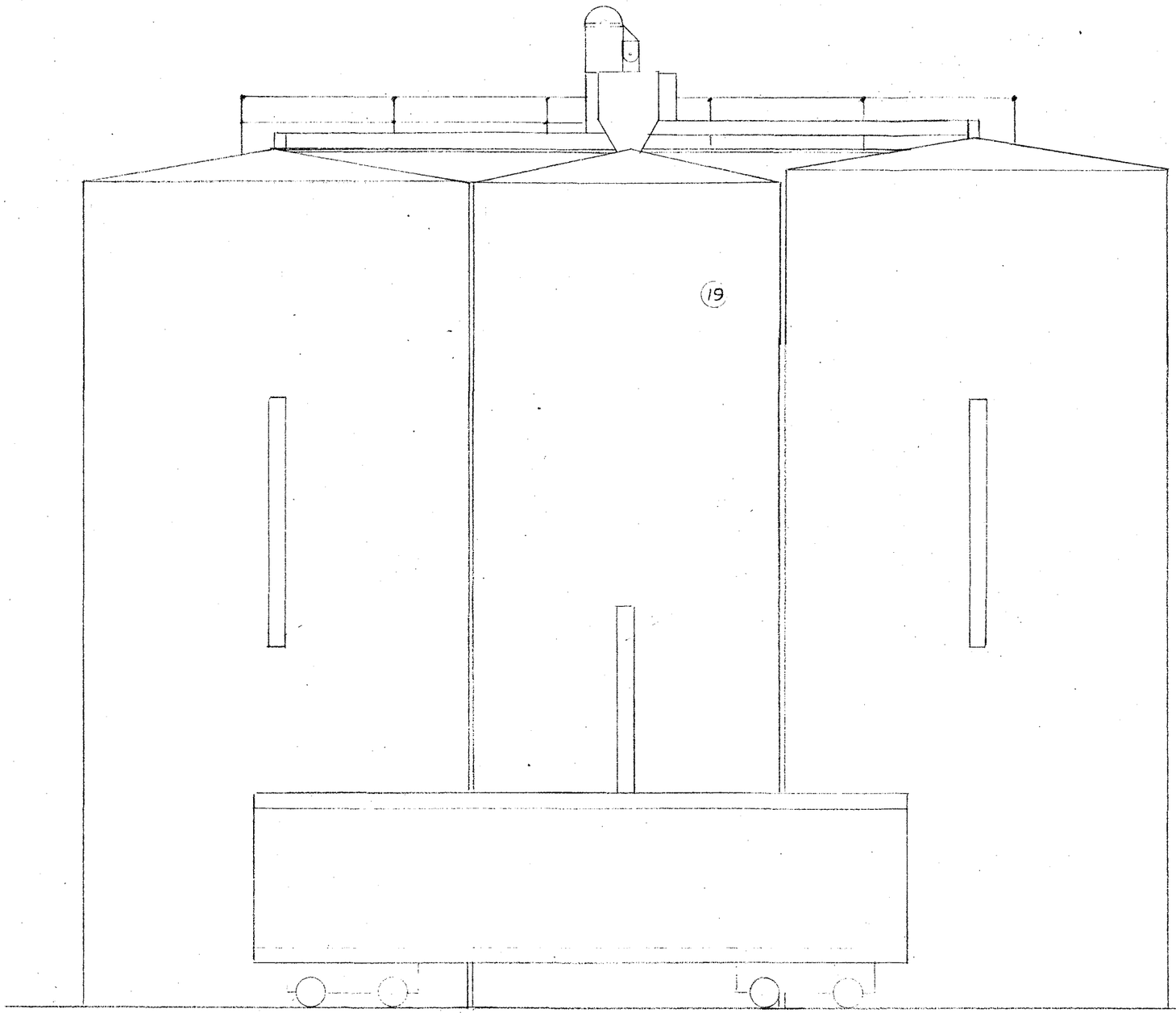
GEORGE S. KEARNEY, E.M.

SAN FRANCISCO, CALIFORNIA
June 23, 1958



SKETCH MAP CHAMBERS—HOUCK AREA APACHE COUNTY, ARIZ.

ELEVATION AA



SCALE 1/8" = 1'-0"

Ground Level Elev 100'

WATER SPRAY - 80 GPM - 20 TPH

SAND PIT AND LOADER {BY OWNER}

SAND TRUCK {BY OWNER}

(1) TRUCK HOPPER

(2) 16" BELT CONVEYOR

14 TPH SAND

(3) SCALPING SCREEN

14 TPH ~ SAND
20 TPH ~ WATER

+10m
1.5 TPH

WASTE BIN

WASTE TO DUMP

SLURRY @ 76% SOLIDS
12.5 TPH ~ SAND
4.0 TPH ~ WATER

(4) DEWATERING CONE

(5) ATTRITION MACHINE

PUDDLING TANK

30" x 19'-3" SCREW CLASSIFIER (6)

16.0 TPH - WATER

-60m ~ 1.8 TPH SAND
17.65 TPH WATER

0.385 TPH WATER

10.7 TPH ~ SAND
2.35 TPH ~ WATER

(9) COMBINATION FILTER AND DRYER

1.9 TPH ~ WATER

(7) FINES SUMP AND PUMP

PIPELING TO RIVER

10.7 TPH SAND @ 0.6% MOISTURE
0.065 TPH ~ WATER

(13) 10" ϕ SCREW CONVEYOR

(14) CHAIN TYPE BUCKET ELEVATOR

(15) 10' ϕ SCREW CONVEYOR

(16) 3-DECK SCREEN

-60m
1.2 TPH

WASTE BIN

WASTE TO DUMP

-40m TO 60m ~ 2.8± TPH

-10m TO 20m 2.0± TPH

STORAGE BIN 565 TON CAPACITY

(18) 8" ϕ SCREW CONVEYOR

STORAGE BIN 565 TON CAPACITY

-20m TO 40m
4.7± TPH

(17) 8" ϕ SCREW CONVEYOR

STORAGE BIN (19) 400 TON CAPACITY

TO TRUCK OR TRAIN

TO TRUCK OR TRAIN

TO TRUCK OR TRAIN

FLOW SHEET

A

10' ±

RELOCATED 8" SPUE

EXISTING TANK
-40 to 60
565 TONS

NEW TANK
-10 TO 20
400 TONS

19

16

15'±
CATWALK

B

EXISTING TANK
-20 TO 40
565 TONS

12' ±
TRUCKING
DRIVEWAY

A

30'-0 ±

9

SHOP

20

WASTE
BIN

WATER
TANK

PUDDLING
TANK

18

21

3

4

5

6

7

OFFICE

FLOOR SUMP & PUMP

2

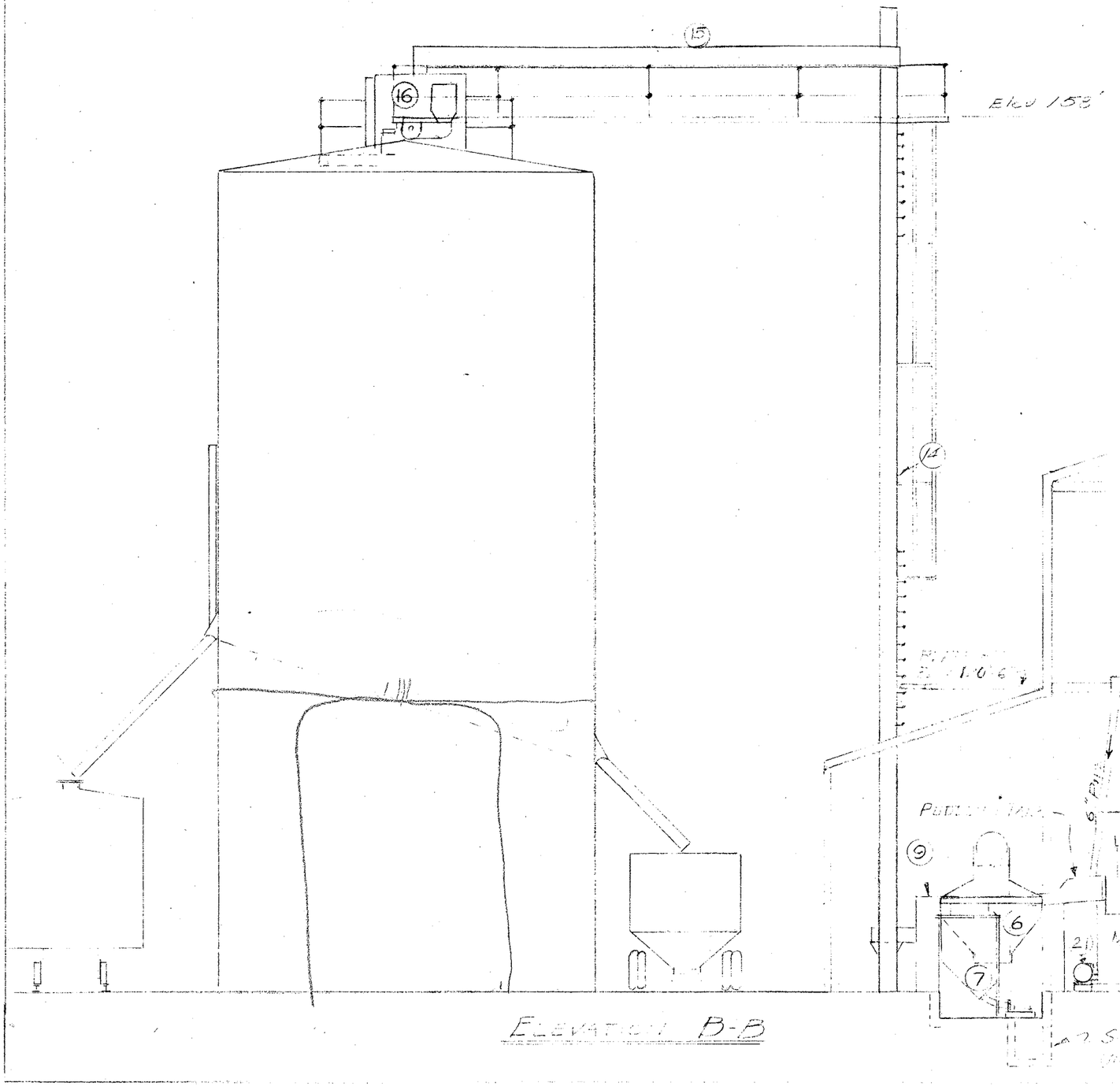
PLAN
SCALE 1/8" = 1'-0"

B

12' ±
TRUCKING
DRIVEWAY

EQUIPMENT LIST

Item No.	Description
1	Truck Hopper
2	Belt Conveyor
3	Sizing Screen, Wet
4	Dewatering Conv.
5	Attrition Machine
6	Screw Classifier
7	Fines Sump & Sump Pump
9	Combination Filter-Dryer
14	Chain-Bucket Elevator
15	Screw Conveyor
16	3 Deck Sifter Screen, Dry
17	Screw Conveyor
18	" "
19	New Storage Tank
20	Mill Water Tank
21	Water Pump



ELEVATION B-B

ANAMAX MINING COMPANY (cont.)

Chief Chemist	D. E. Wood
Director, Loss Prevention	G. H. Johnson
Director, Purchasing, Material Control & Traffic	J. Garay
Land Management & Environmental Control	Don Russell
Chief Metallurgist	E. E. Krist
Financial Manager	T. L. Dooley

ARIZONA MINERALS

P.O. Box 4329, Kingman 86401 - Phone 753-2094 - Employees 3 - Open Pit Mine - Feldspar

President	Chet Cheatwood

ARIZONA PORTLAND CEMENT COMPANY

P.O. Box 338, Rillito 85246 - Phone 622-3503 - Employees 300 - Limestone quarry 5 miles from plant - Lime - Cement - Annual Capacity 1,300,000 tons cement

Plant Manager	Frank Thornberry
Plant Chemist	J. Boyette
Plant Engineer	Les Claire
Chief Electrician	Jack Meeler
Office Manager	Fran Young
Quarry Foreman	Dominic A. Chiaro
Assistant Quarry Foreman	Chuck Hansen
Purchasing Agent	Paul Cowan

ARIZONA SILICA SAND COMPANY

P.O. Box 108, Houck 86506 - Phone 688-2602 - Employees 28 - Open Pit Mine - Plant south of Houck - Hydrafrac Sand - Oil well fracturing, markets include New Mexico, Utah and California

President	Del W. Fisher
Vice President	Robert Fisher
General Manager	Elmer Gilstrap
Superintendent	Ralph Nelson

Jan 1980 active mine list

Introduction

The accompanying report on the sand deposit in Burntwater Wash, Sanders Area, Apache County, Arizona supplements a report made on the same property in February, 1957. At that time, the sand in the Wash within Section 18, T 22 N, R 29 E, G & SRBM was drilled over an area of 26,5 acres and approximately one quarter million tons of marketable sand developed. Exploration of the country adjacent to the Wash was not made, due to the heavy cover of snow.

Following the February report nothingwas done, except for some work on wet screening, until August,1957 at which time the Balcomb Lease on Section 18, T 22 N, R 29 E, was transferred to the Arizona Bancorporation. Instructions were later given to complete the sampling in Section 18 and to explore adjacent ground within the Navajo Reservation.

A brief summary of the sampling, with complete figures on the tonnages of sand developed; results ofthe exploration of adjacent Tribal lands; an estimate of the capital cost of a sand processing plant together with flow sheets are covered in this report.

Summary of Exploration and Developed Tonnages in Section 18

The channel of Burntwater Wash was sampled by hand-auger holes in February, 1957 and the tonnages are tabulated in Table I. The ground being frozen and covered by 10 - 12 inches of snow sampling was limited to the channel and banks of the Wash.

During September and October, 1957 the examination and sampling of Section 18 and adjacent lands belonging to the Navajo Tribe found silica sand in rounded grains on the hill slopes above Burntwater Wash, particularly on the West side of the Wash. Burntwater Wash heads about 3-½ miles north of Section 18 and drains south to the Puerco River, the terrain rising in gentle, rolling slopes on either side of the Wash. On the west side, drainage is into Burntwater Wash for a distance of nearly two miles; on the east side, the divide between Burntwater Wash and Querino Canyon is about ½ mile east of the Wash. Silica sand in various size ranges is found on the surface in the western part of Section 18 and in portions of Sections 12,13,24 and 19 as shown on sketch map.

Two areas of silica sand, totaling 77 acres, were sampled by drill holes. These areas are above the channel and are in the north-west and south-west parts of Section 18. (Sketch Map) Sand in marketable sizes is found on the surface and in the north-west area, drill holes developed sand to a depth of 13 feet. In the south-west area drill holes were stopped at a depth of 10 feet as there were sections exposed in banks and pits. One cut-bank near the south section line shows sand through a vertical height

of 50 feet.

In calculating the tonnages, only the weighted averages of drill hole depths are used and no allowances are given for sand in vertical banks in excess of drill hole depths. The calculated tonnages are conservative and will be exceeded in actual mining.

TABLE ONE

TONNAGES AND GRADING OF DEVELOPED SAND - Section 18, T22N, R 29 E.

	Burntwater Wash Channel	Areas Above Channel	Total Sand Estimated Sec. 18.
Date Sampled	Feb. 1957	Oct. 1957	Feb. - Oct. 1957
No Market +10 and -60	105,185 T	187,193 T	292,378 T
Market Sizes			
-10 +20 Mesh	69,830 T	50,646 T	120,476 T
-20 +40 "	174,960 T	365,945 T	540,905 T
-40 +60 "	95,280 T	389,282 T	484,562 T
Total Market Sizes -10 to+60	340,070 Tons	805,873 Tons	1,145,943 Tons
GRAND TOTAL All Sizes	445,255 Tons	993,066 Tons	1,438,321 Tons
Acres Sampled	26.5	77.0	103.5

Additional sand will be developed in an area of approximately 50 acres which lies between the two sampled areas above the channel. No drilling was done in this block. Exposures of fine sand, 60 mesh and under, are on the surface.

The eastern side of Burntwater Wash, above the rim rock, shows only small patches of sand. A shaly sandstone outcrops along the east side of the Wash and irregular exposures of sandstone are found over the entire eastern half of Section 18.

Summary of Exploration in Areas Outside Section 18.

A hurried examination and random drilling was done in the following areas: (Sketch Map)

Area 1: Sections 12 and 13, T 22 N R 28 E. Considerable silica sand in a good size range occurrs on Section 13, west of Section 18. The exposures are heavy in the drainage channels but goodsand is also found on the ridges and hill slopes. Some fracture sand was observed in narrow gulches near the western side line of Section 12.

Area 2 Sections 24, T 22 N, R 28 E and 19, T 22 N, R 29 E. Excellent silica sand, with size grading equal to that found in Section 18, is found in Burnwater Wash south of Section 18. The banks along the channel are higher than in Section 18; some good sand occurrs in the banks. The channel averages 50 feet or more in width and hand auger holes were drilled to a depth of 4 feet. The slopes south of Section 13 and 18 show silica sand on the surface.

Area 3 Irregular patches of silica sand show in drainage cuts leading to Querine Canyon. The dry stream bed in the Canyon has some silica sand but it is mixed with flat particles.

Area 4 Fracture sand is exposed in the County road, 3½ miles North of the Burntwater Wash road. The sand showing in a grader cut is good quality. This is near the head of the Burntwater drainage basin.

Area 5 Silica sand on Section 7, north of Section 18, occurs in the Wash. Rock outcrops are common and the sand appears to have more flat material than that on Section 18. A detailed examination was not mde as this section is permitted to the Arizona Silica.

Recommendations

Although the reserves of silica sand on Section 18 are adequate for several years operation it is recommended that the possibility of obtaining a permit to mine and process sand from Sections 13, 24 and 19 be investigated. If the annual rantal and negotiated royalty is not excessive it would be desirable to have a permit on these three sections and possibly on Sections 25 and 30. There is considerable sand on the three sections and if a processing plant is built on Section 18 the Indian's sand can be handled in the same plant. The sections have a certain nuisance value and if the Indians receive some royalty they may be amenable to highway upkeep and other assistance.

Estimated Capital Cost of a Processing Plant and Pit Equipment

In order to make an acceptable product the sand must be washed. Tests have shown that the Burntwater Wash sand can be washed without a scrubber; that it can bewashed directly on the screens by sprays. Flow sheets and capital equipment are based on pit mining and a stock pile of pit-run sand; wet screening and stockpiling sized drained material; drying drained material and storing dried sands. The costs shown on the attached sheets are based upon list price of new equipment of various manufacturers. and are listed under heading of F.OB. Cost. Freight is based upon weightof equipment and erection cost is based upon a factor of the equipment cost.

The figures shown are on the high side and the actual cost of the plant will be under the estimated figure.

SCHEDULE ONE

Approximate Capital Cost of Sand Processing Plant
Burntwater Wash, Sanders Area, Sec. 18, T 22 N, R 29 E, G & SRBM,
Apache County, Arizona. Wet Screening - 15.0 Tons/Hr Feed. 12 Tons/Hr Re

ITEM	F.O.B. COST	FREIGHT	APPROX ERECTION	TOTAL	Suggested Source
Truck Disch. Ramp	---	-	$1000.00	$ 1000.00	Force Account
Steel hopper with plate feeder	$ 3000.00	$ 100.00	500.00	3600.00	)Tolleson Blk.
Belt Conveyor,18"x30'	2016.00	50.00	300.00	2366.00	)Barber-Greene
Elevator,50', 10 x 6"	3300.00	325.00	500.00	4125.00	)or Jeffrey
100 Ton Steel Surge Bin with gate	4000.00	200.00	1000.00	5200.00	Tolleson Blk
Feeder	1000.00	100.00	250.00	1350.00	
Screen, D.D. 4' x 7' w/motor, drive and spray	2141.00	)	)	)	)Diester Co.
Screen, D.D. 5' x 7' w/motor,drive and spray	2527.00	)	)	)	)
Pivoted chutes	250.00	250.00	1000.00	6168.00	)
Dryer, with burner, drive cyclone	20756.00	2500.00	4500.00	27756.00	Madsen
Elevator, 50',8"x5"	3520.00	350.00	900.00	4770.00	Jeffrey Mfg
3 Comp. Steel Bin, 400 Ton,w/gate	15476.00	300.00	2000.00	17776.00	Tolleson Blk.
Belt Conveyor,18"x30' Loading	2016.00	50.00	300.00	2366.00	Tolleson Blk.
Platform Scales, 60' with Reg.Beam, 50 T.	4200.00	815.00	1050.00	6065.00	Winslow Scales
Building, steel and wood framed, drain bins and concrete slab	3000.00		5480.00	8480.00	Local or Force
Drainage sump, 20000 gallons	-	-	1270.00	1270.00	Force Account
Water pump for screens 300 GPM, 50psi.	2500.00	57.00	100.00	2657.00	Hazleton
Miscl. Piping and elec. wiring	1000.00	-	500.00	1500.00	
Loader, front end, dryer and tailing	3503.00	-	-	3503.00	
PLANT COST	74205.00	5097.00	20650.00	99952.00	
Loader, front end, 1½ CY	13000.00	-	-	13000.00	Scoopmobile
Truck, 6-8 CY, 4-w drive	6000.00	-	-	6000.00	
PIT EQUIPMENT	19000.00			19000.00	

SCHEDULE ONE

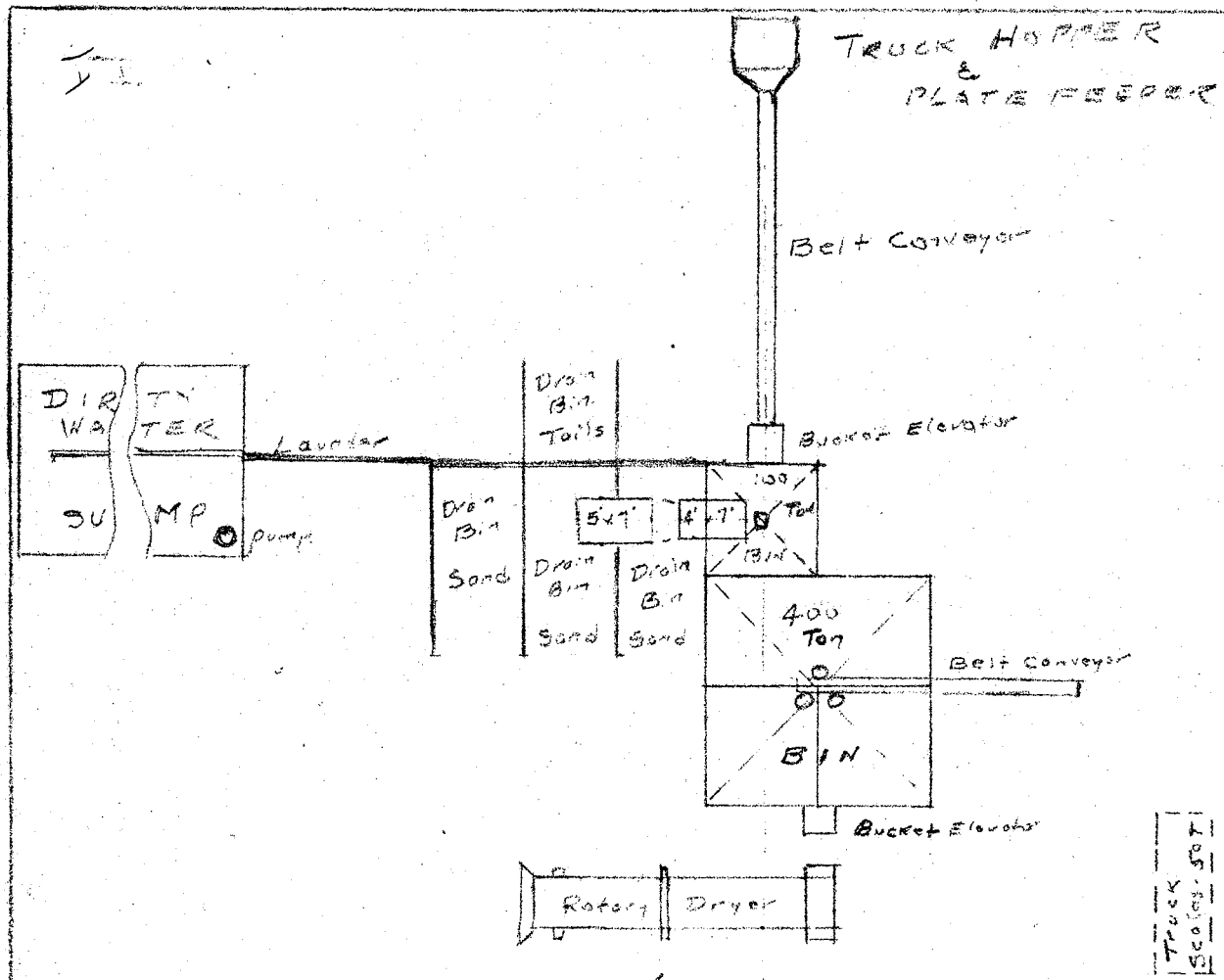
ITEM	F.O.B. COST	FREIGHT	APPROX. ERECTION	TOTAL	Suggested Source
Well, Drilling $6.00/Ft Casing 3.00/Ft (300' deep)	-	-	$2700.00	$2700.00	
Pump	$2000.00	$100.00	500.00	2600.00	
Tank	1000.00	100.00	200.00	1300.00	
WELL COST (Estimate)	3000.00	200.00	3400.00	6600.00	
Power Plant, 200 KW, (Estimate)	24000.00		1000.00	25000.00	
TOTAL				150,552.00	
Add for Engineering and Contingencies				10,000.00	
GRAND TOTAL				$160,552.00	

Flow Sheets

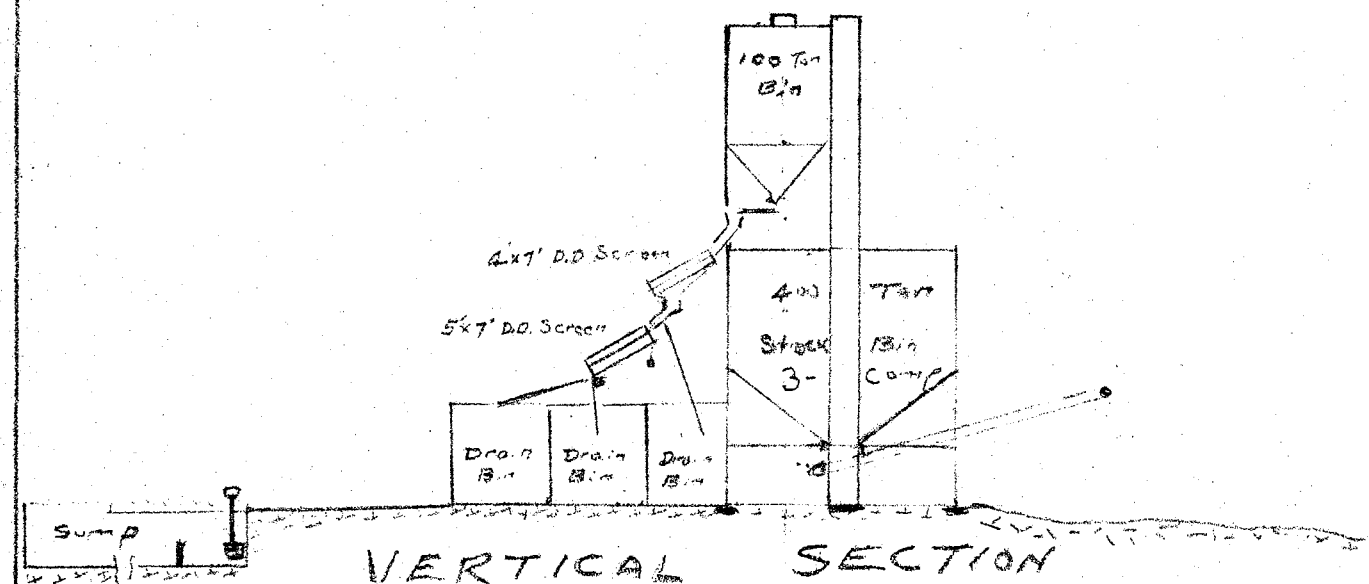
Flow sheets for a wet-screening plant with a recovery of 12.5 tons of screened material per hour or 100 tons in 8 hours are shown in the attached prints.

The flow sheets differ in that one uses a steel bin as a stock-pile for pit-run material before screening and uses drain bins to dewater the screened sands. The second, based upon suggestions of Mr. Del Fisher, uses a stockpile and reclaiming tunnel for pit-run material and either a belt or screw-type dewaterer for dewatering and stockpilingthe sized sands.

The second flow sheet is the simpler and will probably be cheaper as it gets rid of a steel binand bucket elevator.



PLAN



VERTICAL SECTION

FLOW SHEET of SAND PLANT
BURNT WATER WASH DEPOSIT
SANDERS AREA, APACHE COUNTY, ARIZONA

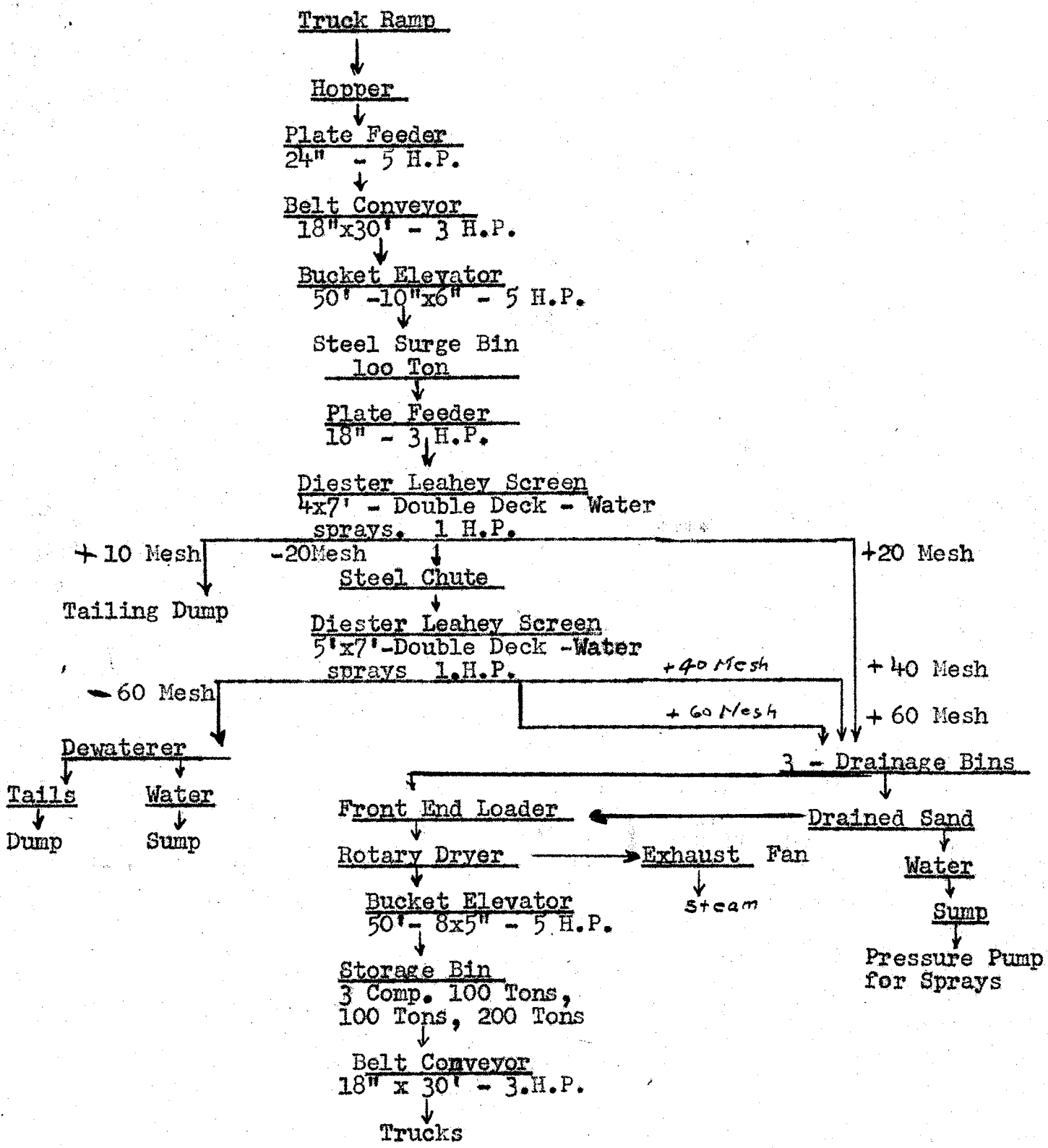
Scale 1" = 20'

Oct. 29, 1957

W. E. T. Cummings

BURNTWATER WASH SAND DEPOSIT
SANDERS AREA, APACHE COUNTY, ARIZONA.

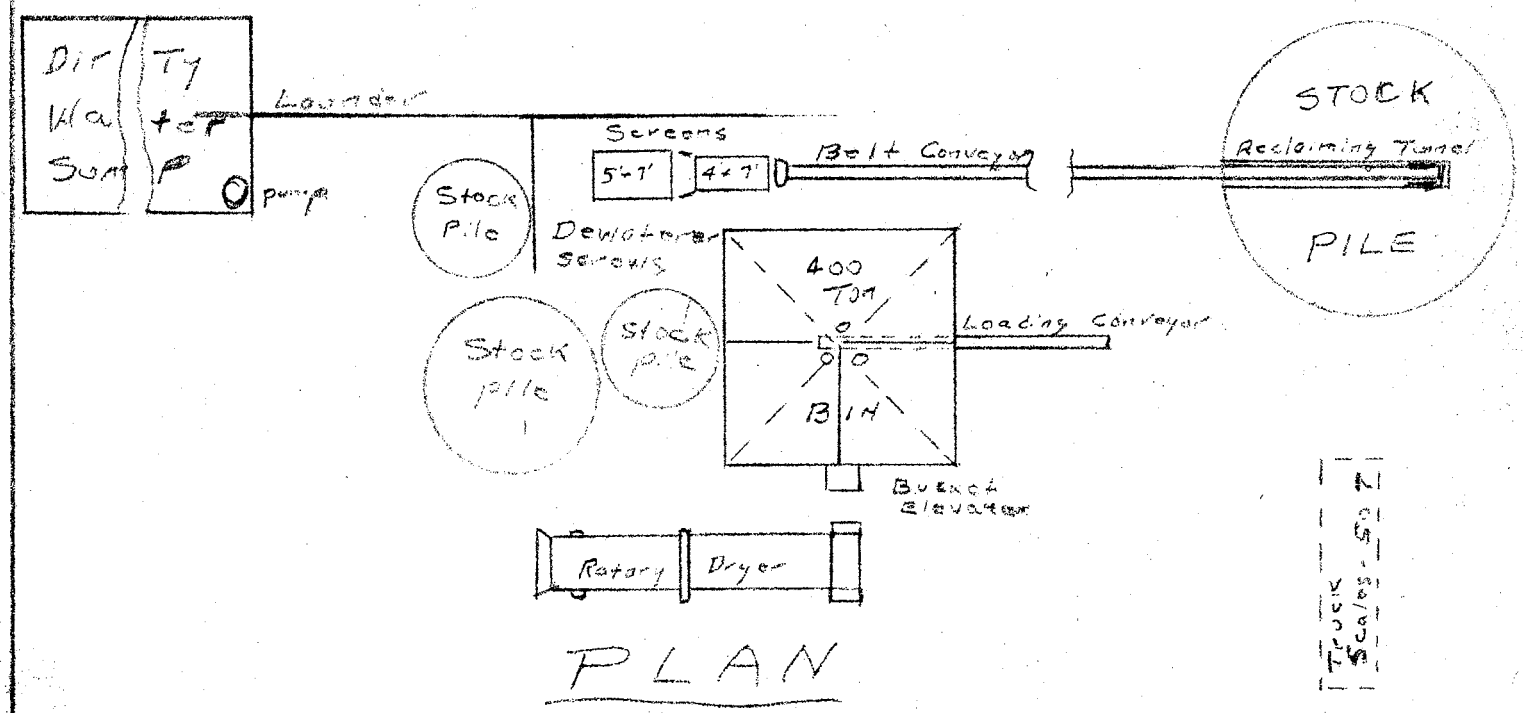
FLOW SHEET for PROPOSED SAND PROCESSING PLANT 15 Tons/Hr. Feed



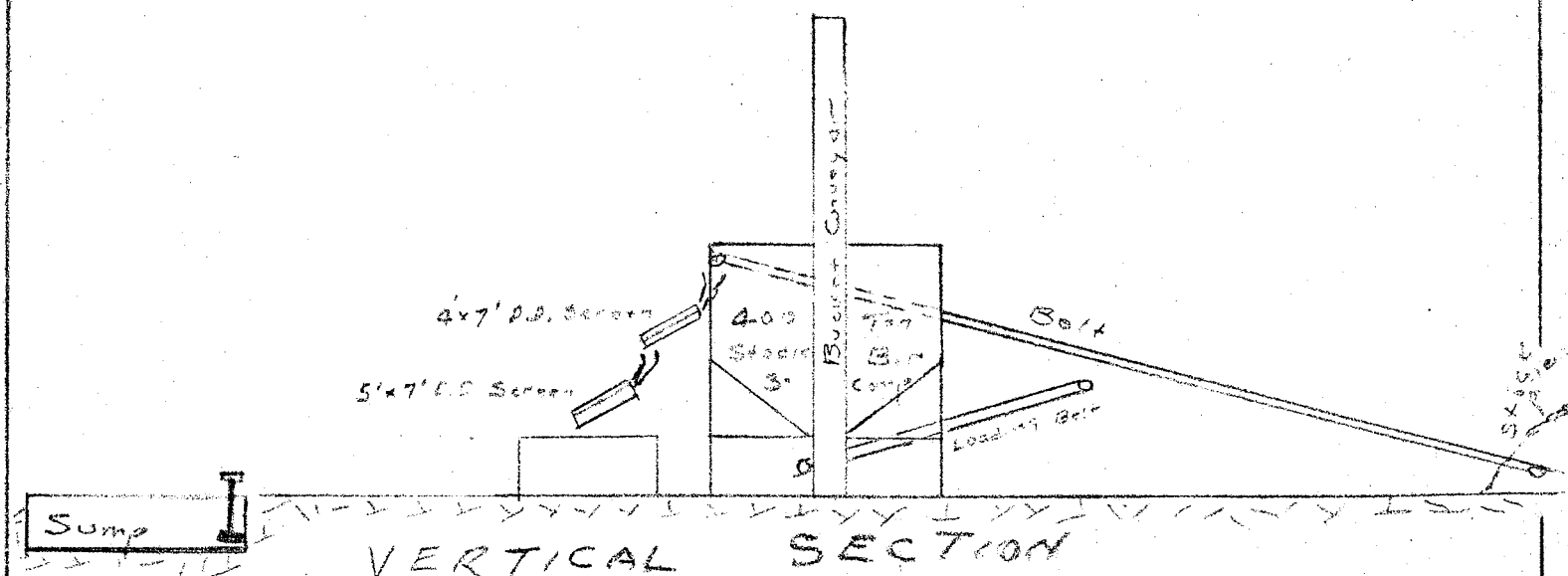
W.P.C

Oct. 28, 1957

-K



PLAN



VERTICAL SECTION

FLOW SHEET OF SAND PLANT
BURNTWATER WASH DEPOSIT
SANDERS AREA, APACHE COUNTY, ARIZONA

Scale 1" = 20'

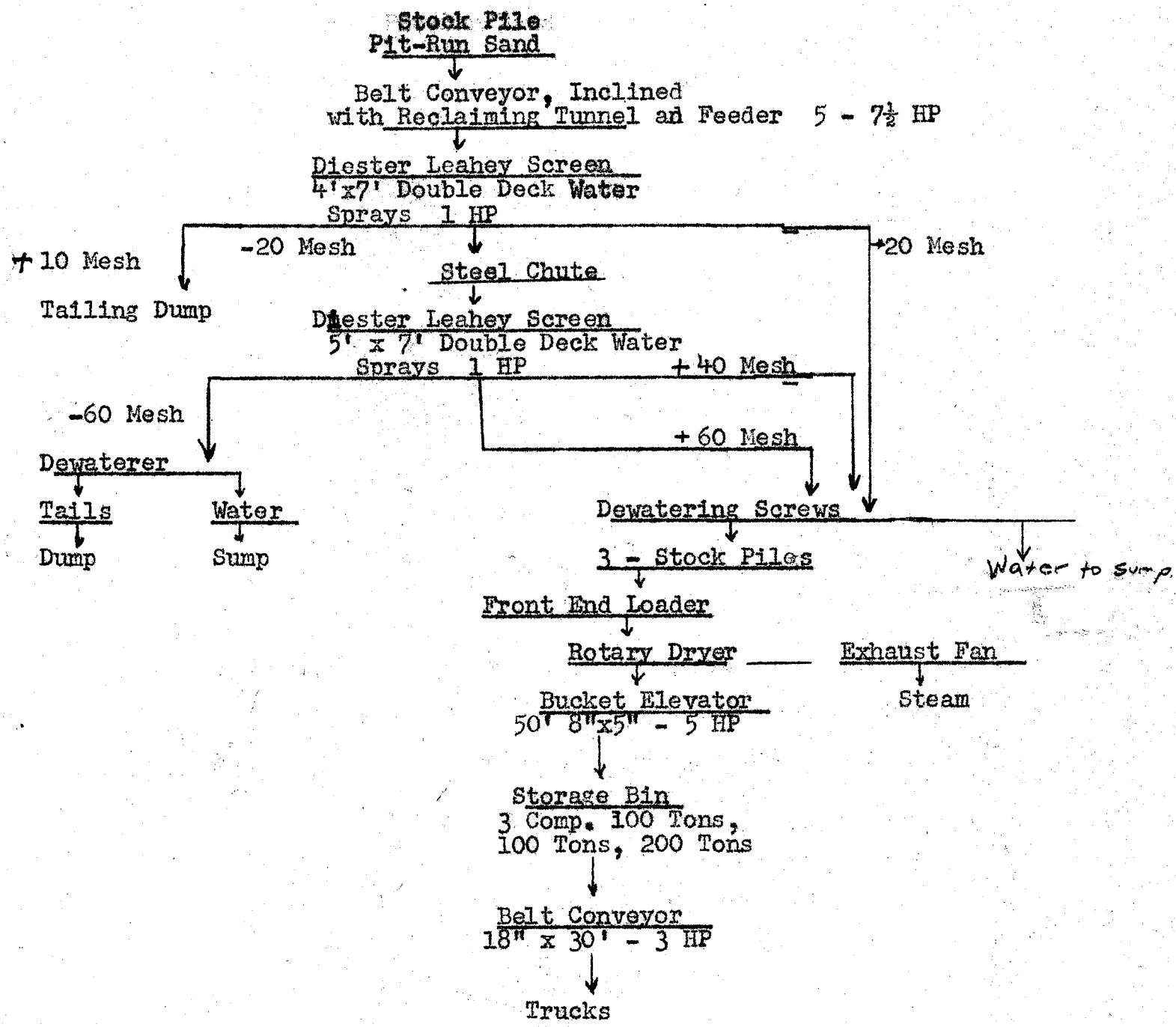
Oct. 31, 1957

W. H. P. Campbell

II

BURNTWATER WASH SAND DEPOSIT
SANDERS AREA, APACHE COUNTY, ARIZONA

FLOW SHEET FOR PRPOSED SAND PROCESSING PLANT 15 Tons/Hr. Feed



V.C.C

Oct 31 1957

Letters from Manufacturers

Manufacturers letters relative to screening and drying are enclosed. The letters from Stone of Deister are self explnatory.

Drying will be the most expensive single operation due to fuel and power cost. Drying has been referred to Madsen, Barber-Greene, Colorado Iron Works, Eimco Corporation, Hardinge Corporation and Standard Steel Corporation. Copies of the correspondence with Madsen and Standard Steel are enclosed. It will be noticed that the Madsen dryer recommended isa larger model than the one now in use at Wide Ruins. and fuel and horsepower requirments seem excessive. The dryer tentatively recommended by Standard Steel may be too small but is interesting from the viewpoint ofpower requirement.

It is possible that a flash or cascade type dryer similar to those used in drying coal may be used. The matter will be referred to Combustion Engineering and Link-Belt.

Electrical Power

This can be referred to the R.E.A. office in Gallup, New Mexico but it is doubtful whether they can furnish power at a reasonable figure. If not, power requirements will depend upon the connected load and will be generated at the plant. We have preliminary quotations from two manufacturers and expect others.

Water

Water requirments for a wet screening plant with the Deister sereens and sprays will be about 275 - 300 gallons per minute. Recovery should amount to 85 - 90% of original water which will leave about 30 gallons per minute ofmake-up water.

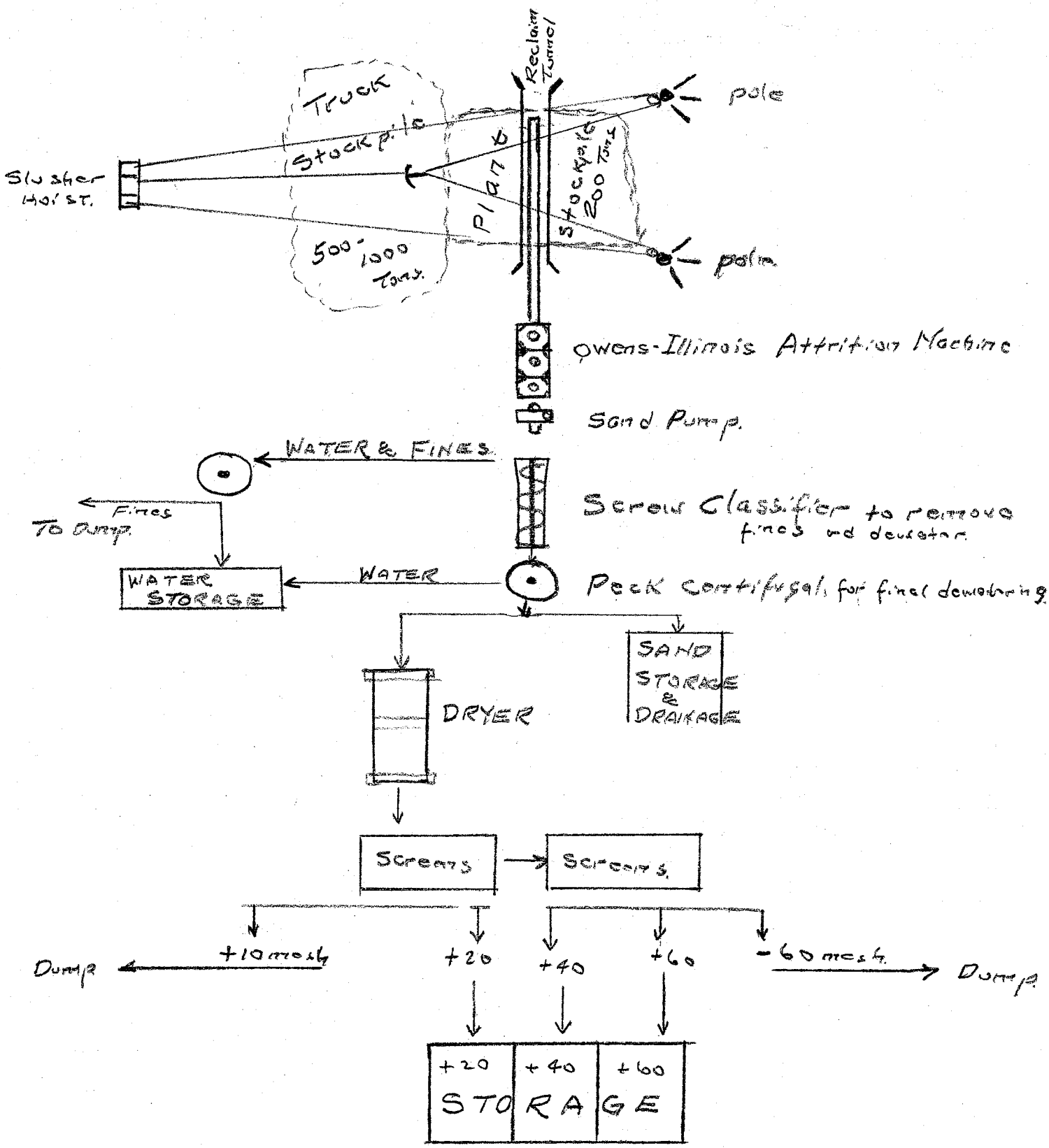
Since this estimate was made up, McRae, well driller at SnowFlake, Arizona, advises that an 8-inch well, cased, will cost $6.50 per foot; that surface water can be picked up between 50 and 200 feet

depending on the collar elevation and that permanent water exists at depths not exceeding 800 feet. The elevation at the Burntwater Trading Post is 6500 feet, the elevation at Sanders is 6000 feet. Wells at Chambers and Sanders strike water at 65 - 85 feet. Indian well in Burntwater Wash strike water at 3-5 feet and an 8-inch well at the trading post is 160 feet with about 80 feet of water. However, the potential production is unknown.

Wm. P. Crawford

Wm. P.Crawford
Registered Mining Engineer
#2591 Arizona Registry

Phoenix, Arizona
November 1, 1957



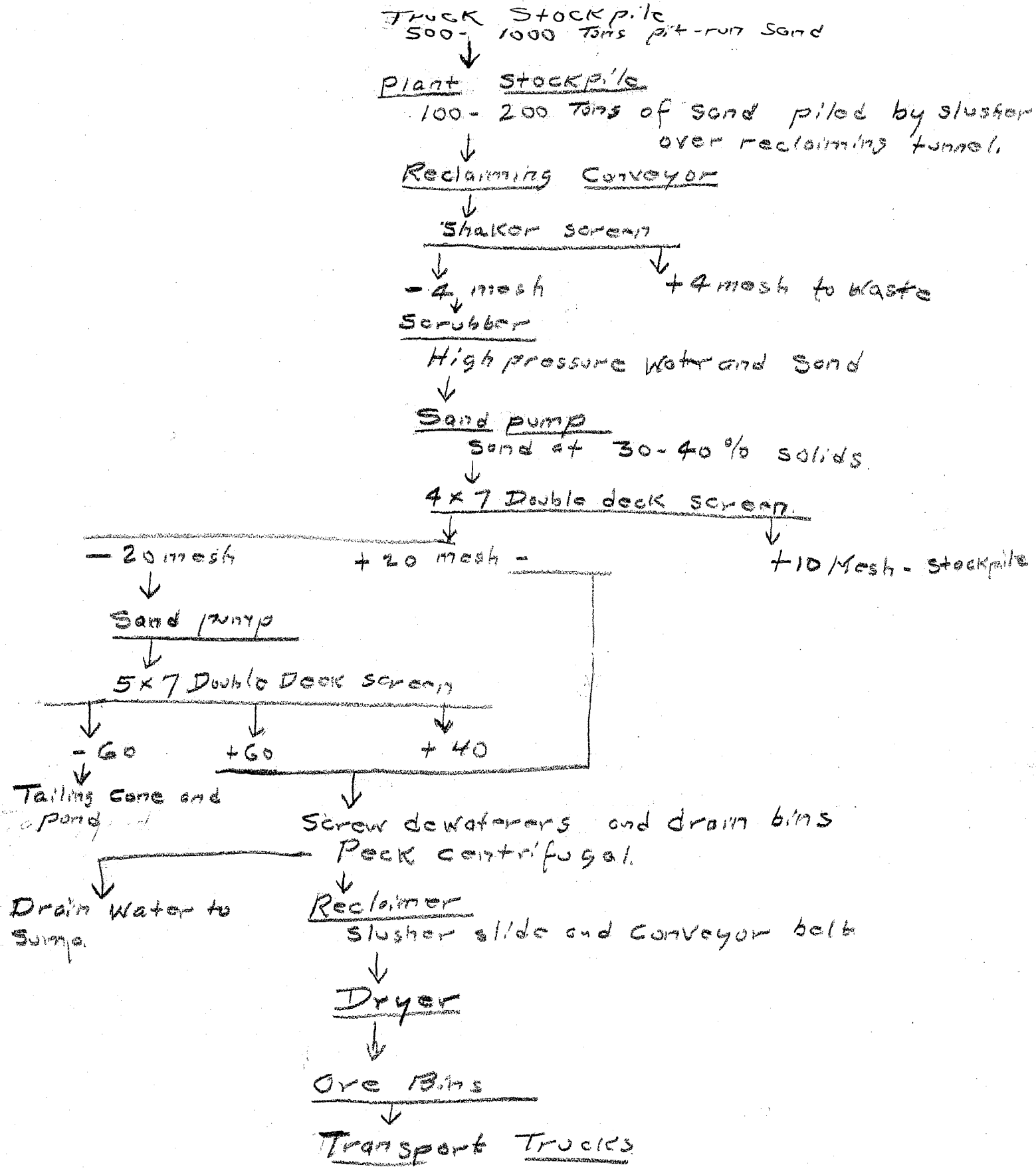
BURNTWATER SAND DEPOSIT

PROPOSED FLOW SHEET FOR WASHING AND DRY SCREENING WITH MAXIMUM WATER RECOVERY.

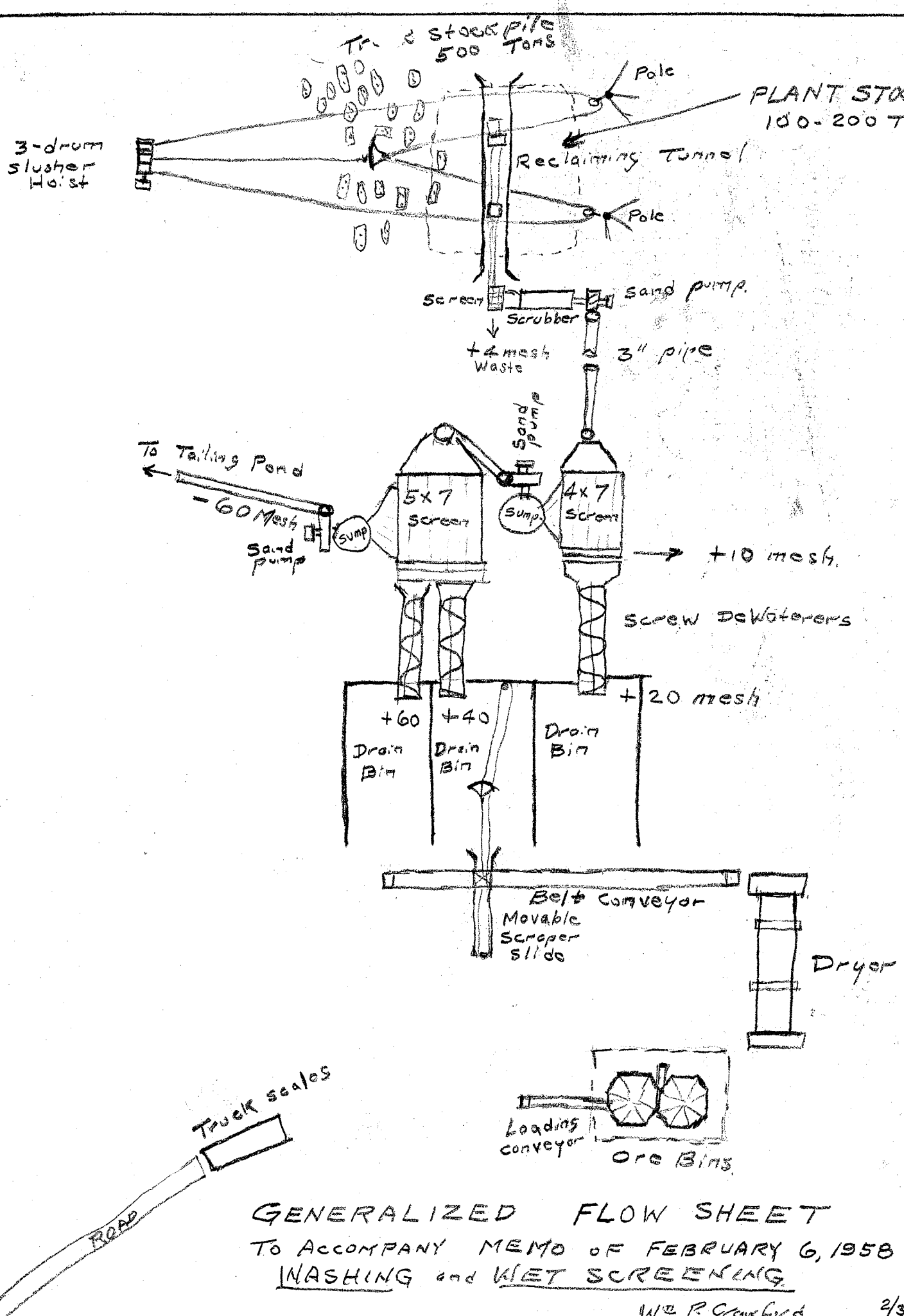
W. R. Crawford 3/1/58

BURNT WATER SAND DEPOSIT.

FLOW SHEET CONTAINING PROCESS MODIFICATIONS, WASHING AND WET SCREENING



W.I.R.C. 2/3/50 A5



GENERALIZED FLOW SHEET

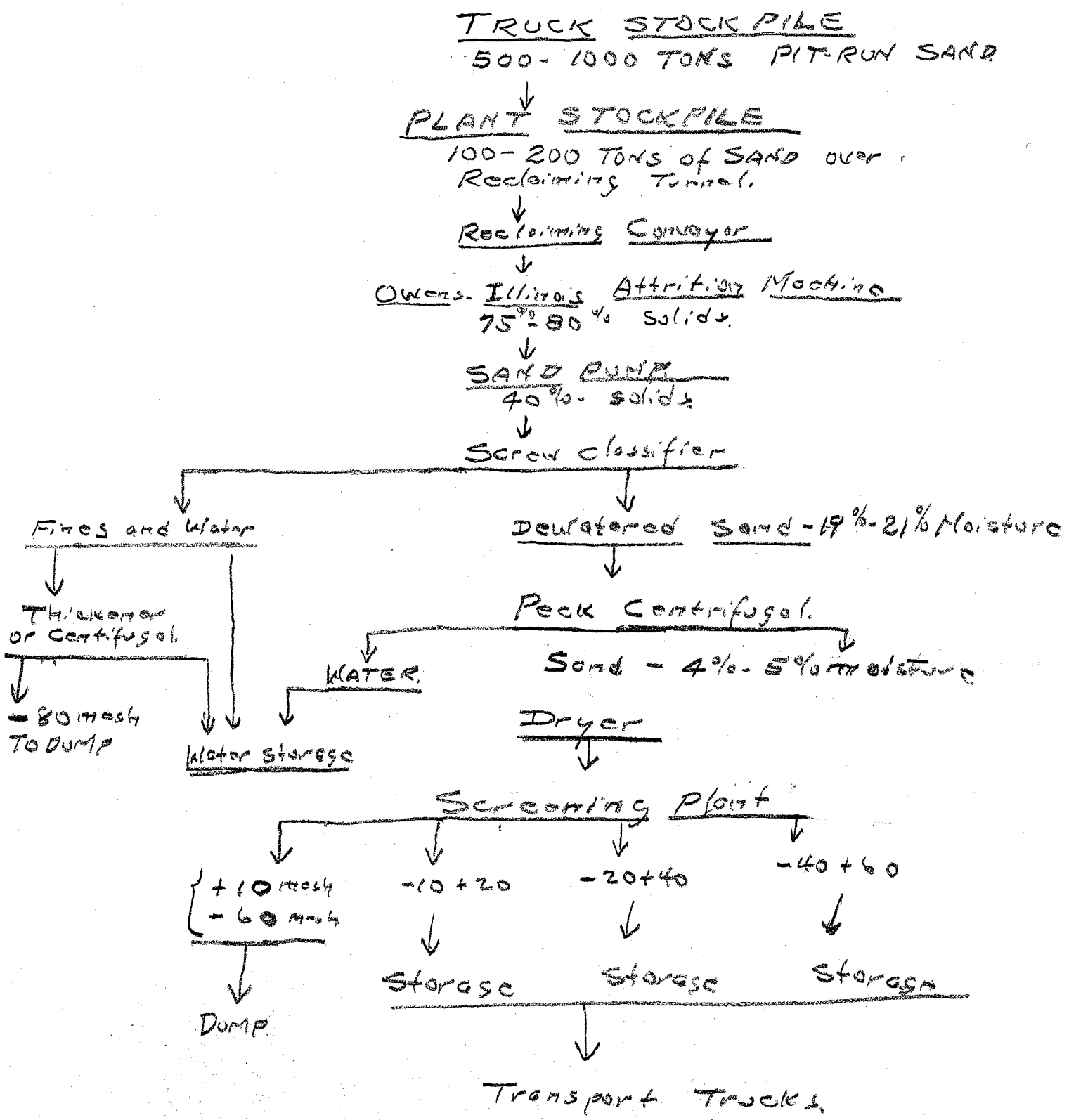
TO ACCOMPANY MEMO OF FEBRUARY 6, 1958

WASHING and WET SCREENING

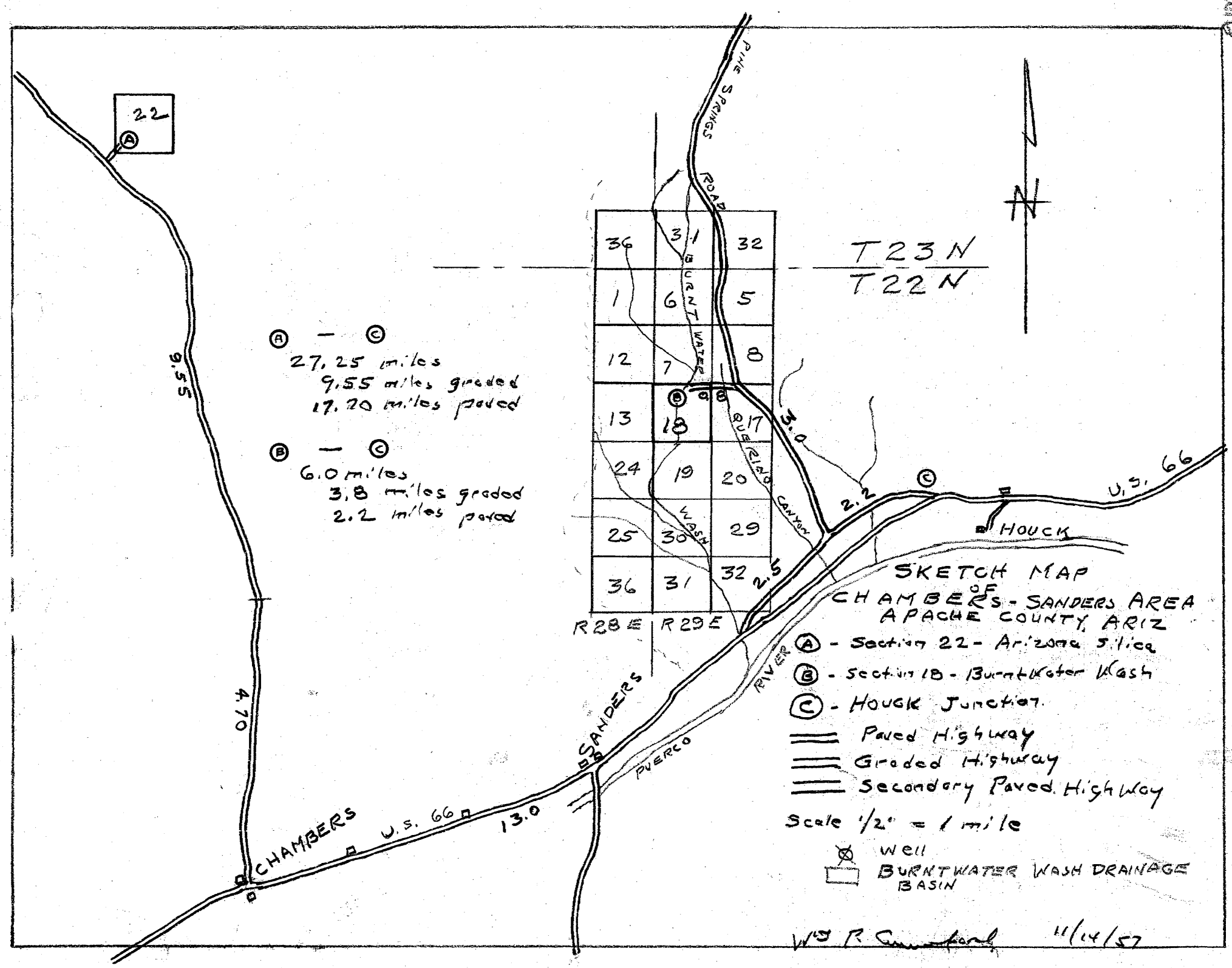
Wm R Crawford 2/3/58

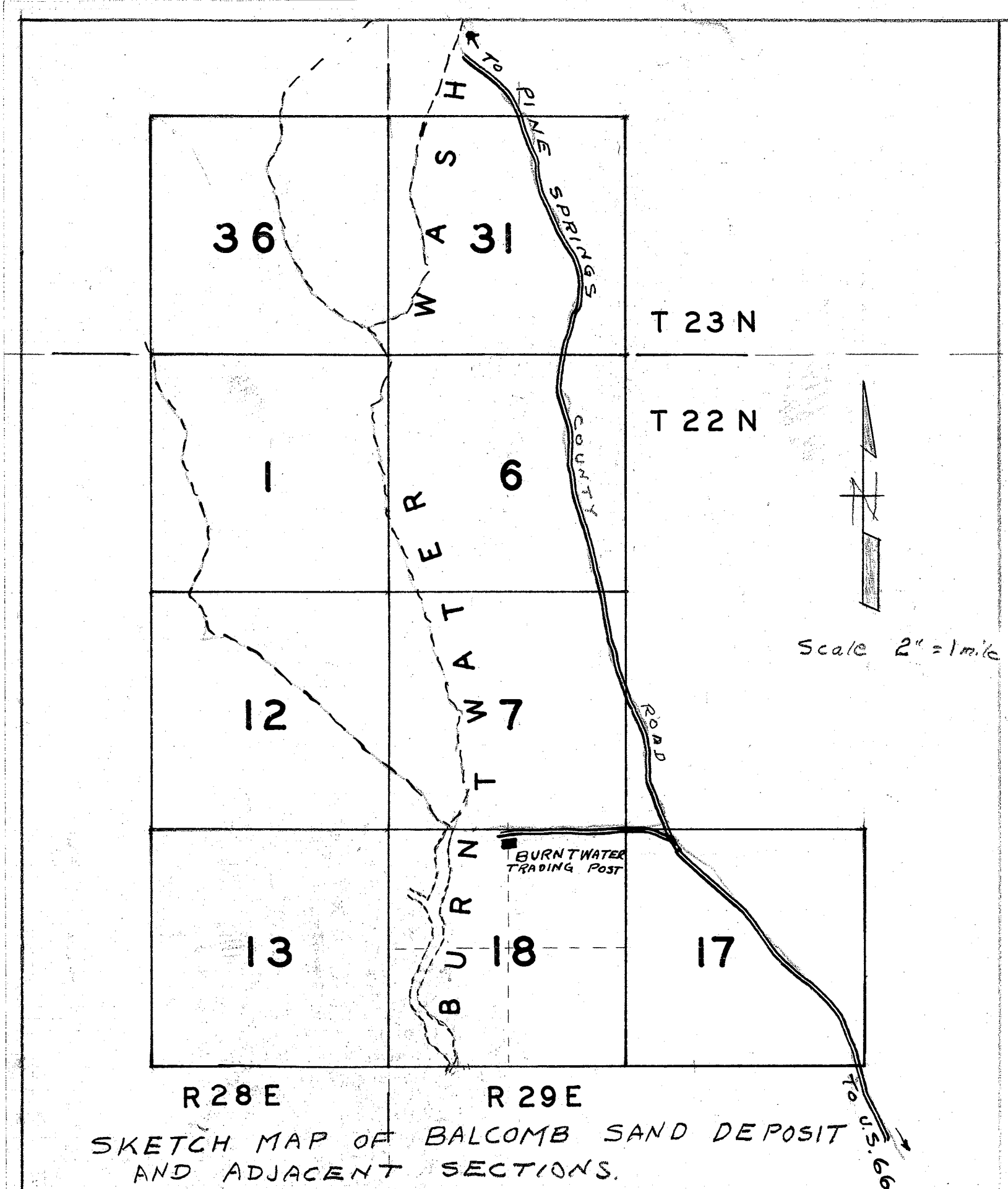
BURNT WATER SAND TYPE SITE

PROPOSED FLOW SHEET FOR WASHING AND DRY SCREENING WITH MAXIMUM WATER RECOVERY.



Wm P Crumpler 3/1/58 A4


22
A
9.55
4.70
CHAMBERS
U.S. 66
13.0
SANDERS
PUERCO
RIVER
PINE SPRINGS
ROAD
BURNT WATER
WASH
QUEBRADO
CANYON
3.0
2.2
2.5
HOUCK
U.S. 66
C
B
36
31
32
1
6
5
12
7
8
13
18
17
24
19
20
25
30
29
36
31
32
R28E
R29E
T23N
T22N
N
A — C
27.25 miles
9.55 miles graded
17.20 miles paved
B — C
6.0 miles
3.8 miles graded
2.2 miles paved
SKETCH MAP
OF
CHAMBERS - SANDERS AREA
APACHE COUNTY, ARIZ
A - Section 22 - Arizona 5.1.ca
B - Section 18 - Burntwater Wash
C - HOUCK Junction
Paved Highway
Graded Highway
Secondary Paved Highway
Scale 1/2" = 1 mile
Well
BURNTWATER WASH DRAINAGE BASIN
W J R Crawford
11/14/57



SKETCH MAP OF BALCOMB SAND DEPOSIT AND ADJACENT SECTIONS.

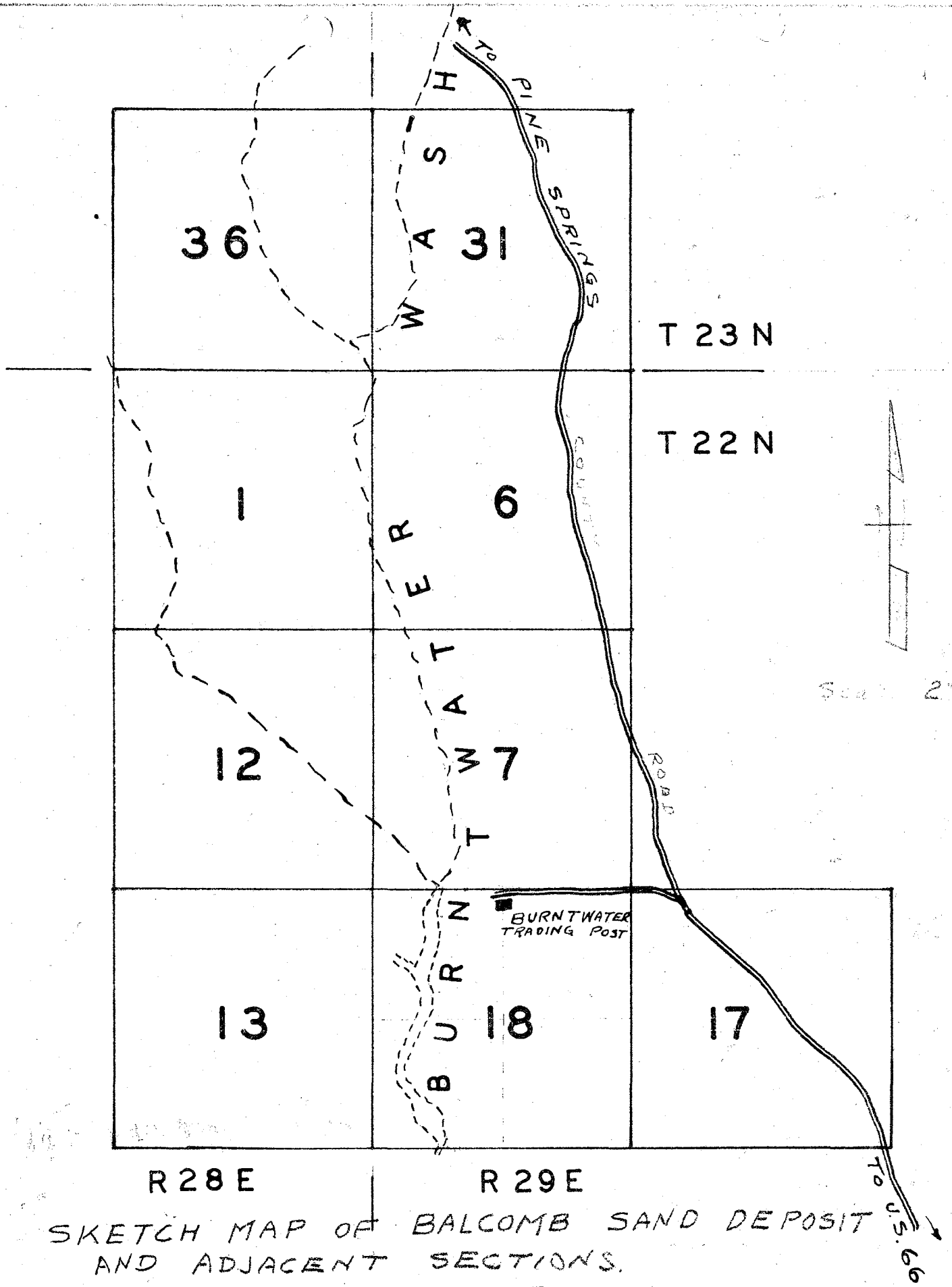
▭ - AREA DRILLED and SAMPLED

▭ - SECTION 18 - BALCOMB DEPOSIT

▭ - SECTION 7 - PERMITTED TO LOTHMANN

▭ - DRILLING PERMIT REQUEST

W.P.C 9/10/57

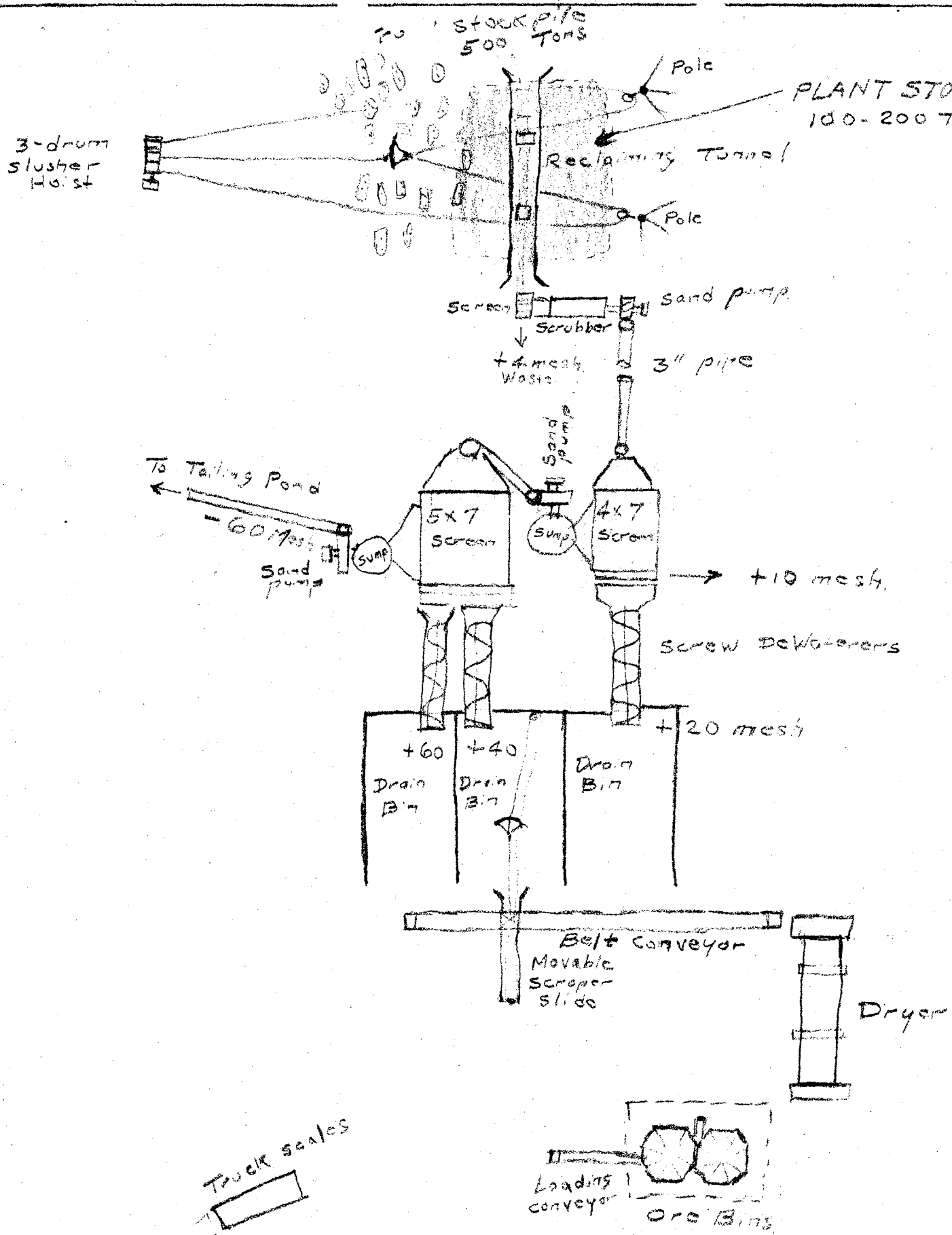


SKETCH MAP OF BALCOMB SAND DEPOSIT AND ADJACENT SECTIONS.

- AREA DRILLED and SAMPLED
- SECTION 18 - BALCOMB DEPOSIT
- SECTION 7 - PERMITTED TO LOTHMANN
- DRILLING PERMIT REQUEST

B14

W.P.C. 9/19



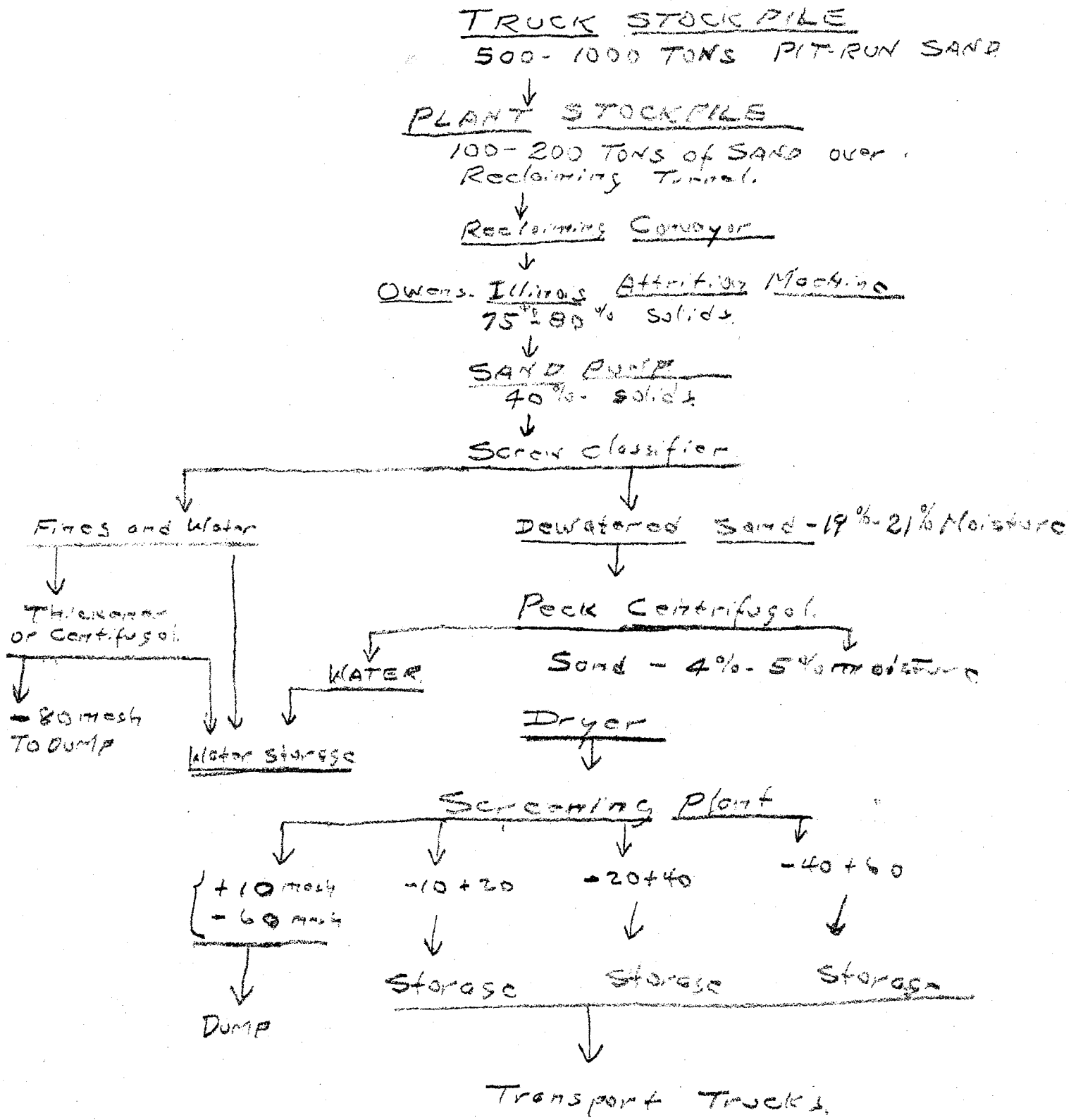
GENERALIZED FLOW SHEET

TO ACCOMPANY MEMO OF FEBRUARY 6, 1958

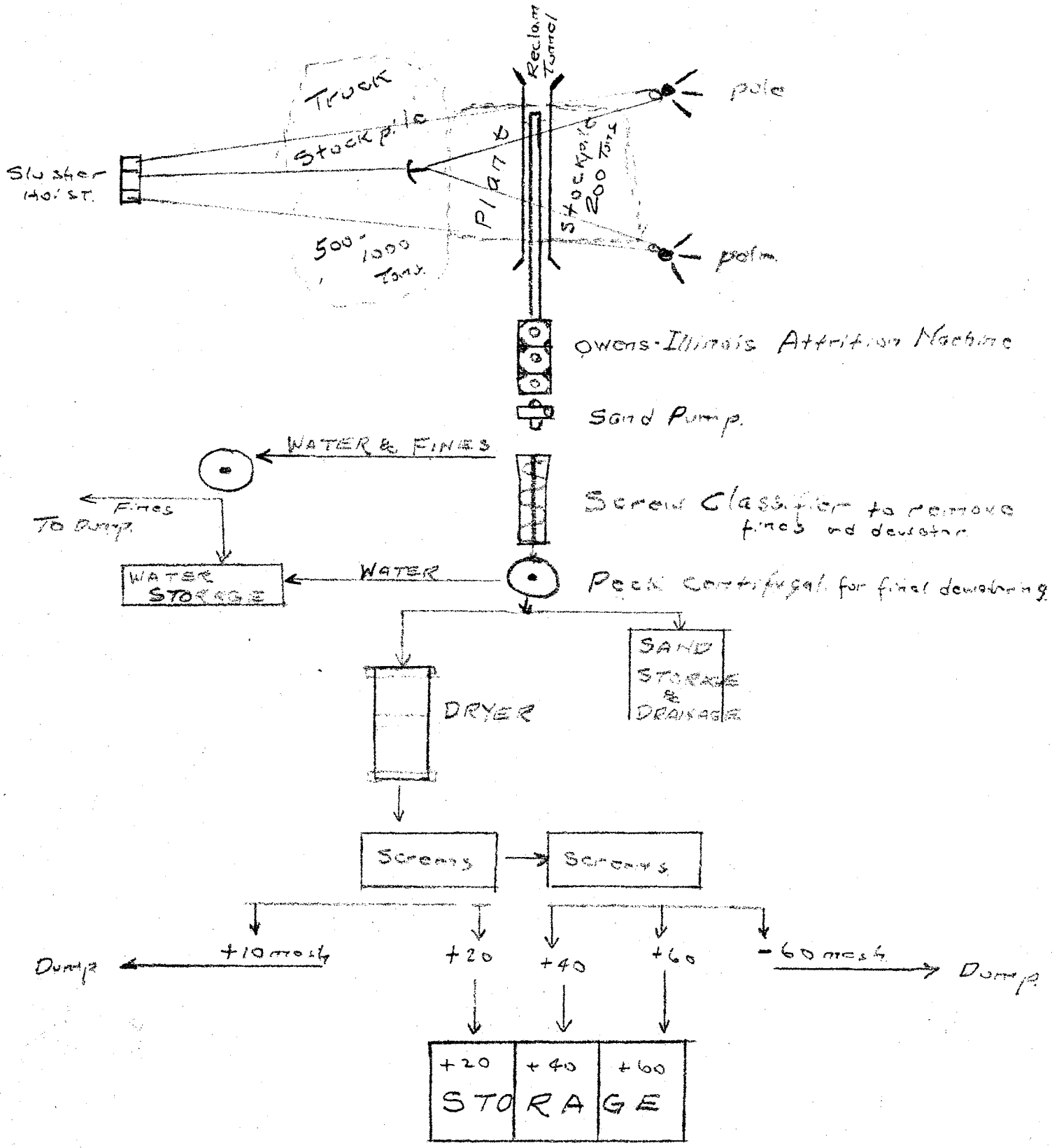
W. R. Crawford 2/3/58

BURNETTE R SAND DEPOSIT

PROPOSED FLOW SHEET FOR WASHING AND DRY SCREENING WITH MAXIMUM WATER RECOVERY



W. P. Crawford 3/1/58



BURNTWATER SAND DEPOSIT

PROPOSED FLOW SHEET FOR WASHING AND DRY SCREENING WITH MAXIMUM WATER RECOVERY.

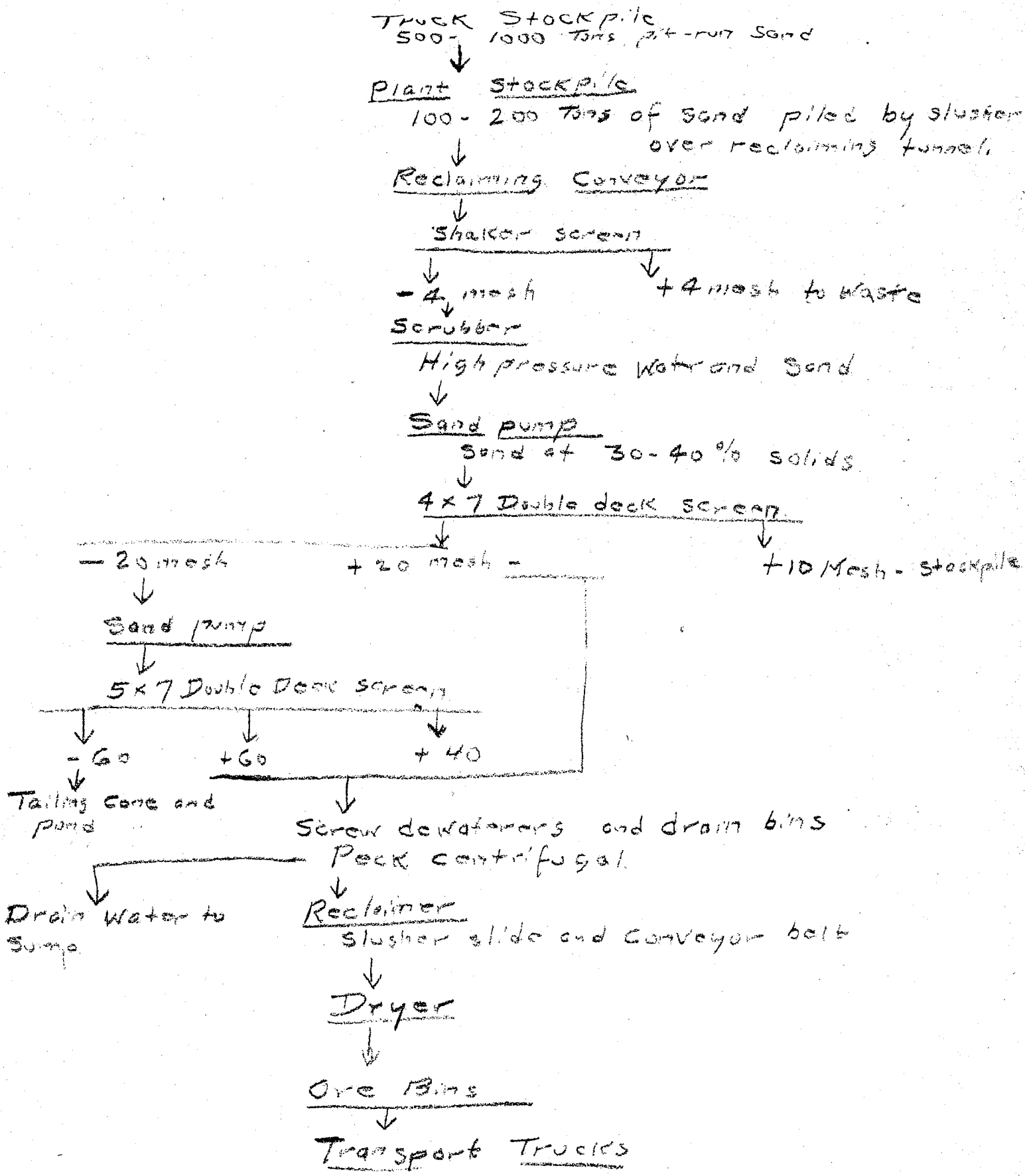
W. P. Crawford

3/1/58

B44

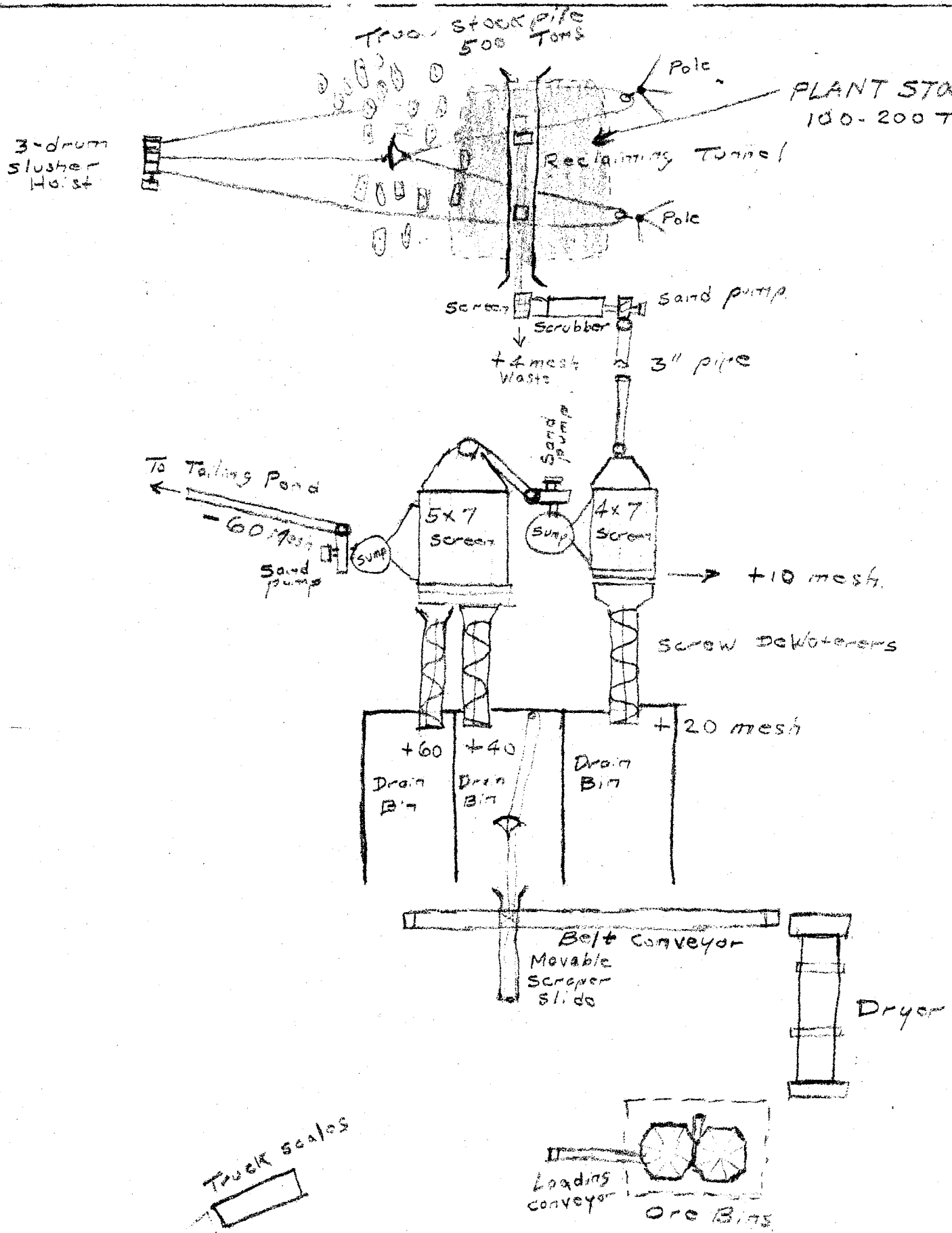
BURIED WATER SAND DEPOSIT

FLOW SHEET CONTAINING PROCESS MODIFICATIONS, WASHING AND WET SCREENING



B45

W.P.C. 2/3/50



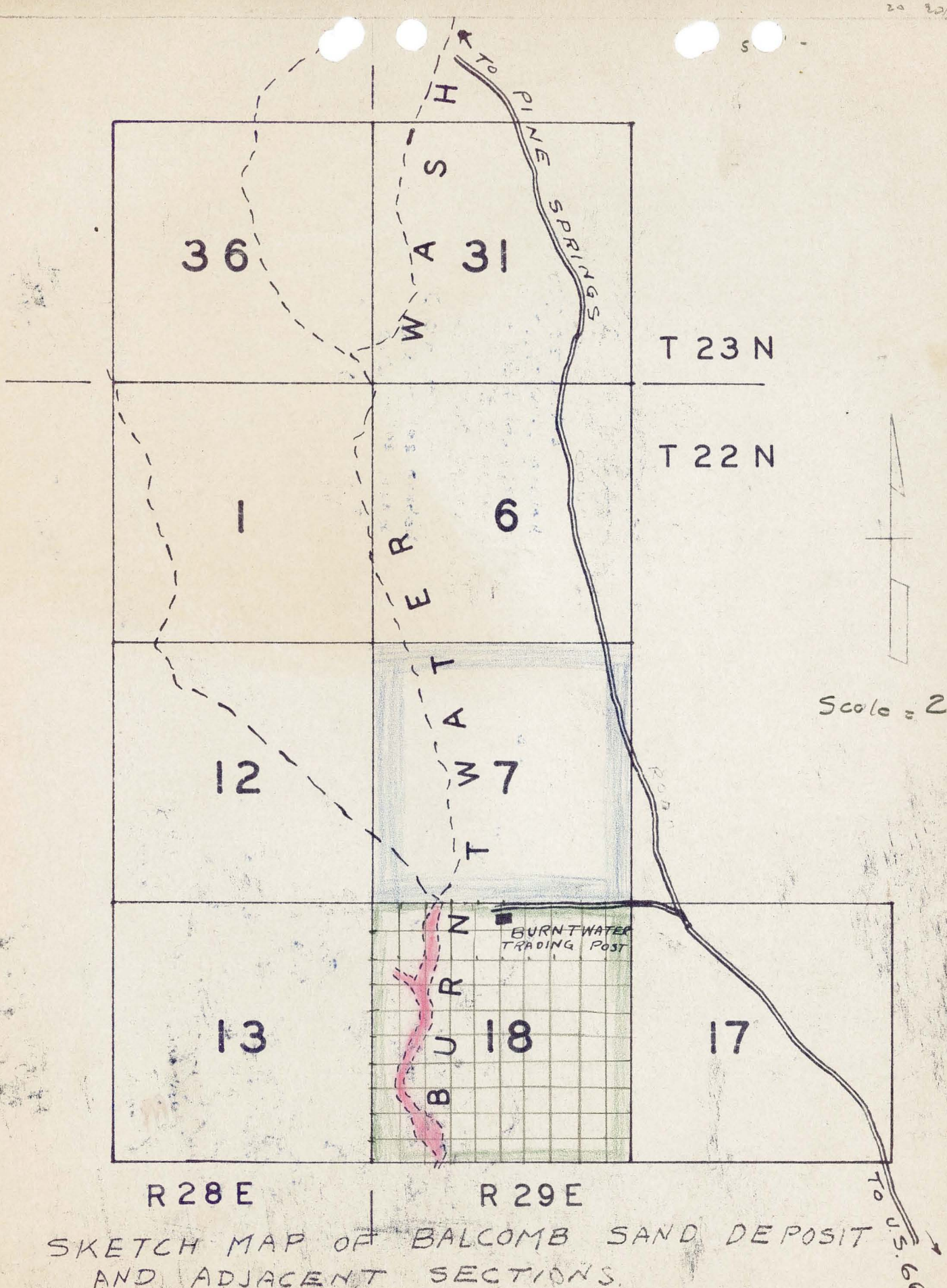
GENERALIZED FLOW SHEET

TO ACCOMPANY MEMO OF FEBRUARY 6, 1958

WASHING and WET SCREENING

W. R. Crawford 2/3/59

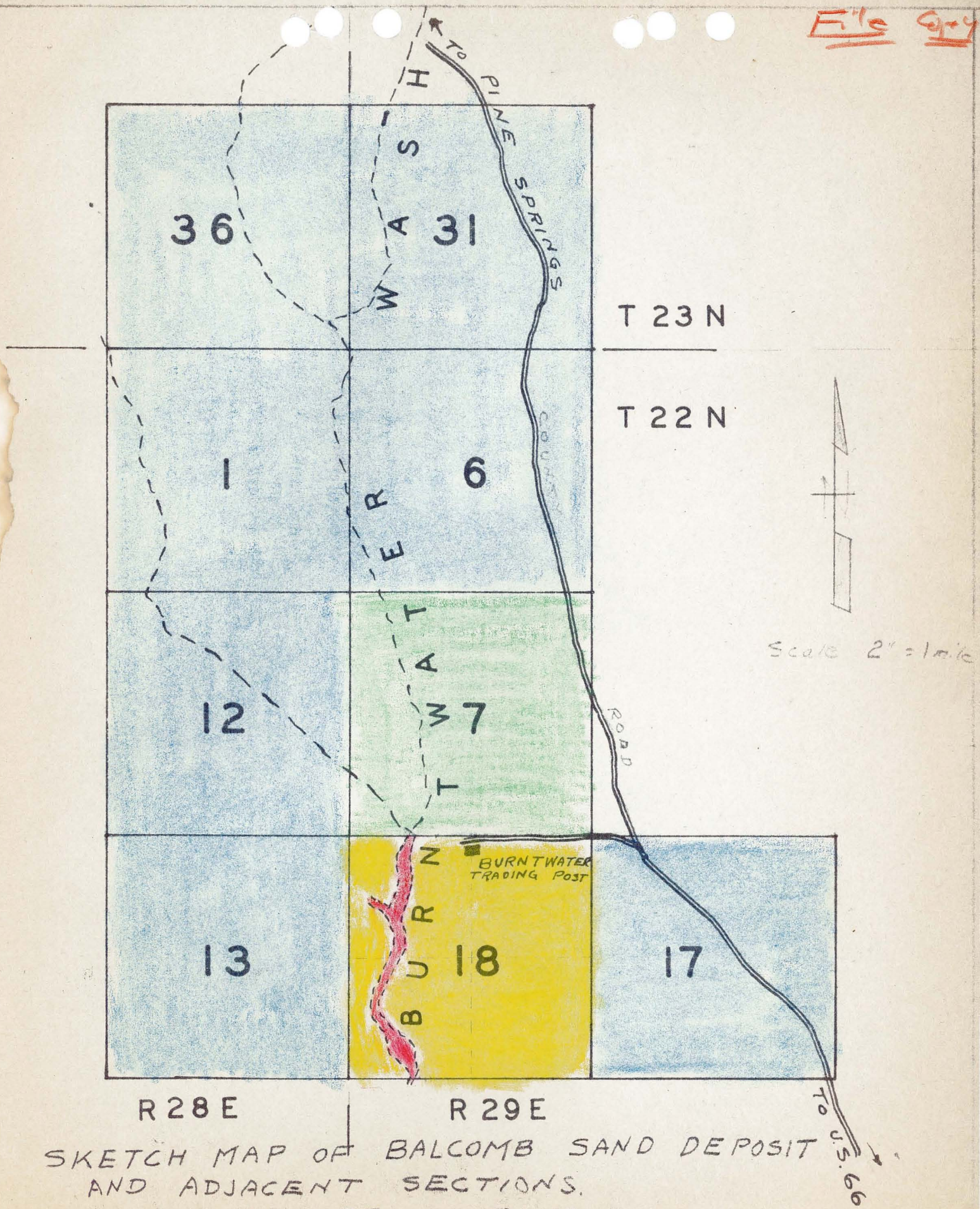
B46



SKETCH MAP OF BALCOMB SAND DEPOSIT AND ADJACENT SECTIONS.

- AREA DRILLED and SAMPLED
- SECTION 18 - BALCOMB DEPOSIT
- SECTION 7 - PERMITTED TO LOTHMANN
- DRILLING PERMIT REQUEST

File 9-4

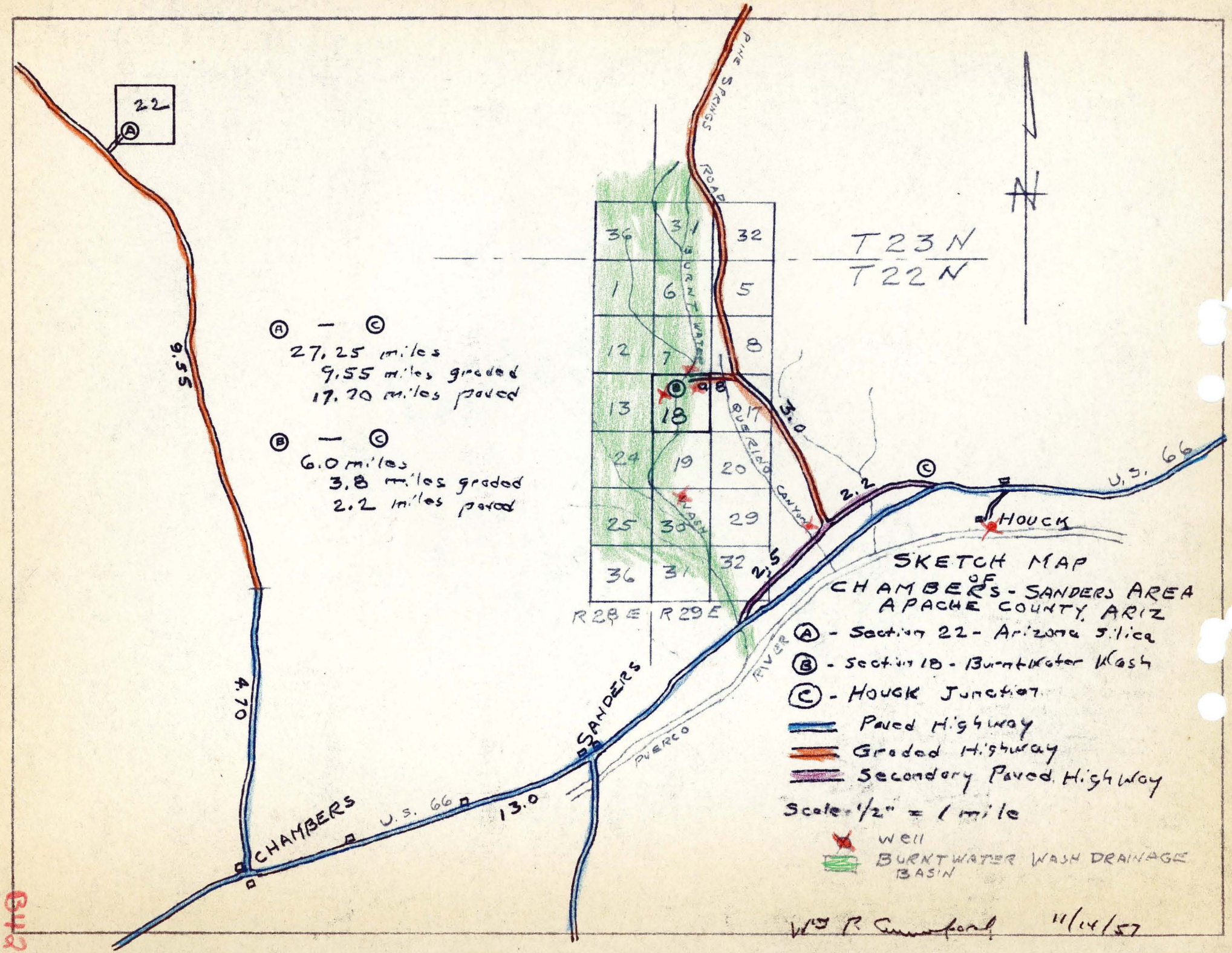


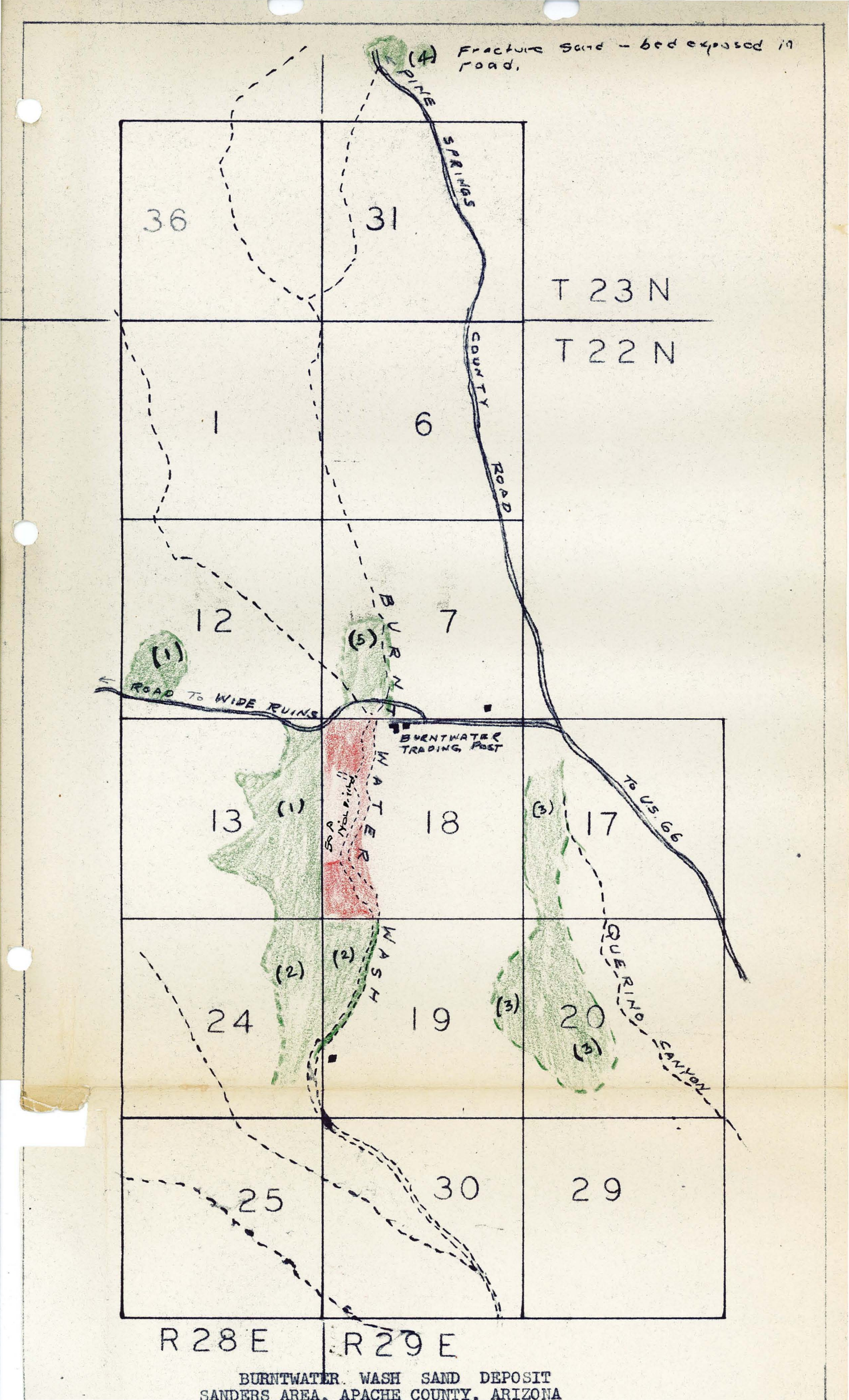
SKETCH MAP OF BALCOMB SAND DEPOSIT AND ADJACENT SECTIONS.

- AREA DRILLED and SAMPLED
- SECTION 18 - BALCOMB DEPOSIT
- SECTION 7 - PERMITTED TO LOTHMANN
- DRILLING PERMIT REQUEST

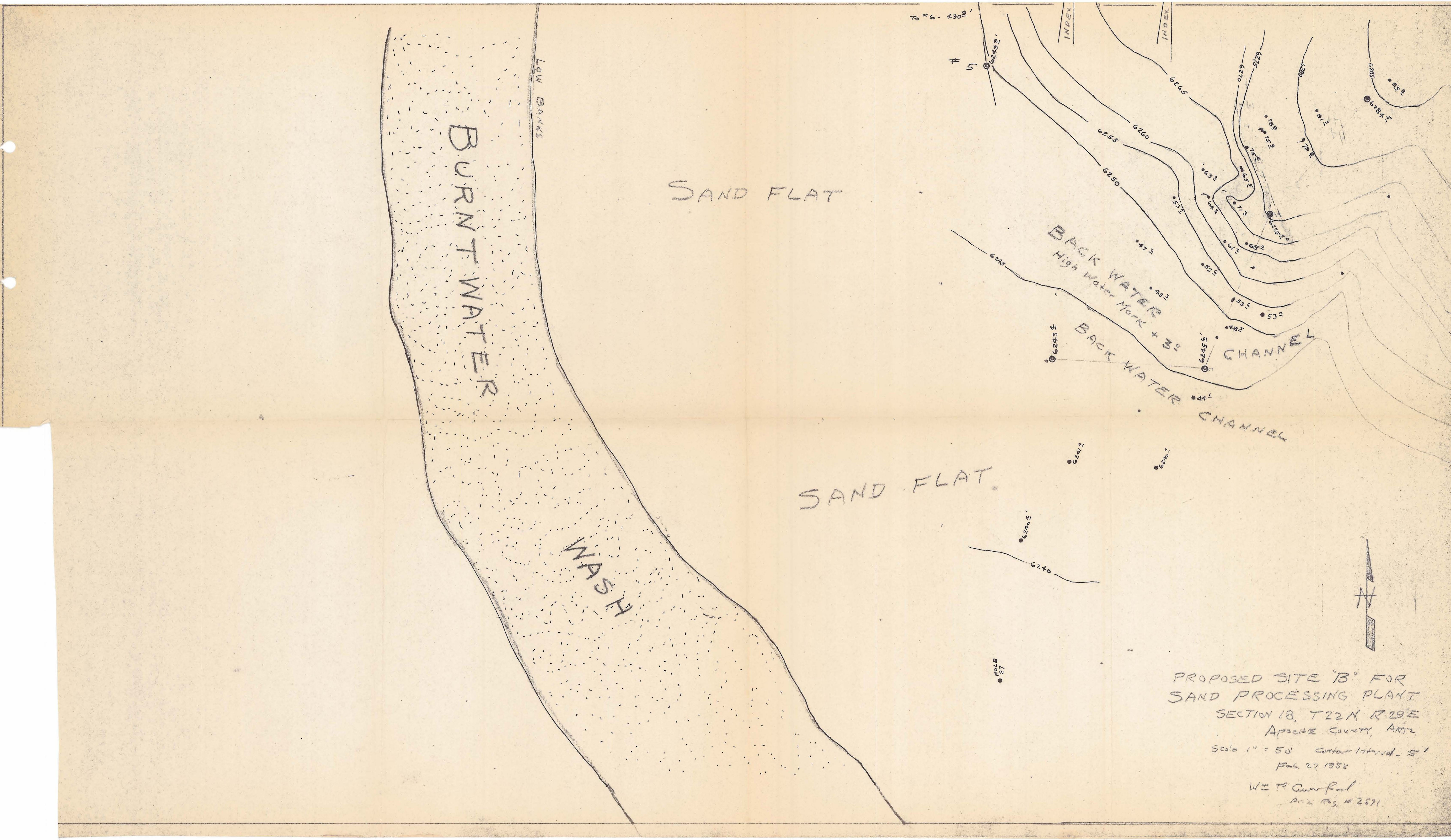
B19

W.P.C. 9/10/57

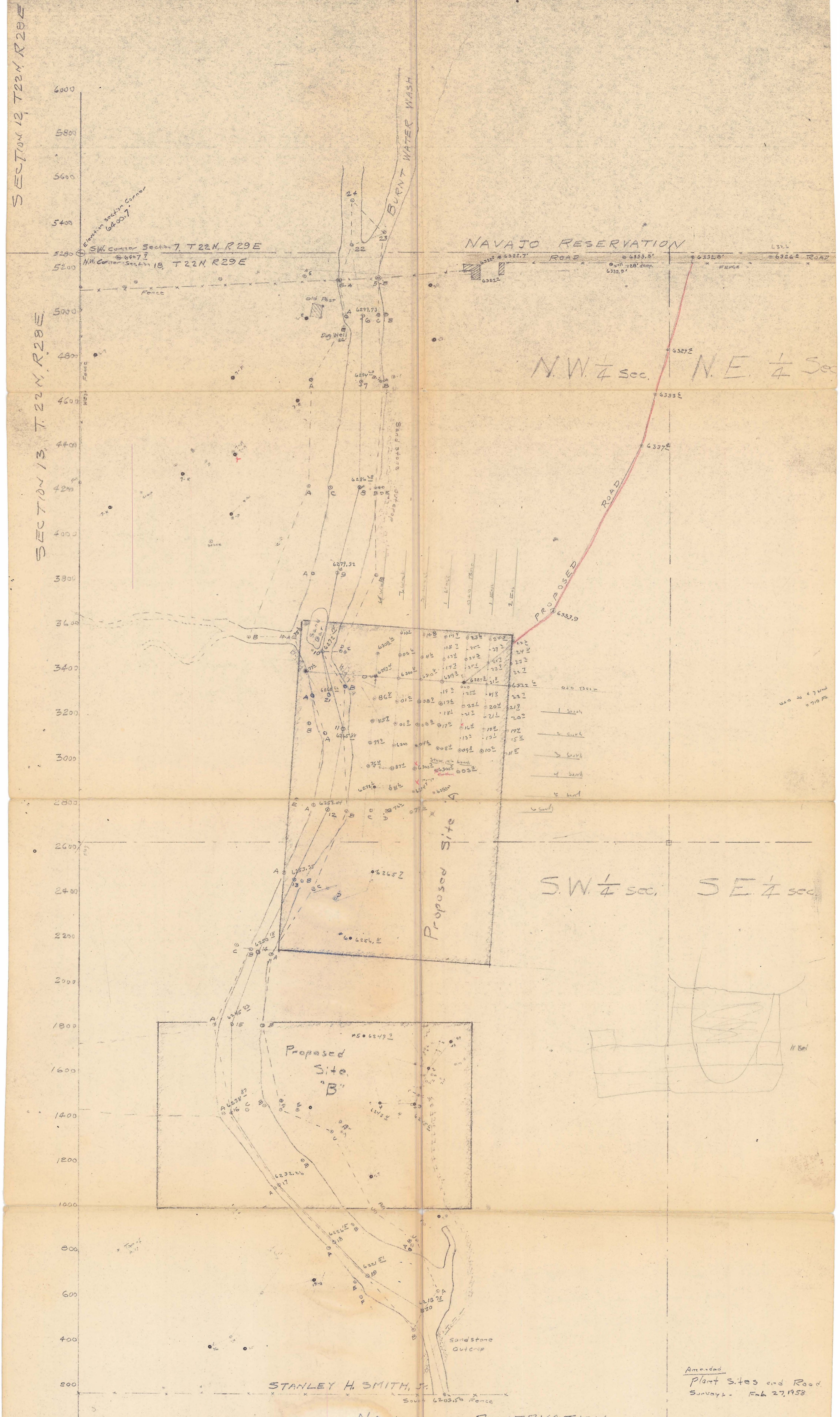

22
A
PINE SPRINGS ROAD
T 23 N
T 22 N
36
31
32
1
6
5
12
7
8
13
18
17
24
19
20
25
30
29
36
31
32
BURNT WATER WASH
QUEBRADO CANYON
WASH
R 28 E
R 29 E
3.0
2.2
2.5
C
U.S. 66
HOUCK
5.5
4.0
CHAMBERS
U.S. 66
13.0
SANDERS
PUERCO RIVER
A — C
27.25 miles
9.55 miles graded
17.70 miles paved
B — C
6.0 miles
3.8 miles graded
2.2 miles paved
SKETCH MAP
OF
CHAMBERS - SANDERS AREA
APACHE COUNTY, ARIZ
A - Section 22 - Arizona Silica
B - Section 18 - Burntwater Wash
C - Houck Junction
Paved Highway
Graded Highway
Secondary Paved Highway
Scale: 1/2" = 1 mile
well
BURNTWATER WASH DRAINAGE BASIN
W. R. Crawford
11/14/57



BURNTWATER WASH SAND DEPOSIT
SANDERS AREA, APACHE COUNTY, ARIZONA



PROPOSED SITE "B" FOR
SAND PROCESSING PLANT
SECTION 18, T22N, R29E
APACHE COUNTY, ARIZ
Scale 1" = 50' Contour Interval - 5'
Feb. 27 1958
Wm P. Crawford
Ariz Reg. # 2591



SAND DEPOSIT
IN
SEC. 18, T. 22N; R29E.
STANLEY H. SMITH, Jr. OWNER
PETER BALCOMB, LESSEE
---- Outline of Area Sampled and Estimated
BURNT WATER WASH
SANDERS, APACHE COUNTY
Scale 1" = 200'
Feb. 12, 1957.

Cubic Yards in Sampled Area, Sec. 18.

+20 mesh	+40 mesh	+60 mesh
52,504	131,549	71,639

20 mesh, 40 mesh and 60 mesh sand equal 76.4% of the total cubic yards in the Sampled area.
Total yardage in sampled area = 334,778 Cu. Yds.
Total of +20, +40, +60 mesh sand = 255,692 Cu. Yds.

E.M.
Wm. P. Crawford, Reg. Prof. Engineer
Reg. No. 2531