TASK 2

PROJECT ACCESS

SUBTASK 2.10

PRELIMINARY REPORT

ACCESS PLAN

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

SUSITNA HYDROELECTRIC PROJECT
PLAN OF STUDY

TASK 2
PROJECT ACCESS
SUBTASK 2.10
PRELIMINARY REPORT
ACCESS PLAN

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FEBRUARY 1981

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A. INTRODUCTION

The Susitna Hydroelectric Project has, for many years, been considered a Viable Source of "clean" energy for Central Alaska. The project has been viewed as including one or more dams on the upper Susitna River. The U.S. Corps of Engineers has done extensive preliminary work on the project. In an effort to expedite the project, the Alaska Power Authority in late 1979 selected Acres American, Incorporated to conduct necessary feasibility studies and prepare the necessary FERC license application.

The location of the project is about 150 air miles North of Anchorage. The dams, as proposed, would be up stream from Talkeetna laying between the Parks Highway and the Denali Highway. This area is remote with no existing Access. The quantities of materials and supplies required for construction of the project and for the maintenance of the construction camps are of such a magnitude as to require major transportation facilities to serve the project site. One Subtask of the plan of study is the preparation of an access plan. This plan will determine the most desirable location for an access route and the most economical transporation mode or modal split to serve the project needs. R&M Consultants has been selected as a subconsultant to Acres American, Incorporated to prepare the access study.

This report is intended to serve as a detailed outline of the final access plan to be published about May 1, 1981.

B. PROJECT PARAMETERS

The plan of study for the Susitna Project calls for the analysis of three general routes and two transportation modes to provide access to the proposed dam sites from port facilities or instate sources of supply. Consideration must be given to using road, railroad or a combination of both to serve the project.

The three alternate routes to be studied were required to accomodate the following:

- Serve all dam sites that might be proven feasable by other portions of the over all study.

- Corridors had to be included on the North and South sides of the Susitna River with connections to the Alaska Railroad near Gold Creek, to the Parks Highway and to the Denali Highway.

In order to be able to make a valid comparison between alternatives a basis for that comparison must be established, with this thought in mind, proposed design ciriteria were developed and submitted to Acres American. The criteria submitted are shown in Table 1.

TABLE 1

ORIGINAL PROPOSED DESIGN CRITERIA

	Road	Railroad
Design Speed	30 mph	N/A
Maximum Grade	10%	2.5%
Maximum Curvature	19°	10°
Design Loading	HS-20	E 50

Design criteria such as these are used to establish guidelines for design. The designer normally attempts to provide horizontal and vertical alignment that is better than the mimimum alignment such limits would provide. In order to maintain a schedule and have possible corridors identified for photography, work began on a number of possible alignments prior to approval of the proposed criteria. While the corridor definition work was in progress correspondence was received asking that roadway criteria be adopted that would essentially conform to a 50-60 mile per hour design speed. The recommended design parameters for the railroad were accepted. Later correspondence from Acres American confirmed roadway design criteria for 60 mile per hour design speed. The relatively high roadway design parameters are required because of the size and weight of certain components of the dams that must be manufactured and imported to the site. The required parameters are given in Table 2.

TABLE 2

APPROVED ROADWAY DESIGN PARAMETERS

Design Speed	60 mph
Maximum Grade	6%
Maximum Curvature	5°
Design Loading (Construction Period)	80 Kip Axle & 200 Kip total
Design Loading (After Construction)	HS-20

APPROVED RAILROAD DESIGN PARAMETERS

Maximum Grade	2.5%
Maximum Curvature	10°
Loading	E-50.*

* The Alaska Railroad has indicated that the current system load rating is E-50. The Railroad has suggested design loading of E-72.

C. CORRIDOR SELECTION

The Sustina Hydroelectric Project is located on a section of the Susitna River that is remote wilderness. Earlier studies by government agencies had generated some contour mapping in the vicinity of the proposed dam sites. The only other available contour information was USGS mapping on a one-inch (1") equals one (1) mile scale with one-hundred foot (100') contour intervals. To aid the project team in selecting possible routes a low level helicopter flight was made in late March, 1980. A mosaic was then made of the USGS mapping from Gold Creek and the Parks Highway through the Watana site and out to the Denali Highway north of Watana. Using the preliminary design parameters and information gained from the overflight of the project area, a number of possible alignments were laid out on the map mosaic.

The various alternatives were split into convienent segments. Some of these segments were unique while others could be common to two (2) or more alternatives. Each segment was analized for grades on a section by section basis. Each curve was checked for degree of curve and deflection angle. Each curve and each identifiable gradient section were then tabulated. The various segments considered were combined to provide a total of thirty-three (33) possible alignment alternatives that could conceivably be constructed to provide access to one or both of the principle dam sites. The principle damsites were identified in the early stages of the study as Devils Canyon and Watana. The various combination of segments making up potential access routes were compared. The alignment identified as being the most attractive within each of the three (3) general corridors required by the plan of study was selected for further work. A low level reconnaissance flight with part of the environmental team was made April 30, 1980 to review the proposed corridor alignments prior to the photographic flights. Valuable input for future anlalysis was gained, and there was nothing identifed that would force a major line change at this early stage of the work.

On May 15, 1980 the proposed corridor alignments were presented to representatives of Acres American. Photographic flights of the proposed corridors were approved at that meeting.

For the purpose of analysis the proposed general corridors are identified as follows:

Corridor 1 — On the north side of the Susitna River between the Parks Highway and the Watana Dam site.

Corridor 2 — On the south side of the Susitna River between the Parks Highway and Watana Dam site.

Corridor 3 Connecting Watana Dam site with the Denali Highway to the north.

A number of alternative segments were considered within each of these three (3) general corridors. The alternative segments within the respective corridors are discussed below and shown in Appendix A.

1. Corridor 1

a. Alternative 1-A This alternative begins at Watana Camp, and then proceeds north to a crossing of Tsusena Creek. After leaving Tsusena Creek the line proceeds through a pass at four-thousand foot (4000') elevation into the upper reaches of Devils Creek. As the line leaves Devils Creek it follows the side slope around just to the north of High Lake while gradually dropping in elevation and reaches the bluffs at Devils Canyon very near the Devils Canyon Dam site. From Devils Canyon Damsite the line traverses around into the Portage Creek drainage and, after crossing Portage Creek parrallels an existing fourwheel driving trail to a crossing of the Alaska Railroad at Chulitna Pass and on to the Parks Highway.

This alternate crosses the highest ground at just over four-thousand foot (4000') elevation near the head of Devils Creek. Through various sections it also crosses some of the most difficult terrain of any route investigated, particularly in crossing Portage Creek. The entire section from just above Devils Canyon across Portage Creek and out to the vicinity of the cabins on the west side of Portage Creek is side hill construction in very steep and broken terrain.

Preliminary grades are generally within criteria except for a few short sections. A preliminary check indicates that the grade problems should be solvable with minor adjustments of the line and some heavy earthwork.

Alternative 1-A has a number of curves that exceed the desired degree of curve parameter. As stated above this line traverses some very difficult terrain, in the Devils Canyon through Portage Creek section. Because of this it may be difficult to eliminate all of the tight curve problems without of costly construction.

b. Alternative 1-B is an alternate segment in Corridor 1 beginning at point 6 on sheet 6 and rejoining 1-A at point 4 on sheet 4 of Appendix A. This alternate segment utilizes a pass into Devils Creek immediatley south of the pass used by alternate 1-A. The pass utilized makes it possible to hold the high point of the line to just over three-thousand four-hundred foot (3400') elevation.

As originally laid out 1-B has about two-thousand feet (2000') that exceed the six percent (6%) grade parameter. These areas can be eliminated during refinement of the alignment. There are a few curves on this alternate that exceed the five degree (5°) parameter. These involve drainage crossings where changes in grade and some grading work will enable the designer to comply with approved guidelines.

c. Alternate 1-C is a totally new line between Watana Dam site and alternate 1-B at its crossing of Devils Creek (See point 5 on sheet 4 of Appendix A). This alternate follows the river and would provide water level access to the reservoir of Devils Canyon Dam.

The preliminary layout includes several relatively short sections that exceed the desired maximum grade. A few of these grade problems may be eleminated by refining the line, however it may not be possible to eliminate all of the steeper sections.

Alternate 1-C includes at least three (3) curves that would be difficult and costly to flatten enough to comply with the desired criteria.

Alternate 1-C is the longest of the three (3) lines between Watana and Devils Creek and would require at least three (3) bridges.

d. Alternate 1-D is an alternative crossing of Portage Creek that uses switch backs and relatively steep grades to shorten the stream crossing. (See point 2 on sheet 5 to point 3 on sheet 4 of Appendix A.) A thirty (30) mile per hour alignment is possible but nothing better. This segment is effectively eliminated for this reason.

2. Corridor 2

a. Alternate 2-A begins at Watana Dam site on the south side of the river. The line proceeds southerly past the west end of Fog Lakes and across Fog Creek to the

north end of Stephan Lake with good line and grade. The line climbs toward the high ground west of Stephan Lake at a comfortable grade to the top of the Prairie Creek drainage. (See point 15 sheet 10 of Appendix A.) From there the road stays on the high ground at elevations of about three-thousand four-hundred feet (3400') to a point immediatley south of VABM CHUNILA (See sheet 8 of Appendix A) with good line and grade. From that point the line decends via steep grade and very tight switch backs to the Railroad at Sherman. This line is approximately fifty-six point six miles (56.6) in length.

Grades for the most part are acceptable on the altermate 2-A with the exception of the climb from Sherman through the switch backs. It will be difficult to improve signifcantly on that section. Another problem with 2-A that must be considered is that a nine (9) mile plus spur must be constructed to serve Devils Canyon Dam. This spur is alternate 2-C and a part of 2-B. (See Sheet 9 of Appendix A.)

b. Alternate 2-B begins as 2-A flattens out after climbing out of the Stephan Lake basin. (See point 15 on sheet 10 of Appendix A). This segment travels northerly along the top edge of a deep narrow drainage for about six (6) miles (see point 13 sheet 10 Appendix A) where it turns westerly and crosses into and desends an unnamed drainage to Devils Canyon Dam site where it can connect with 2-1. Much of alternate 2-B exceeds acceptable grades and several curves exceed the acceptable degree of curve. This would be a thirty (30) mile per hour segment without question and the segment would include one (1) major bridge.

c. Alternate 2-C is the segment that connects 2-A with 2-B about three (3) miles south of Devils Canyon. (See Point 11 and 12 Sheet 9 Appendix A.) The section is six (6) miles long and a major part exceeds grade criteria. The line has good horizontal alignment but grades make this alternate very questionable.

d. Alternate 2-D is a segment that connects 2-A at Sherman with the Parks Highway by a pass through the ridge on the west side of the Susitna River. The segment would require a major bridge and a crossing of the mainline railroad. This segment can completely satifsy desired criteria. (See Sheet 7 of Appendix A.)

e. Alternate 2-E is a segment that begins at Sherman and goes north essentially parrallal to the mainline railroad to connect with 1-A at Chulitna. This segment was addressed in order to provide alternative points of connection with the Parks Highway should some alternate within corridor 2 be ultimately selected. Only a portion of this segment would be used. A major river bridge may be required depending on what portion of the segment may be used. (Point 7 sheet 7 to point 1 sheet 2 of Appendix A.)

The grades can be kept within desired limits with some heavy grading in two (2) short sections. The hoizontal alignment is within criteria.

f. Alternate 2-F is a segment that would provide for a shorter roadway crossing of Fog Creek. The segment connects with 2-A on both ends and would require a high bridge approximately five-hundred fifty feet (550') long over Fog Creek. (Point 20 to 23 sheet 12 of Appendix A.) Grades are good throughout the segment. One (1) curve as shown is too tight. The curve could be brought into conformance by skewing the bridge across the creek and some grading work on the bridge approaches.

g. Alternative 2-G is a segment intended to connect 2-B with 2-I at Devils Canyon Dam site by essentially paralleling the railroad line 2-R. (Point 12 sheet 10 to point 10 sheet 9 of Appendix A.) 2-G begins about five-hundred feet (500') in elevation above 2-R then parallels the rail line 2-R at a somewhat steeper gradient to connect with 2-I at Devils Canyon Dam site. This segment is located in some difficult terrain. Some heavy cuts and fills will be required and at least one (1) major bridge will be required across the side drainage just upstream from Devils Canyon Dam site.

h. Alternate 2-H is a segment of roadway that goes up over a small bluff just upriver from the present railroad bridge at Gold Creek to avoid some difficult construction going around the face of the bluff. Both grade and alignment criteria can be satisfied. This segment is shown connecting with 2-E in two different ways. This is to indicate what might be required for connecting with Parks Highway using either 1-A or 2-D.

i. Alternate 2-I is a roadway following exactly on the railroad alignment 2-R from Devils Canyon Dam site to 2-H just above Gold Creek. (Point 10 sheet 9 to point 9 sheet 8 of Appendix A.) All design criteria for the roadway are satisfied.

j. Alternate 2-R is the railroad alignment between Gold Creek and Watana Dam site on the south side of the river. The rail line is within criteria the entire length. The maximum curvature is about eight degrees (8°) and the ruling grade is about two point three percent (2.3%). The most difficult terrain is from Devils Canyon Dam to the Stephan Lake basin divide. One (1) major bridge will be required near Devils Canyon and one (1) or more minor bridges are likely. There is a six (6) mile section on one side of a north-south drainage that will be full bench cut in rock and may require snow sheds to keep the tracks open in winter (see sheet 10). This line appears to be the only feasible possibility for rail access from Gold Creek to Watana.

3. Corridor 3

a. Alternate 3-A begins at Watana Dam site and proceeds northeast up the west side of Deadman Creek then through a saddle into the upper Butte Creek drainage and along the west shore of Butte Lake to the Denali Highway. This alternate is the shortest connection to an existing highway. Only two (2) short sections that exceed four percent (4%) grade. The sharpest curve on the preliminary line is six degrees (6°).

b. Alternate 3-B coincides with 3-A from Watana Dam site to the first crossing of Deadman Creek about five point five (5.5) miles northeast of the dam site (see point 22 on sheet 13 of Appendix A). This alternate then proceeds easterly into the Watana Creek drainage and then northeasterly through a saddle into the lower end of Butte Creek drainage. The line traverses the west side of the Butte Creek valley passing west of Snodgrass Lake and connecting with the Denali Highway near the Susitna River Bridge. This alternate is slightly longer than 3-A and otherwise meets all design parameters.

With the various segments identified and estimates made of grades and curvature a total of thirty-three (33) combinations were developed and compared. The criteria used to compare the alternative combinations are as follows:

- Overall length to be constructed;
- Average grade;
- Average deflection per mile.

The tabulation of this comparsion is included in Appendix B.

The alternatives identified as being most favorable based on length, alignment and grade are as follows:

For Corridor 1. Parks Highway to Watana Dam site - North side
Use combination 2, Segments 1-A and 1-B

Overall Length	64.9 Miles
Average Grade	2.4%
Deflection Per Mile	7°06'±

This Corridor will be identified as Alternate A in further studies.

For Corridor 2. Parks Highway to Watana Dam Site - South Side
Use Combination 33, Segments 2-A; 2-F; 2-B; 2-G; 2-H; 2-E; 2-I

Overall Length	66.5 Miles
Average Grade	2.2%
Deflection Per Mile	4.°50°±

This Corridor will be identified as Alternate B in further studies.

For Corridor 3. Watana Dam to Denali Highway
Use combination 10 - Segment 3-A

Overall Length	39.1 Miles
Average Grade	1.3%
Deflection Per Mile	1°30'±

This Corridor will be identified as Alternate C in further studies.

For Railroad.
Use 2-R on the south side of the river from Gold Creek to Watana Dam site. This closely follows the preferred road alignment for Corridor 2.

Overall Length	58 Miles
Average Grade	1.5%
Deflection Per Mile	5°11'±

This line will be identified as Alternate R in further studies.

D. PROJECT DESIGN DEVELOPMENT

The Susitna Project is currently envisioned as two dams. The dams being a rock and earthfill structure at the Watana Site and a concrete gravity dam at the Devils Canyon Site. Preliminary layouts are similar to those developed by th Corps of Engineer is their 1979 feosibility report. Appendix C shows the Corps of Engineer layouts. Other plans are still under consideration however the impact of the other plans on access would be small.

E. PROJECT SCHEDULE

The project schedule, as currently planned, calls for beginning construction of the Watana dam site in 1985 with power on line in 1993. Work would then shift immediately to the Devils Canyon site with power on line projected for the year 2000.

The FERC license application is scheduled for submission in June 1982. Design of the facilities for Watana should proceed con currently with FERC review. In this way initial mobilization to Watana could be made via a snow road during the winter of 1984/1985. This will allow work to begin on the deversion tunnels early in 1985. Construction of the access should begin as early as possible. Access construction could take anywhere from one to four years to build depending on which plan is selected and the final project schedule. In any case it will be necessary to move equipment and supplies in large quantities during 1985 construction season.

F. LOGISTICS

The dams and associated facilities are of a size the require vast quantities of equipment Materials Supplies and people for construction. Because of the remote location a base camp must be provided that will resemble a small town complete with all essential services.

1. Construction

The access facility will be a major transporation link between the existing transportation system and the project. As such it will be a major construction project in itself, in addition, a full scale maintenance program will be required to keep the access facilities in good condition so that the flow of essential materials will not be unduly disrupted.

Major items of work for the dam include the following:

Common Excavation	28,400,000	C.Y.	1,440,000	C.Y.
Rock Excavation	60,680,000	C.Y.	1,355,000	C.Y.
Concrete	425,000	C.Y	2,547,000	C.Y.
Cement	188,300,000	Lb.	793,220,000	Lb.
Reinforcing Steel	41,152,000	Lb.	29,981,000	Lb.
Misc. Steel	44,694,000	Lb.	34,293,000	Lb.

The primary materials for each dam include:

Diesel Fuel
Gasoline
Tires and Equipment Parts
Cement
Reinforcing Steel
Structural Steel

In addition there will be many many items needed in lesser quantities including the large specialty pieces such as transformers and generators for each dam. For a comparison of transportation costs only the easily identified major items will be used. These items will accurately identify relative differences in transportation costs when reviewing alternative plans.

In order to estimate quantities of fuel, tires and parts required at each site estimates of equipment fleets with average unit fuel consumption figures were made. Those figures are shown below:

Equipment	Fuel Per Unit (1 gallon/hr.)	# Units	
		Watana	Devils Canyon
40 C.Y Ent. Dump	21	40	15
8 C.Y. Loaders	15.5	10	6
Motor Patrol (cat. 14)	6.5	8	6
D-9	17	30	10
D-7	8	10	5
Cranes	10	2	4
Rock Crusher	20	1	2
Screening Plant	10	1	2
Concrete Plant	10	1	5
Mixer Trucks	10	3	3
Fork Lifts	5	6	6
Dump Trucks	10	10	6
Miscellaneous	7	20	20
Pickup and other Gasoline Vehicles	2	60	60

WEEKLY DIESEL FUEL REQUIREMENTS FOR CONSTRUCTION
ASSUME 24 HOUR PER DAY AND 7 DAY PER WEEK

Equipment Type	Watana gallons/week	Devils Canyon gallons/week
* End Dumps	94,080	25,280
* Loaders	18,228	10,416
Motor Patrols	6,552	4,368
D-9	57,120	19,040
D-7	8,960	4,480
Cranes	2,240	4,480
Crushers	2,240	4,480
Screaning Plant	1,120	2,240
Concrete Plant	1,120	5,600
Mixer Trucks	3,360	3,360
Fork Lifts	3,360	3,360
Dump Trucks	11,200	6,720
Miscellaneous Vehicles	15,680	15,680
Total Gallons per week	225,260	119,504

* Assume ½ down for service and maintenance.

Truck Loads @ 7,500 Gal./load	30 Loads/wk.	16 Loads/wk.
Rail Car - 20,000 Gal/load	11 Loads/wk.	6 Loads/wk.
Gasoline	20,160 Gal./wk.	20,160 Gal./wk.
Truck Loads @ 7,500 Gal./load	2.69 Loads/wk.	2.69 Loads/wk.
Rail Car Loads @ 20,000 Gal./load	1.01 Cars/wk.	1.01 Cars/wk.

Cement	Watana	Devil Canyon
Time Requirement	7 yrs.	6 yrs.
Quantity	94,150 ton	396,600 ton
Quantity per week	258.65 ton/wk.	1271.15 ton/wk.
Truck @ 30 ton/load	8.6 trucks	42.4 truck/wk.
Carloads @ 75 ton	3.5 Cars/wk.	16.9 Car/wk.
Steel (all)	42,923 ton	32,137 ton
Quantity per wk.	117.9 ton/wk.	103 ton/wk.
Truck @ 30 ton	3.9 Truck/wk.	3.4 Load/wk.
Car Loads @ 75 ton	1.6 Loads/wk.	1.4 Load/wk.
Tires and Mainteance	2 Truck/wk.	2 Truck/wk.
Subtotal Trucks/wk.	47.2	66.5
Subtotal Rail Cars/wk.	18.1	26.3

Supplies and fuel for the base camp must flow steadily and smoothly. The construction camp population is estimated at 1100 people. For the purposes of this report it is assumed that each person will require approximately ten pounds of food and supplies, exclusive of fuel, daily. Fuel consumption for power and heat are assummed to be the equivalent of 50 gallons of diesel fuel per hour. These figure convert to the following delivery rates:

Camp Supplies

$$\frac{1100 \text{ persons}}{2000 \text{ lb.}} \times \frac{10 \text{ lb.}}{\text{person}} \times \text{ton} = 5.5 \text{ ton/day}$$

Truck Loads @ 30 ton each = 1.3 trucks per week
Rail Cars @ 75 ton each = 0.5 cars per week

Camp Fuel

50 gallons per hour = 8,400 gallons per week

Truck Load @ 7,500 gallons = 1.12 loads per week
Rail car load @ 20,000 gallons = 0.42 loads per week

PRIMARY DELIVERIES ALL MATERIALS

	Watana Dam	Devils Canyon Dam
Trucks	49.6 trucks	68.9
Contingency & Misc.	10.4	14.1
Total	60.0 trucks per week	83.0 trucks
Rail Cars	19	27.2
Contingency	4	5.8
Total	23 cars per week	33.0 cars per week

The figures used herein are intended only as preliminary estimates to be used in demonstrating the order of magnitude of the logistic requirements. These figures will be used in the cost comparisons for the various alternatives to be considered.

2. Construction Camp Location

The final decisions on the number and location of construction camps has not been made as of this time for the purposed of analysis it will be assumed that a camp will be provided near the Watana Site and that as activiities decrease of Watana and

increase at Devils Canyon the Watana Camp will be relocated to Devils Canyon. The difference in cost to the total project between the assumption made and other camp alternatives is considered quite small.

3. Access Construction

The logistic requirements of access construction will not be considered separately as they are included in the estimated construction cost outlined below. Again the magnitude of these costs are quite small in comparison to the total project and should not seriously impact the major decisions.

G. ENVIRONMENTAL ISSUES

Environmental issues pertaining to all aspects of the Susitna Project are being adressed by Acres American through another Subconsultant, Terrestrial Environmental Specialists, Inc., (TES). TES has been involved in the access planning and will continue to be involved to insure that potential environmental conflicts are identified and given proper attention.

Representitives for TES were included in a low level aerial reconnaissance of the general corridors in April 1980. In November 1980 the access planning was presented to TES and a request for Macro-Scale input made. That input was available in early February 1981 and is included in Appendix D of this report. This input will be considered in comparing alternative access plans.

H. ALTERNATIVE ACCESS PLANS

The final Access plan must provide the most economical method of serving the logistics requirements of the project, including construction schedule, provide a facility can serve the ultimate recreational uses following construction, provide for maintanance of the facilities and control or minimize the impact on the environment.

1. Available Ports

It is a given that much of the materials required for the project must come from outside of Alaska. Fuel and Lubricants are available in Alaska. At this time nearly everything else must be imported via ship or barge. The sea ports or points through which materials might flow are:

- Anchorage
- Seward
- Whittier
- Valdez
- Fairbanks (for fuel only)

The access plans must include the ports through which materials should flow. For comparison purposes shipping rates through the possible ports were requested.

Material From Seattle	Cost in $/Ton * To Anchorage	** To Seward	*** To Whittier	* To Valdez
Reinforcing Steel	72.00	72.00	54.00	86.00
Structural Steel	85.40	85.40	64.00	125.00
Cement	66.00	66.00	49.60	80.00
Other	80.00	80.00	60.00	110.00

* Quoted by Pacific Western.
** Information not received - Estimated equal to Anchorge.
*** Information not recieved - Rail Barge Operation - Rates Estimated of 75% of Anchorage be cause of reduced handling.
**** Rates for fuel included in model alternate section.

2. Surface Transportation Modal Alternates

There are two obvious modes of transportation available to serve the project, Truck and Rail. The project may be served by either one or a combination of both. In order to compare the two modes the respective rates are presented in ton-mile figures. In this way length of haul may be considered in the analysis.

FREIGHT RATES IN $/TON-MILE

Item	Rail*	Truck**
Steel	0.2577	0.2412
Cement	0.1275	0.2412
Fuel	0.1450	0.2412
Other	0.1262	0.2412

* From price per 100 Lb. rates quoted by ARR.
** One rate for all quoted by Gold Streak Truck Lines including 16% fuel surcharge.

The modal alternates that seem most probable include the following:

- Truck from port to the site.
- Rail from port to the site.
- Rail to Gold Creek or Cantwell and truck from the rail head to the site.

3. Alternative Access Routes

To this point three alterative Corridors have been defined. Estimates have been made of the amounts of materials required at each site and freight handling costs have been identified for the available transportation modes and ports. The three major costs pertaining to access are logistics, construction and maintenance. Estimated construction costs are outlined be low. Maintenance costs will not be estimated in detail. Instead, an estimate of the relative difference in difficulty of maintenance will be applied to an average assumed maintenance figure of $10,000 per mile per year.

	Section	Maintenance Factor
A-1	Parks Highway to Portage Creek	1.0
	Portage Creek - Devils Canyon	1.4
A-2	Devils Canyon - Watana	1.0
B-1	Parks Highway to Gold Creek	1.0
B-2	Gold Creek to Devils Canyon	1.2

	Section	Maintenance Factor
B-3	Gold Creek to Stephan Lake	1.3
	Stephan Lake to Watana	1.0
C	Denali Highway to Watana	0.8
R-1	Gold Creek to Devils Canyon	0.5
R-2	Devils Canyon to Stephan Lake	0.7
	Stephan Lake to Fog Creek	0.6

The alternate corridors identified here-in are split into segments for further analysis. Those segments are as follows:

Segment	Description
A-1	Parks Highway to Devils Canyon
A-2	Devils Canyon to Watana
B-1	Parks Highway to Gold Creek
B-2	Gold Creek to Devils Canyon
B-3	Devils Canyon to Watana
C	Denali Highway to Watana
R-1	Gold Creek to Devils Canyon
R-2	Devils Canyon to Watana

ESTIMATED CONSTRUCTION COSTS

SEGMENT A-1

Excavation	2,125,000 c.y. @ $5.80	$12,325,000
Drainage	19,800 L.F. @ $50.00	990,000
Base	200,000 c.y. @ $12.00	2,400,000
Surfacing	530,000 s.y. @ $25.00	13,250,000
Guard Rail	20,000 L.F. @ $30.00	600,000
Bridges	Lump Sum	5,200,000
Contingency 25%		8,691,000
		$43,456,000

SEGMENT A-2

Excavation	2,125,000 c.y. @ $5.10	$10,837,500
Drainage	18,200 L.F. @ $50.00	910,000
Base	240,000 c.y. @ $12.00	2,880,000
Surfacing	625,000 s.y. @ $25.00	15,625,000
Guard Rail	10,000 L.F. @ $30.00	300,000
Bridge	Lump Sum	1,200,000
Contingency 25%		7,810,500
		$39,563,000

SEGMENT B-1

Excavation	890,000 c.y. @ $4.75	$ 4,227,500
Drainage	5,320 L.F. @ $50.00	266,000
Base	78,000 c.y. @ $12.00	936,000
Surfacing	240,000 s.y. @ $25.00	6,000,000
Guard Rail	7,000 L.F. @ $30.00	210,000
Bridges	Lump Sum	7,200,000
Contingency 25%		4,709,500
		$23,549,000

SEGMENT B-2

Excavation	735,000 c.y. @ $4.75	$ 3,491,250
Drainage	7,600 L.F. @ $50.00	380,000
Base	64,500 c.y. @ $12.00	774,000
Surfacing	195,000 s.y. @ $25.00	4,875,000
Guard Rail	10,000 L.F. @ $30.00	300,000
Contingency 25%		2,454,750
		$12,275,000

SEGMENT B-3

Excavation	2,125,000 c.y. @ $5.10	$10,837,500
Drainage	23,520 L.F. @ $50.00	1,176,000
Base	208,000 c.y. @ $12.00	2,496,000
Surfacing	622,000 s.y. @ $25.00	15,550,000
Guard Rail	15,000 L.F. @ $30.00	450,000
Bridges	Lump Sum	8,500,000
Contingency 25%		9,752,500
		$48,762,000

SEGMENT C

Excavation	2,125,000 c.y. @ $5.10	$10,837,500
Drainage	20,000 L.F. @ $50.00	1,000,000
Base	230,000 c.y. @ $12.00	2,760,000
Surfacing	687,000 s.y. @ $25.00	17,175,000
Guard Rail	20,000 L.F. @ $30.00	600,000
Contingency 25%		8,093,500
		$40,466,000

SEGMENT R-1

Excavation	500,000 c.y. @ $4.75	$ 2,375,000
Drainage	8,100 L.F. @ $60.00	486,000
Ballast & Rails	85,000 L.F. @ $100	8,500,000
Contingency 25%		2,850,000
		$14,211,000

SEGMENT R-2

Excavation	1,125,000 c.y. @ $5.80	$ 6,525,000
Drainage	21,000 L.F. @ $60.00	1,260,000
Ballast & Rails	198,000 L.F. @ $100.00	19,800,000
Bridges	Lump Sum	10,000,000
Contingency 25%		9,400,000
		$46,985,000

1. Plan 1

This plan utilizes roadway from the Park Highway to Watana Dam via Alternate A along the North side of the River. Materials such as cement and steel should enter the State through Whittier on rail cars. Food and other camp supplies through Anchorage via container. Fuel should come from Kenai to Anchorage via existing pipeline. All materials and supplies would be carried by rail to a rail head at Huricane. At Huricane materials would be transfered to trucks for transport to the site. An alternate for fuel could be rail haul from the refinery at North Pole, Alaska.

Construction Costs	$ 83,019,000
Logistic Costs	79,219,781
Maintenance	8,200,000
	$170,438,781

2. Plan 2

This plan utilizes roadway from the Parks Highway to Watana Dam via Alternate B along the South side of the River. Material handling would be the same as for Plan 1.

Construction Costs	$ 84,586,000
Logistic Costs	77,747,656
Maintenance	7,330,000
	$169,663,656

3. Plan 3 - All Rail

This plan would serve both damsites total by a rail line. See Alternate R. This alternate would preclude public access. Trains would be broken and cars dropped on the siding at Gold Creek. An engine and train crew would be stationed at Gold Creek. This crew would shuttle cars from Gold Creek to the project site daily. Passenger service would be required from a large parking area at Hurricane daily. If public access is desired after construction the rails could be removed and the road bed graded into a one lane road with turnouts. Costs shown below do not include the passenger movement requirements as that could be a break even fare arrangement.

Construction Costs	$ 61,196,000
Logistic Costs	47,831,424
Maintenance	3,020,000
	$112,047,424

4. Plan 4

This plan uses a combination of rail and truck. Construction of Watana Dam would be served from a rail head at Cantwell by truck across the Denali highway and along Alternate C. Construction of Devils Canyon dam would be served by truck from a rail head at Hurricane. This plan does not include a connection between the two dams.

Construction Costs	$ 76,290,000
Logistic Costs	88,143,998
Maintenance	7,494,000
	$171,927,998

5. Plan 5

This plan serves Watana by truck from a rail head at Cantwell and Devils Canyon by rail from Gold Creek. In the plan there is no connection between dams.

Construction Costs	$ 54,667,000
Logistic Costs	63,837,470
Maintenance	6,384,000
	$124,898,470

6. Plan 6

This plan serves both dams by truck from a rail head at Hurricane. The south side of the river is used to Devils Canyon with a major bridge downstream from the damsite, then following Alternate A to Watana. This seems to have the least objectionable environmental concerns.

Construction Costs	$ 87,387,000
Logistic Costs	77,747,656
Maintenance	6,910,000
	$172,044,656

7. Plan 7

This plan is identical to Plan 5 except that a service road for maintenance purpose is included along Segment A-2.

Construction Costs	$ 74,458,500
Logistic Costs	63,837,470
Maintenance	7,784,000
	$146,079,970

8. Plan 8

This plan is the same as Plan 4 except that a service road would be provided along Segment A-2 as in Plan 7.

Construction Costs	$ 96,071,500
Logistic Costs	88,143,998
Maintenance	8,894,000
	$193,109,498

I. ANALYSIS

It is a given that Watana dam will be constructed first. This can be justified for economic reasons in that Watana is the more costly structure. Therefore early construction will minimize the effects of inflation on the total project.

Plans 1 through 3 and Plan 6 require construction of the total access facility before significant work can be done on the dam. These plans would take 2 to 3 seasons to construct due to length bridges, and the difficulty in leap-frogging construction crews due to the problems of resupplying the forward crews. Considering an estimated project cost of 2 billion dollars and an inflation rate of 10% per year, a two year delay in starting construction of the dams could increase project costs by as much 400 million dollars, this exceeds the highest cost access plan by a factor of 2.

Plans 4, 5, 7 & 8 all serve Watana from the north. The 39-mile segment from Denali Highway to Watana dam could be made serviceable in one construction season thereby allowing work to progress on Watana while the remaining segments of the access plan are being constructed.

Plans 4 & 5 do not provide for access between dams. Providing access between the dams has a significant advantage for the maintenance and operation of the total complex. Without the connection crews would have to be stationed at both sites or face a 150-mile one way trip to go from one site to the other. With the connection this becomes a 35-mile trip and would allow one crew to maintain and operate both dams.

Plans 7 & 8 include a secondary service road between the two dams and allow the earlier construction. Plan 7 uses rail from Gold Creek to Devils Canyon and is the lower cost plan.

Plan 7	$146,079,970
Plan 8	$193,109,498

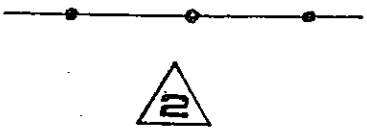
J. RECOMMENDED PLAN

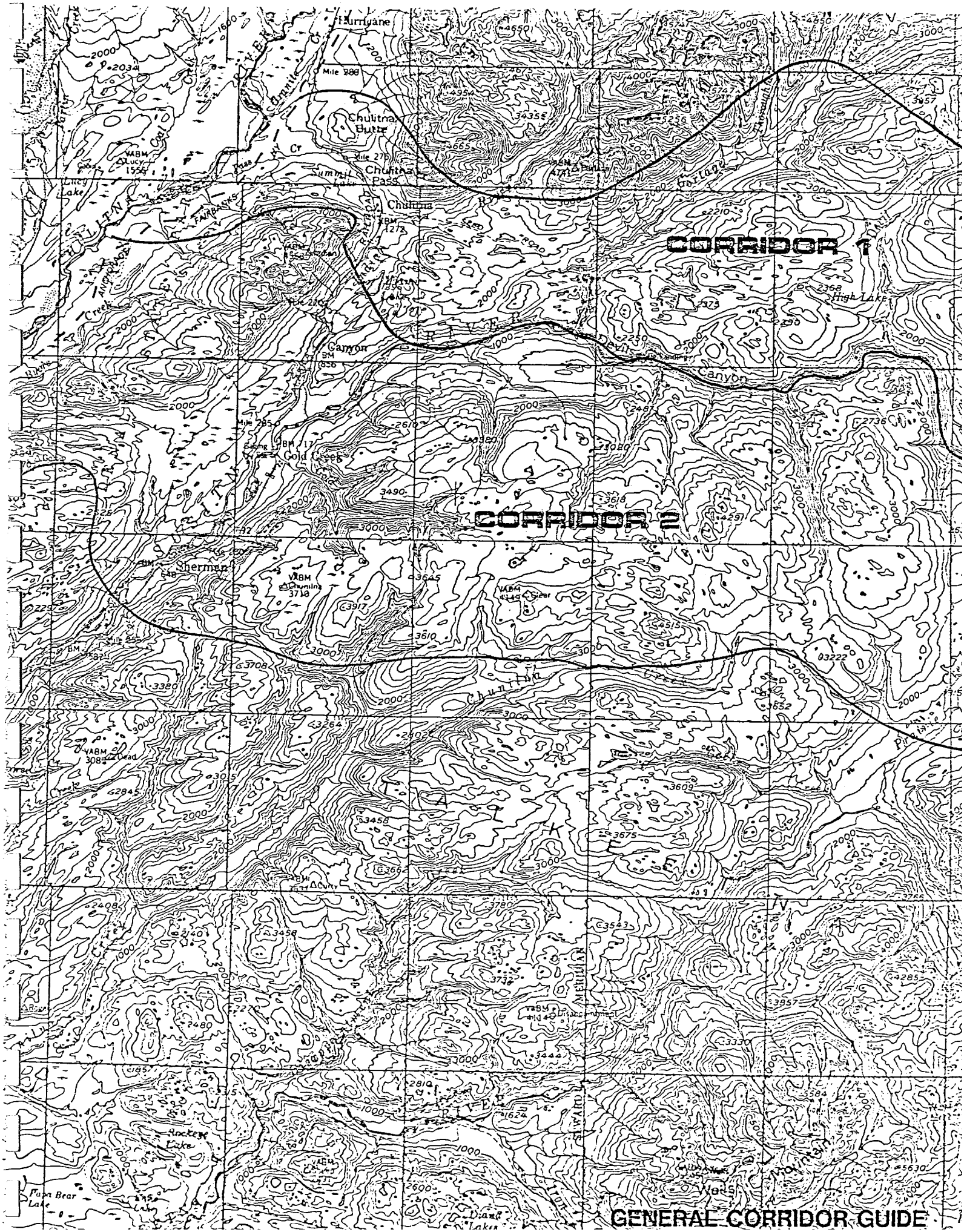
It is recommended that access Plan 7 be accepted as the most cost effective access plan that serves all primary project requirements.

APPENDIX A

PROPOSED CORRIDORS

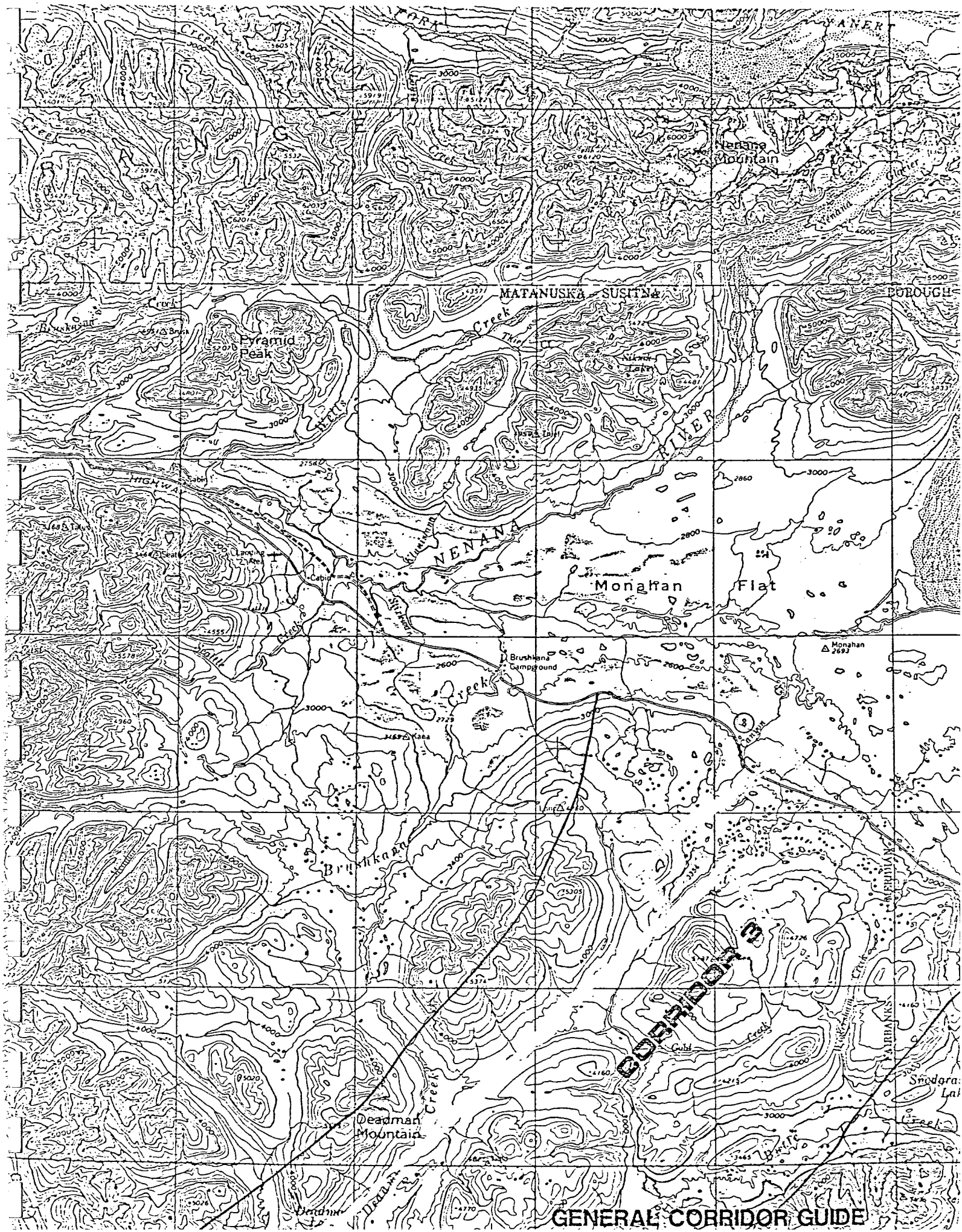
INDEX





GENERAL CORRIDOR GUIDE

GENERAL CORRIDOR GUIDE



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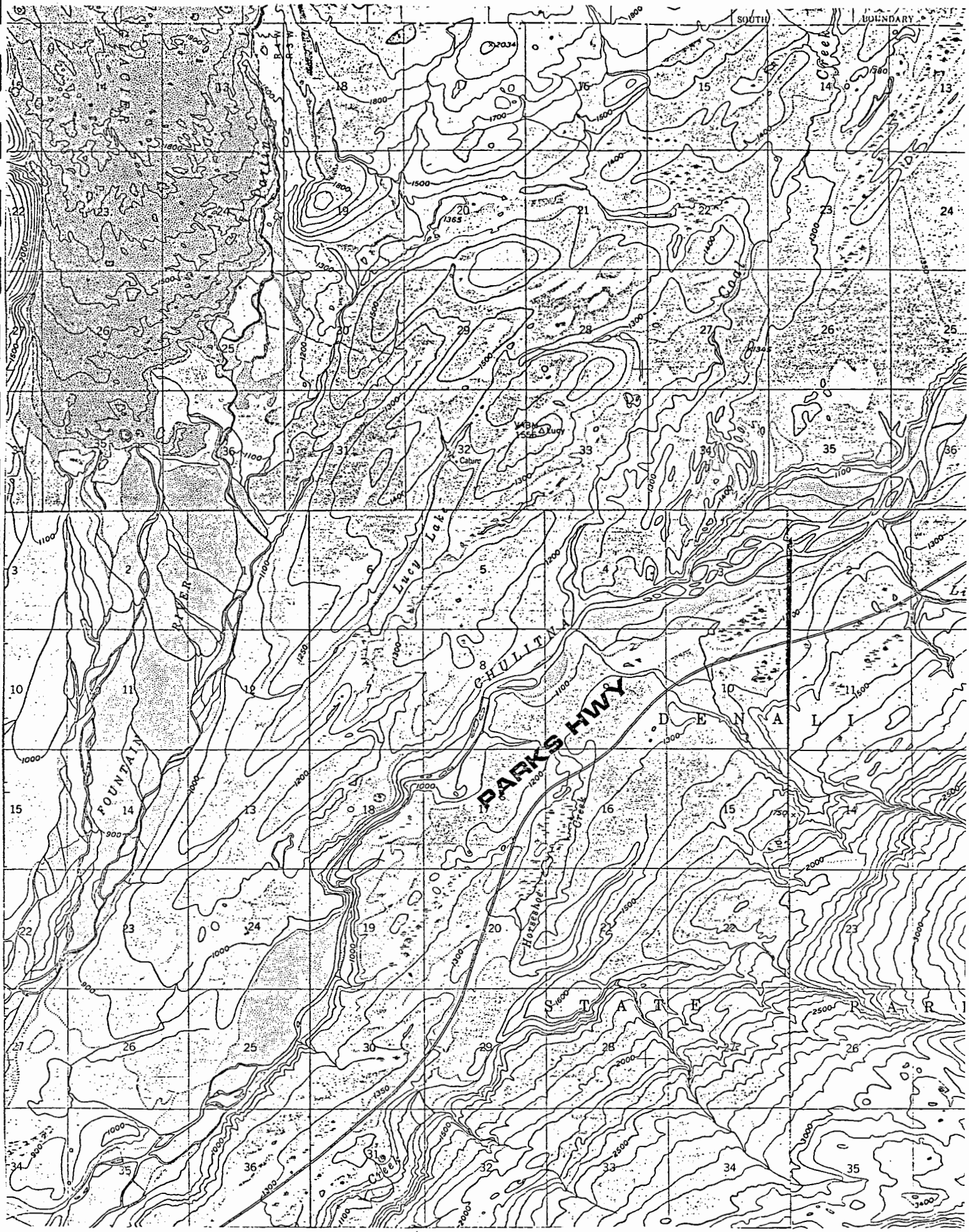

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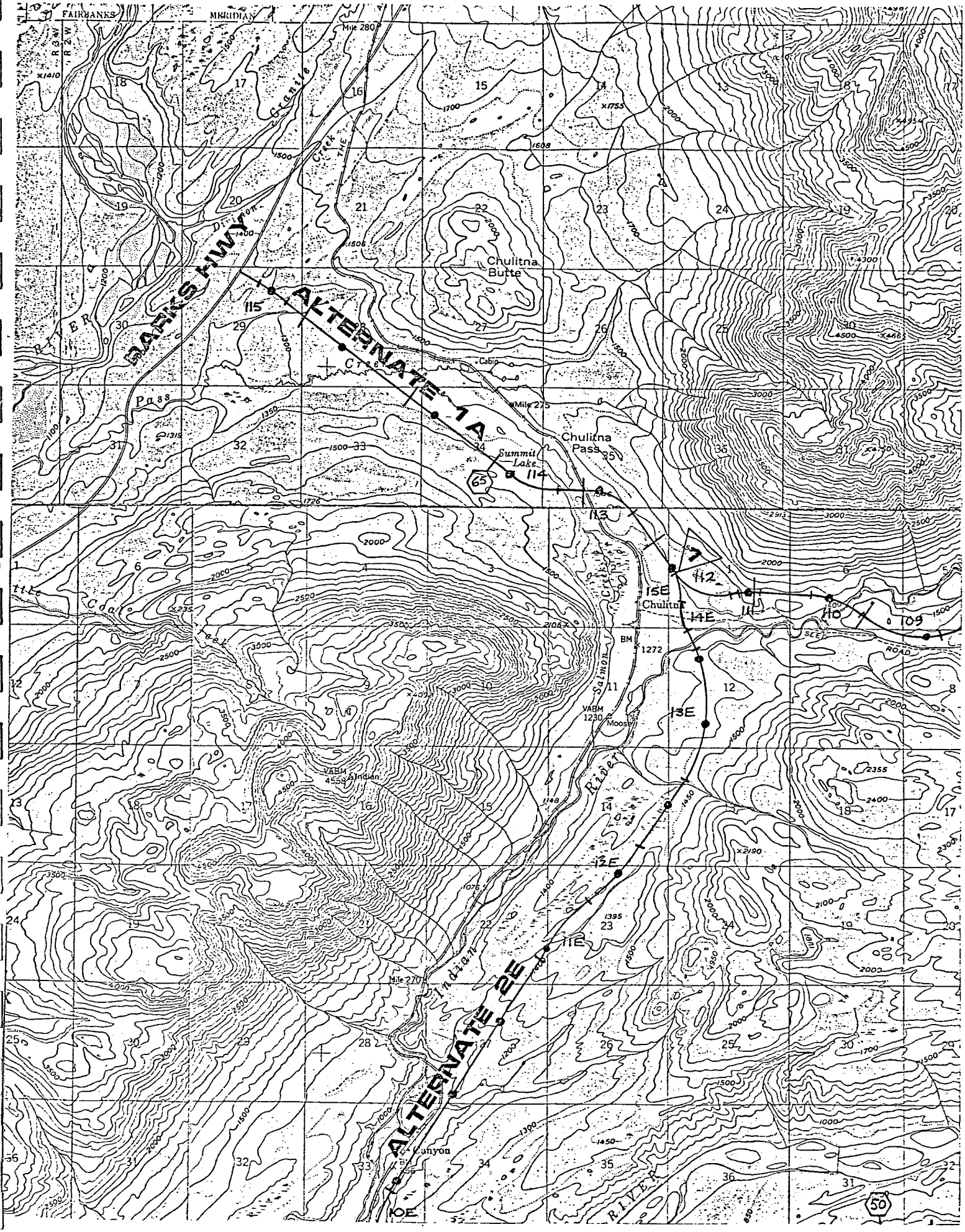
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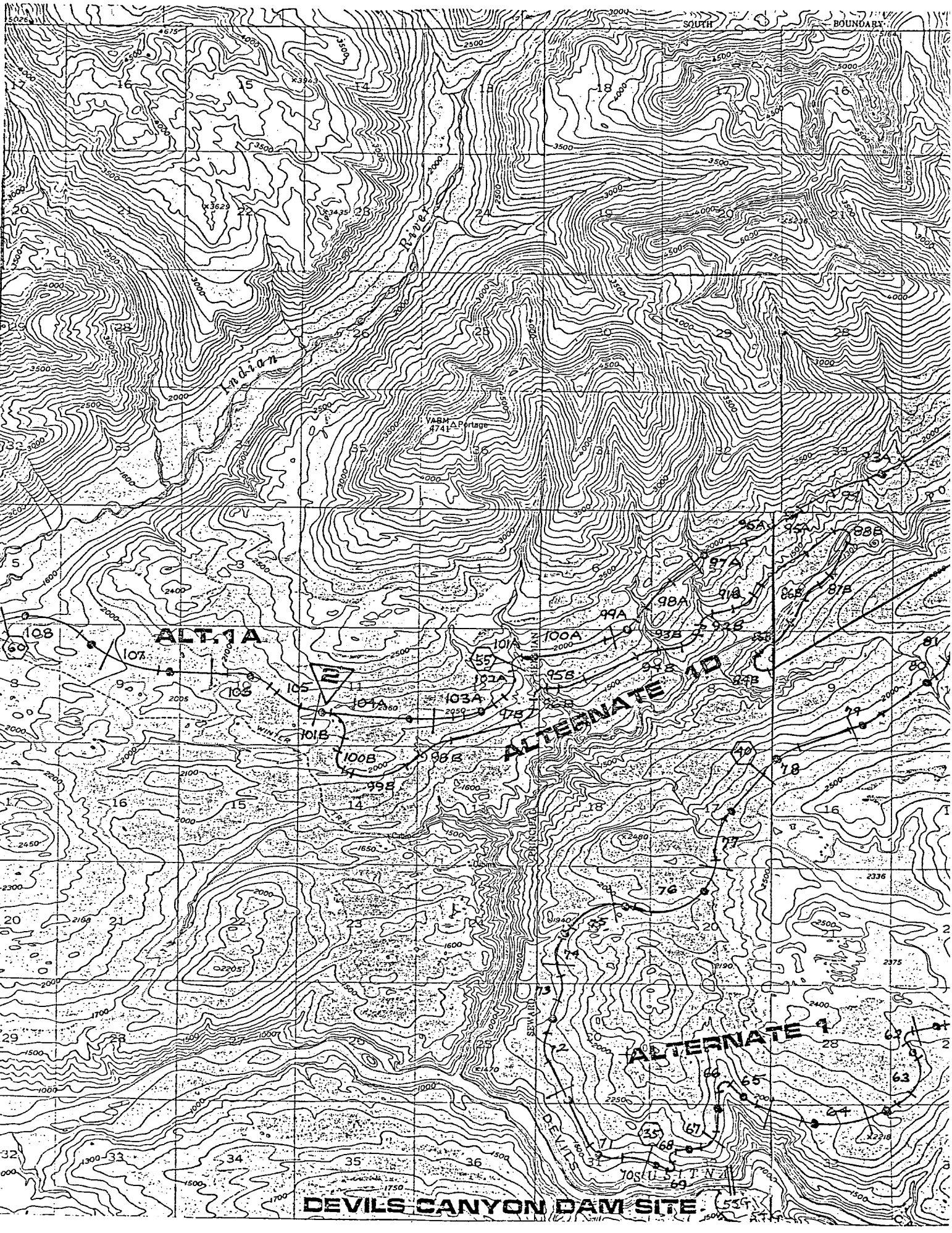
R 3 W
R 2 W
Mile 280
Granite Creek
THE
DENALI HWY
ALTERNATE 1A
Chulitna Butte
Cabin
Mile 275
Chulitna Pass
Summit Lake
114
115
65
113
112
111
110
109
15E
14E
13E
12E
11E
10E
Chulitna
Salmon
VABM 1230
Moose
VABM 4658
Indian
Mile 270
ALTERNATE 2E
Canyon
RIVER
SLED ROAD
50


ALT. 1A
ALTERNATE 1D
ALTERNATE 1
DEVILS CANYON DAM SITE
Indian River
SOUTH BOUNDARY
Portage
Cabin
TRAIL
SEWARD PENINSULA
DEVILS
JOSEPHINE
108
107
106
105
104A
103A
102A
101A
101B
100B
99B
98B
97B
96B
95B
88B
87B
100A
99A
98A
97A
96A
95A
93B
91B
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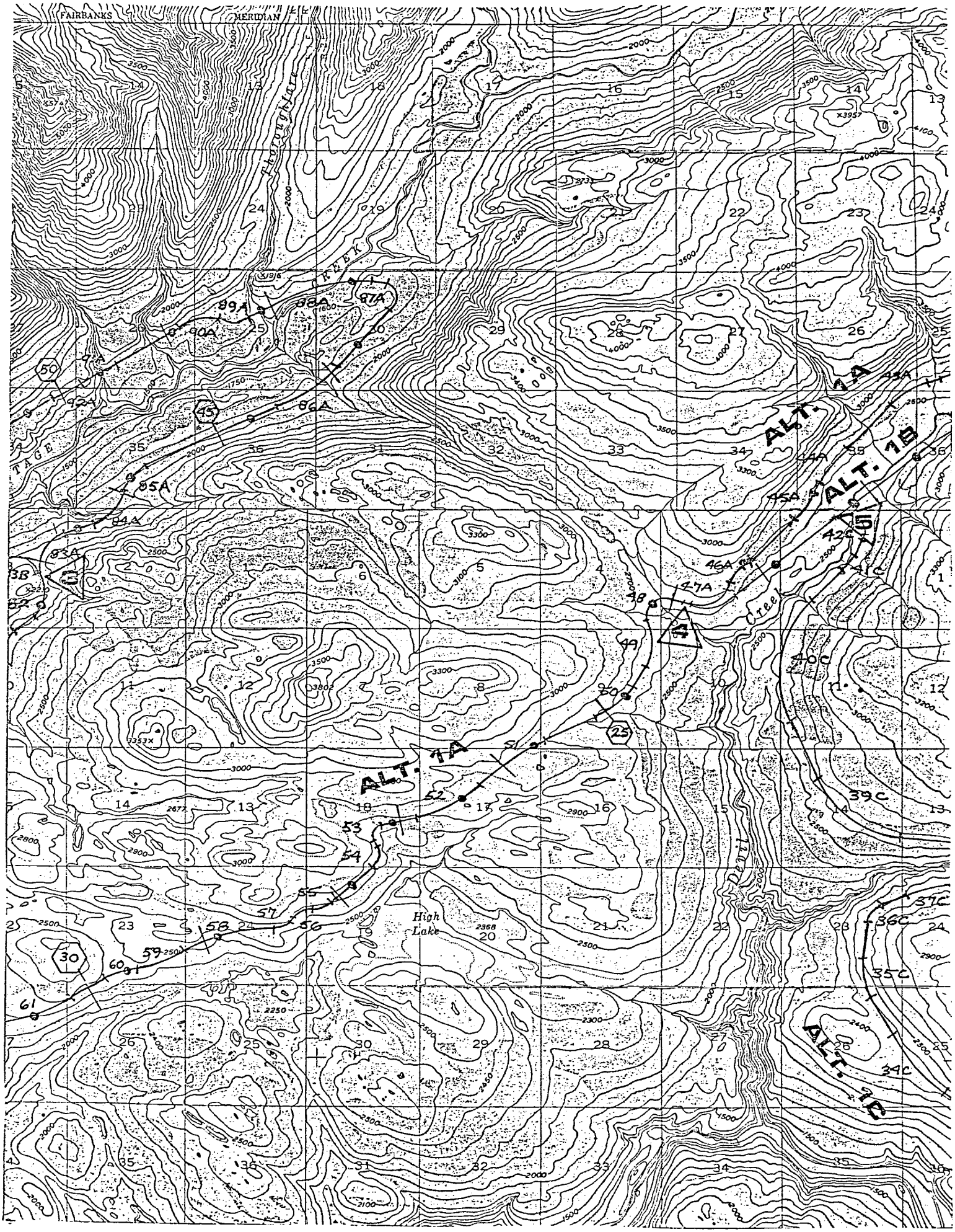
FAIRBANKS MERIDIAN
Thorofare Creek
ALT. 1A
ALT. 1B
ALT. 1C
ALT. 1D
Tree
Devil
High Lake
89A
88A
87A
90A
86A
85A
84A
83A
46A
47A
49
52
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36C
35C
34C
50
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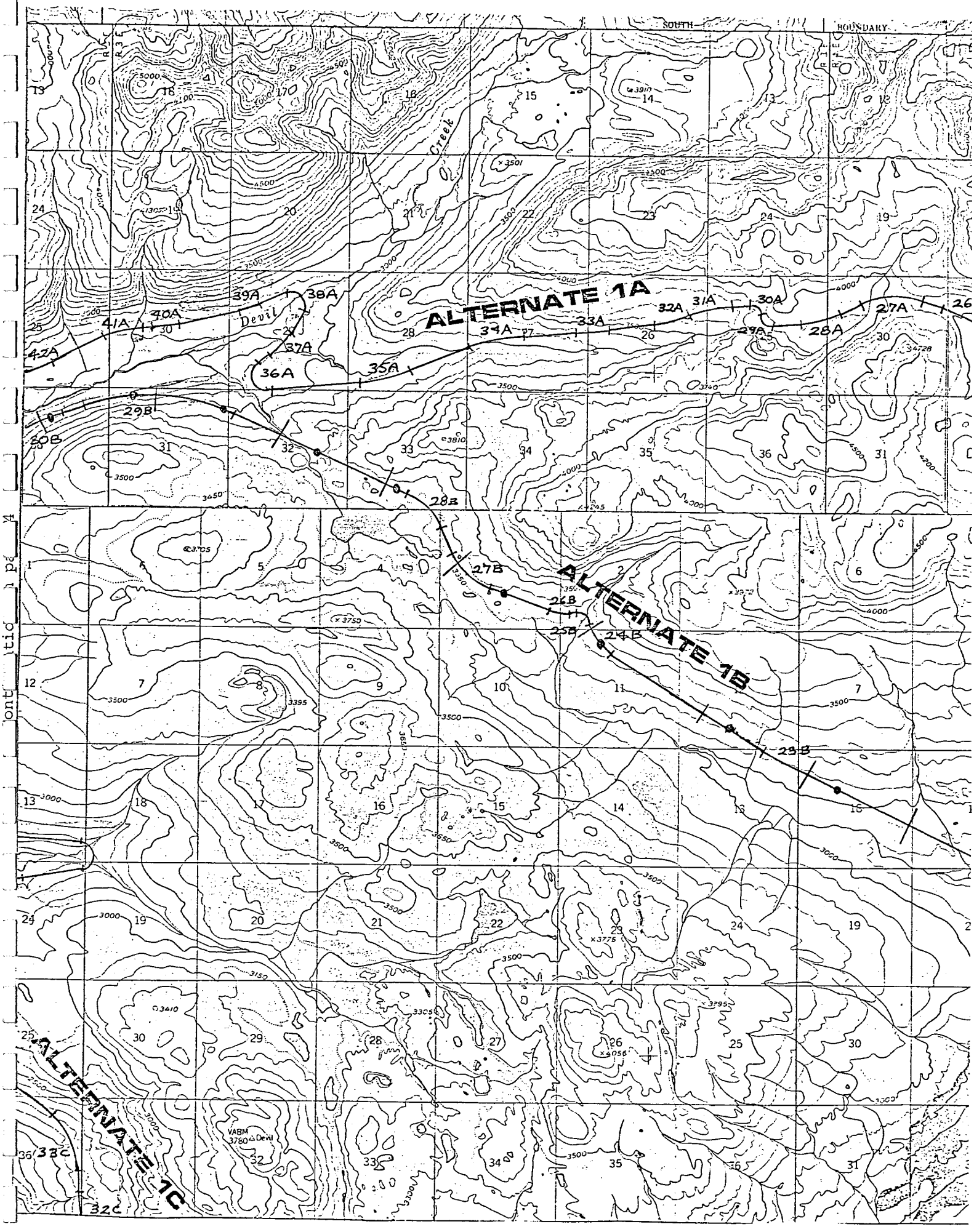
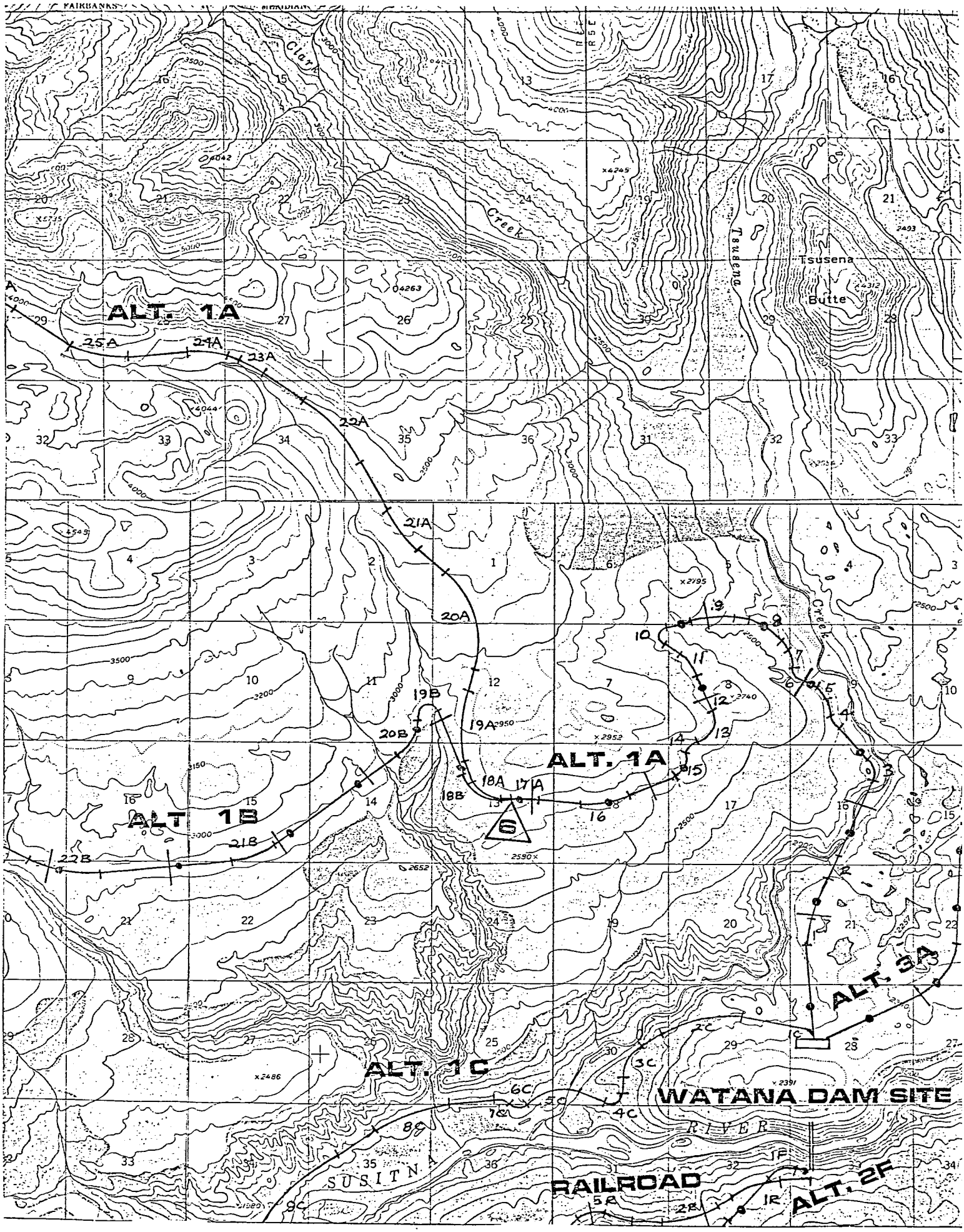
30
25
5
4


ALTERNATE 1A
ALTERNATE 1B
ALTERNATE 1C
Devil
Creek
SOUTH
BOUNDARY
VABM
3780 Devil


ALT. 1A
25A
24A
23A
22A
21A
20A
19B
19A
18A
17A
ALT. 1A
ALT 1B
22B
21B
20B
18B
6
ALT. 1C
ALT. 3A
WATANA DAM SITE
RIVER
SUSITNA
RAILROAD
ALT. 2F
Tsusena
Butte
Creek
Tsusena Creek

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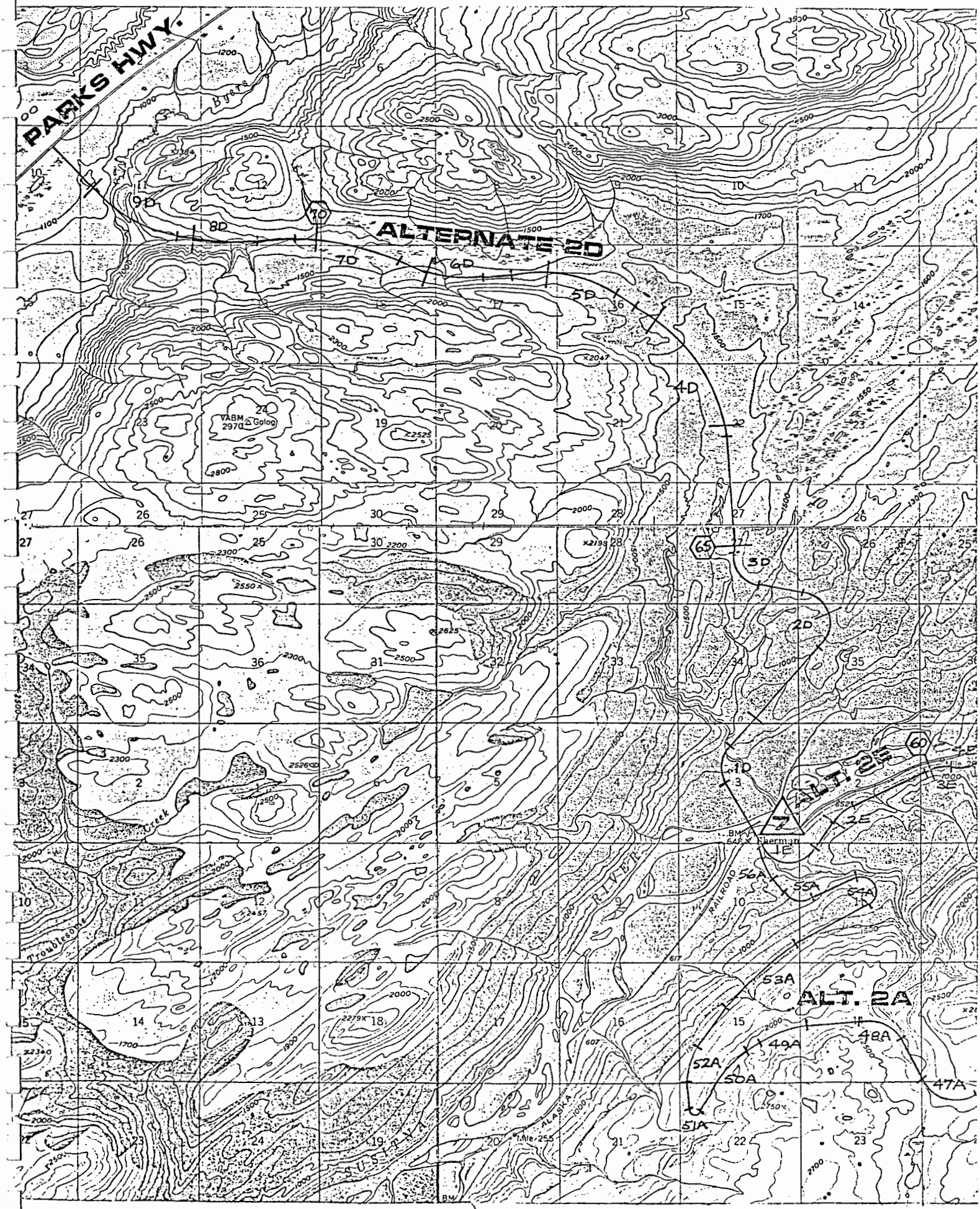

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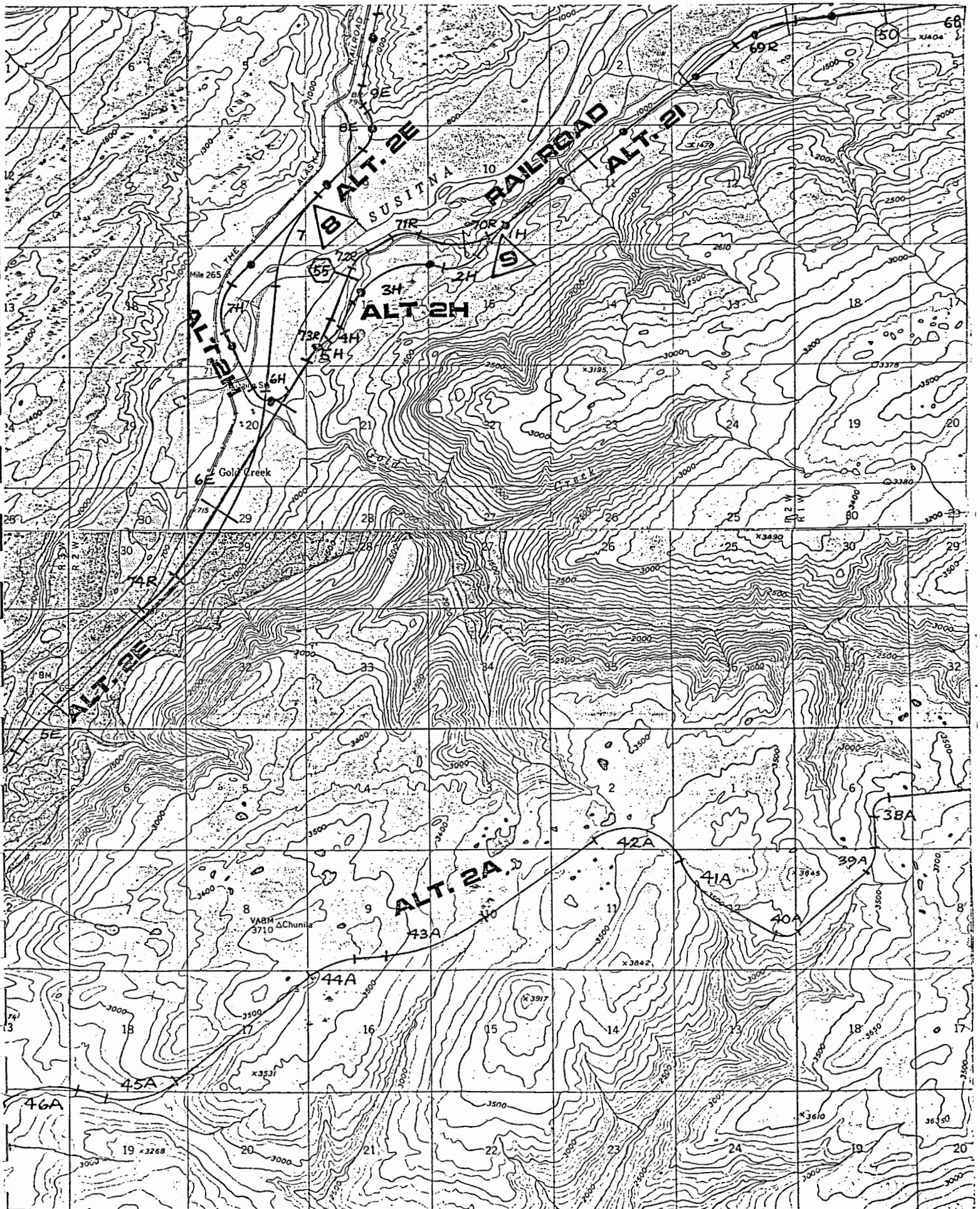

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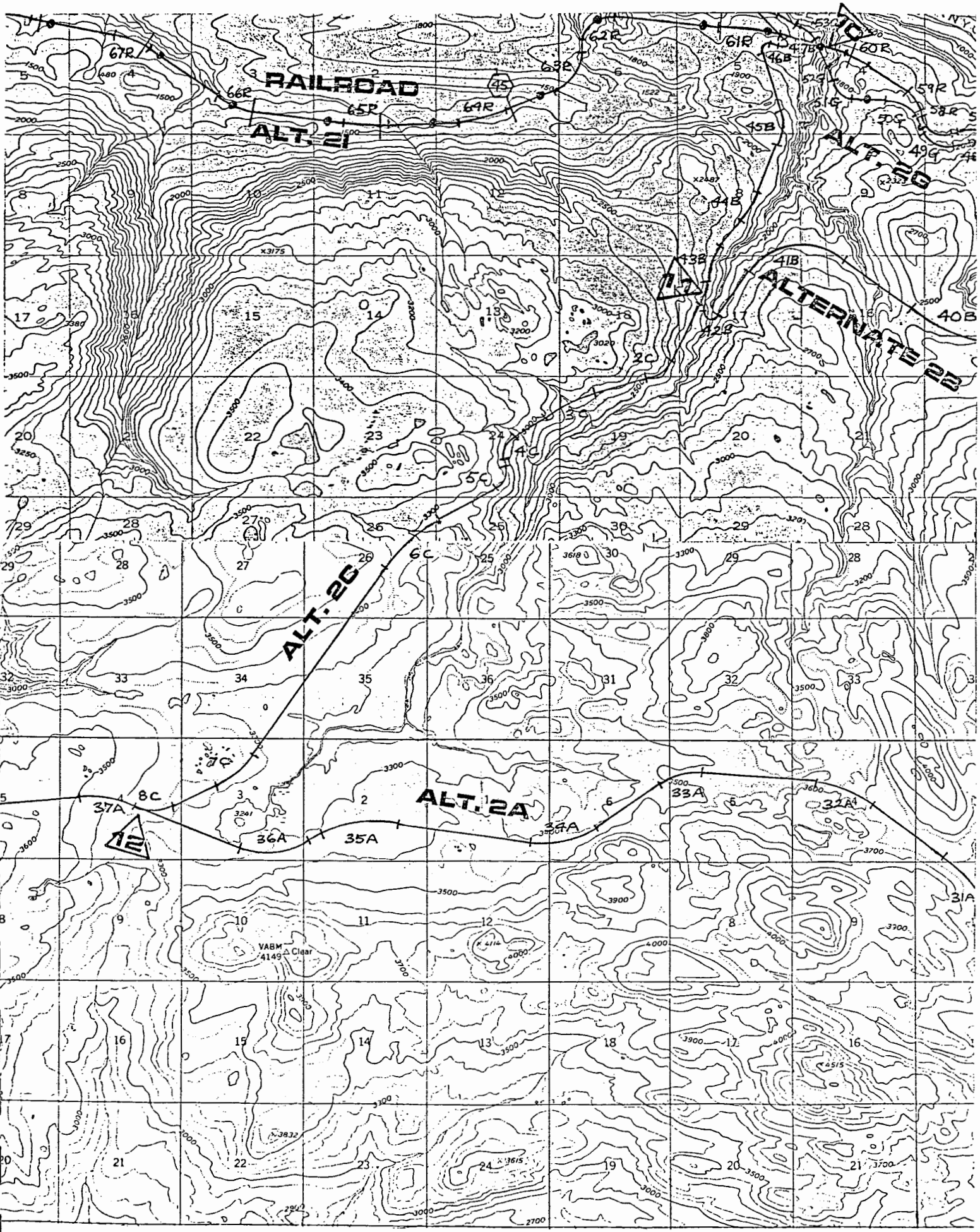

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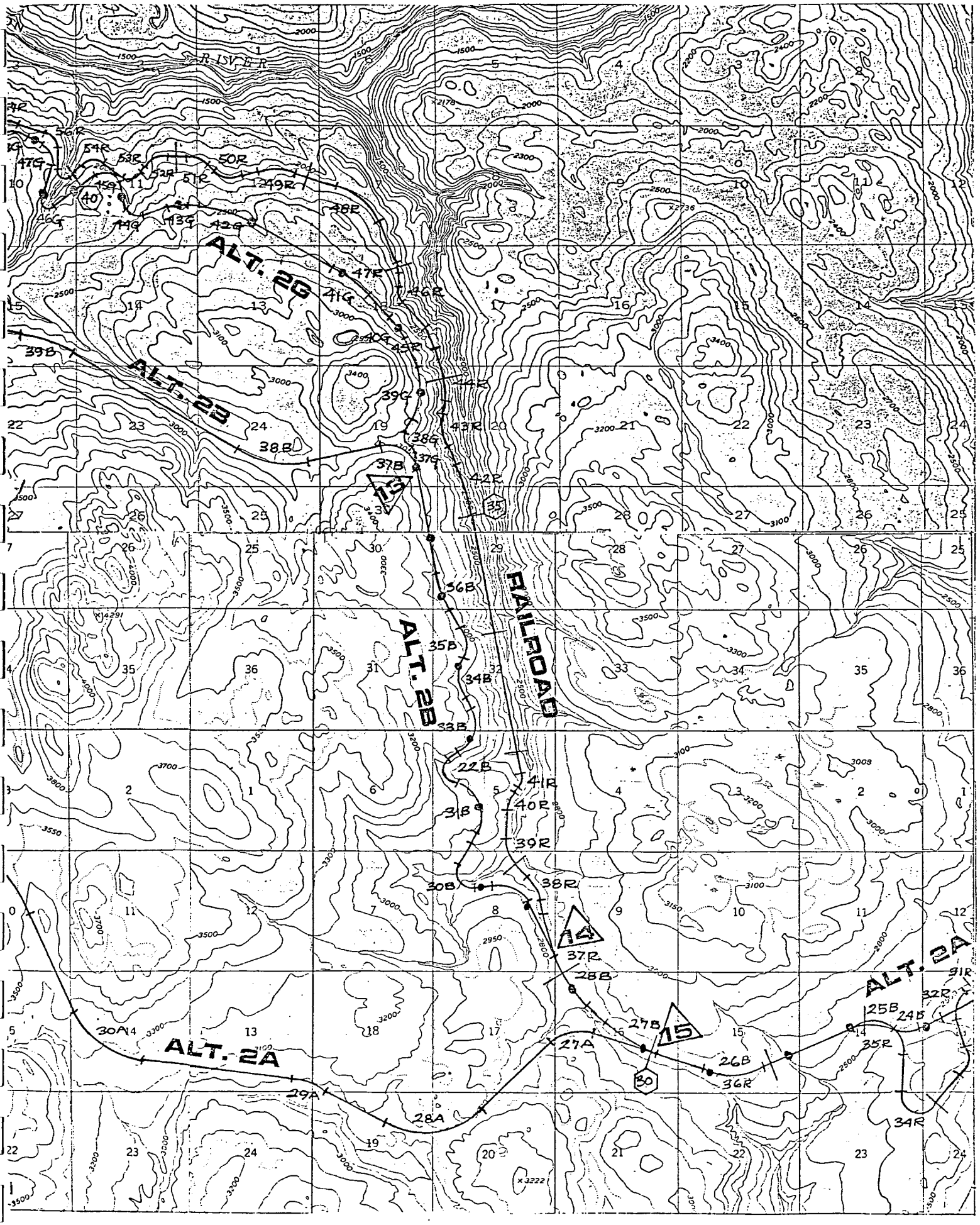

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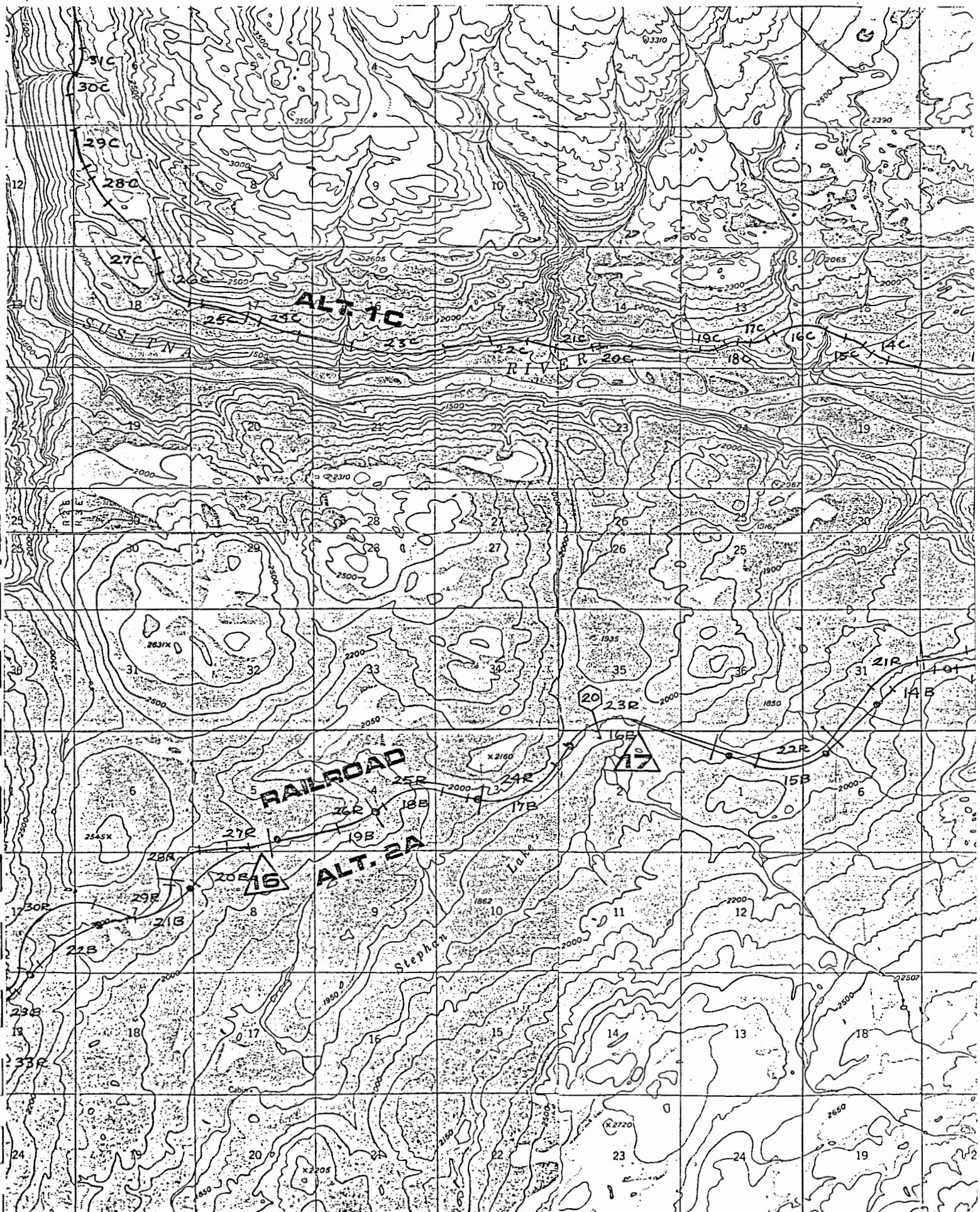

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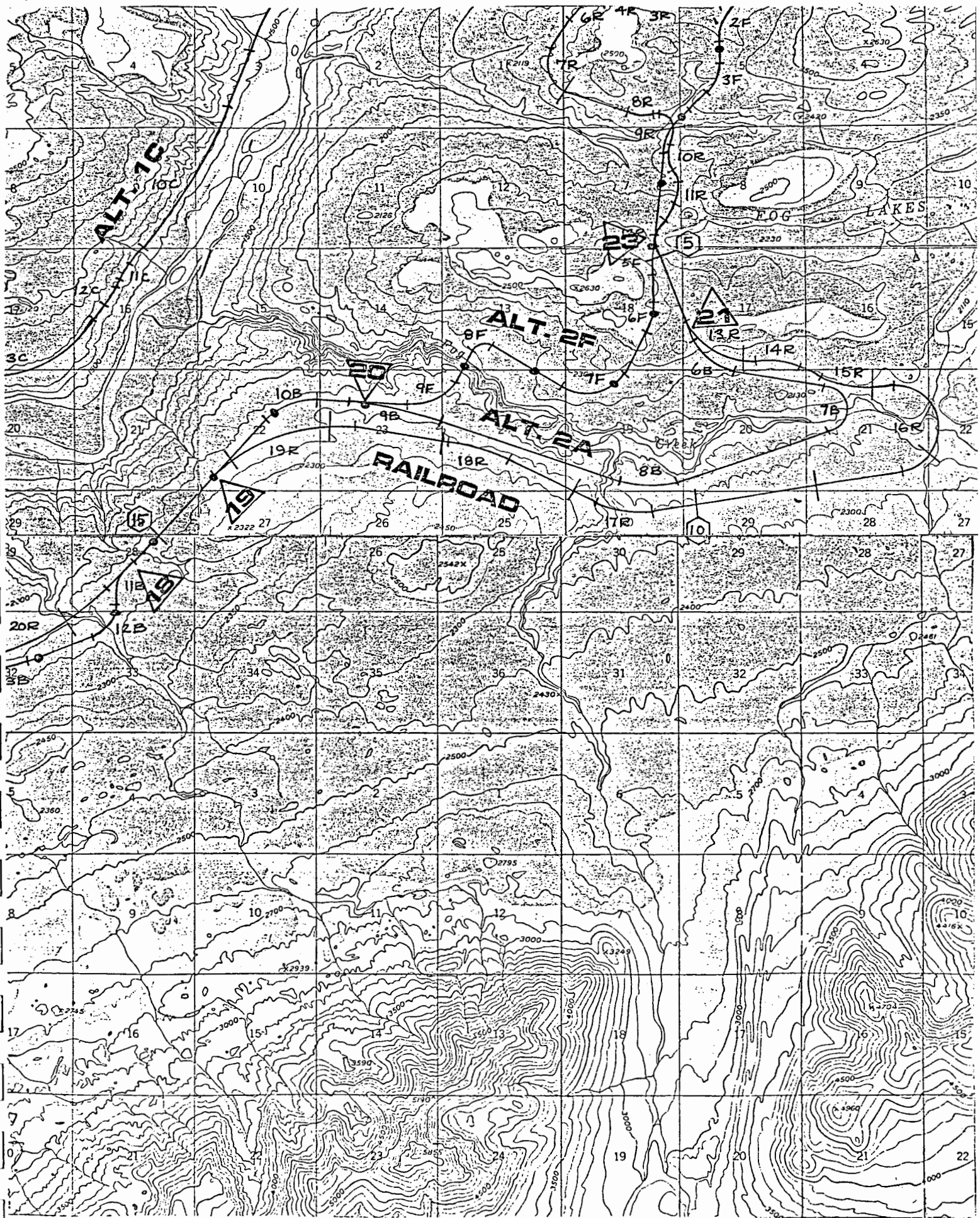

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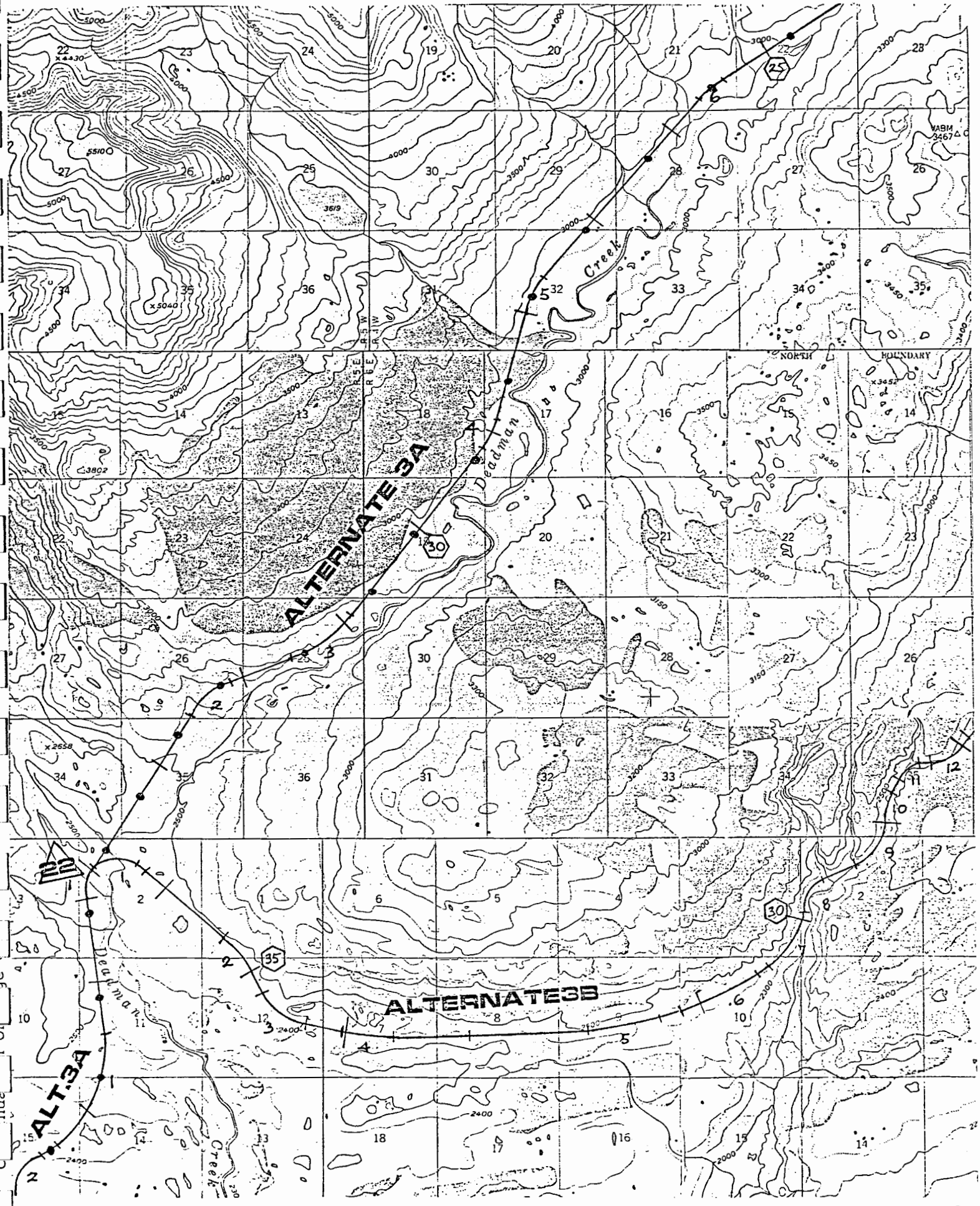

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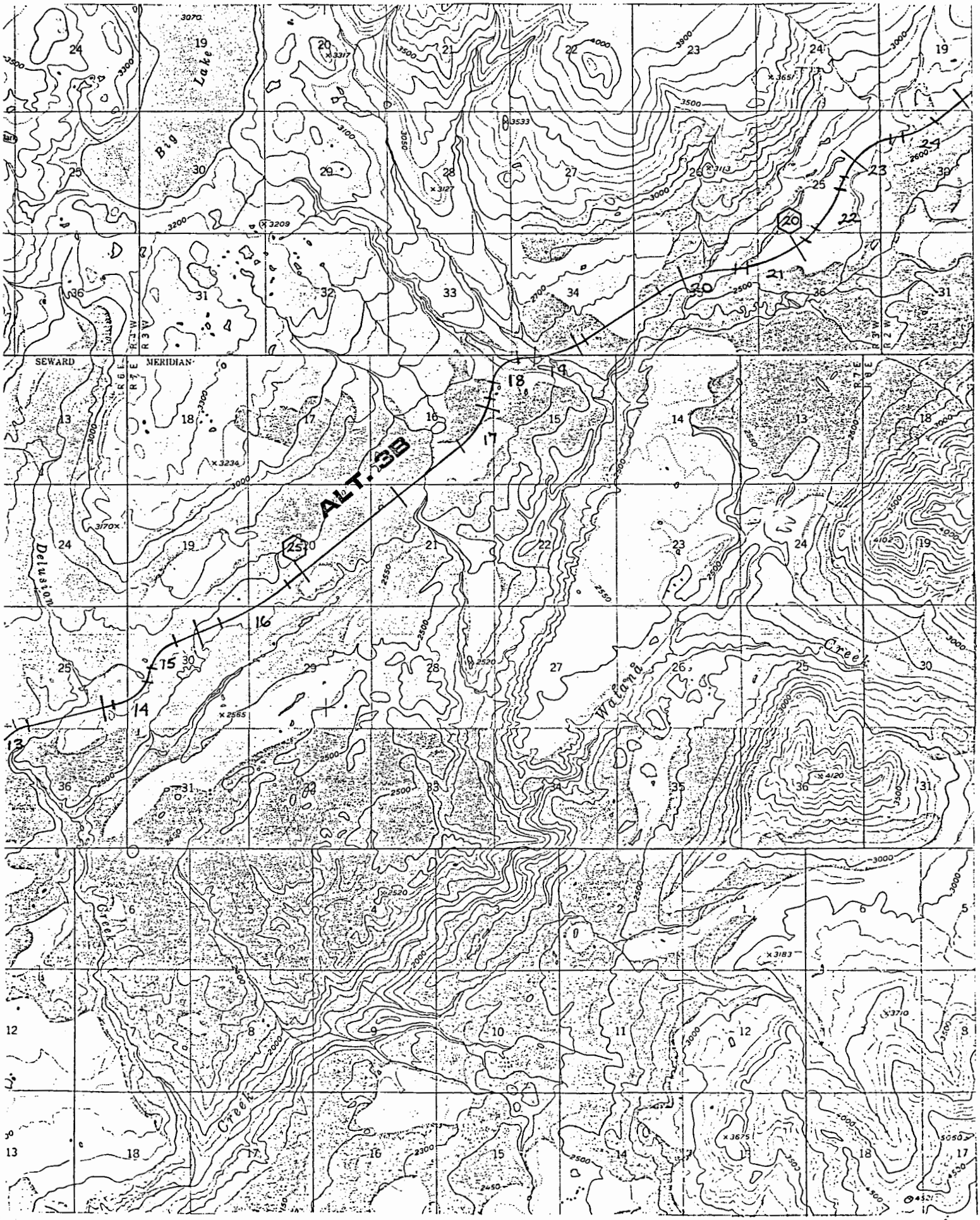

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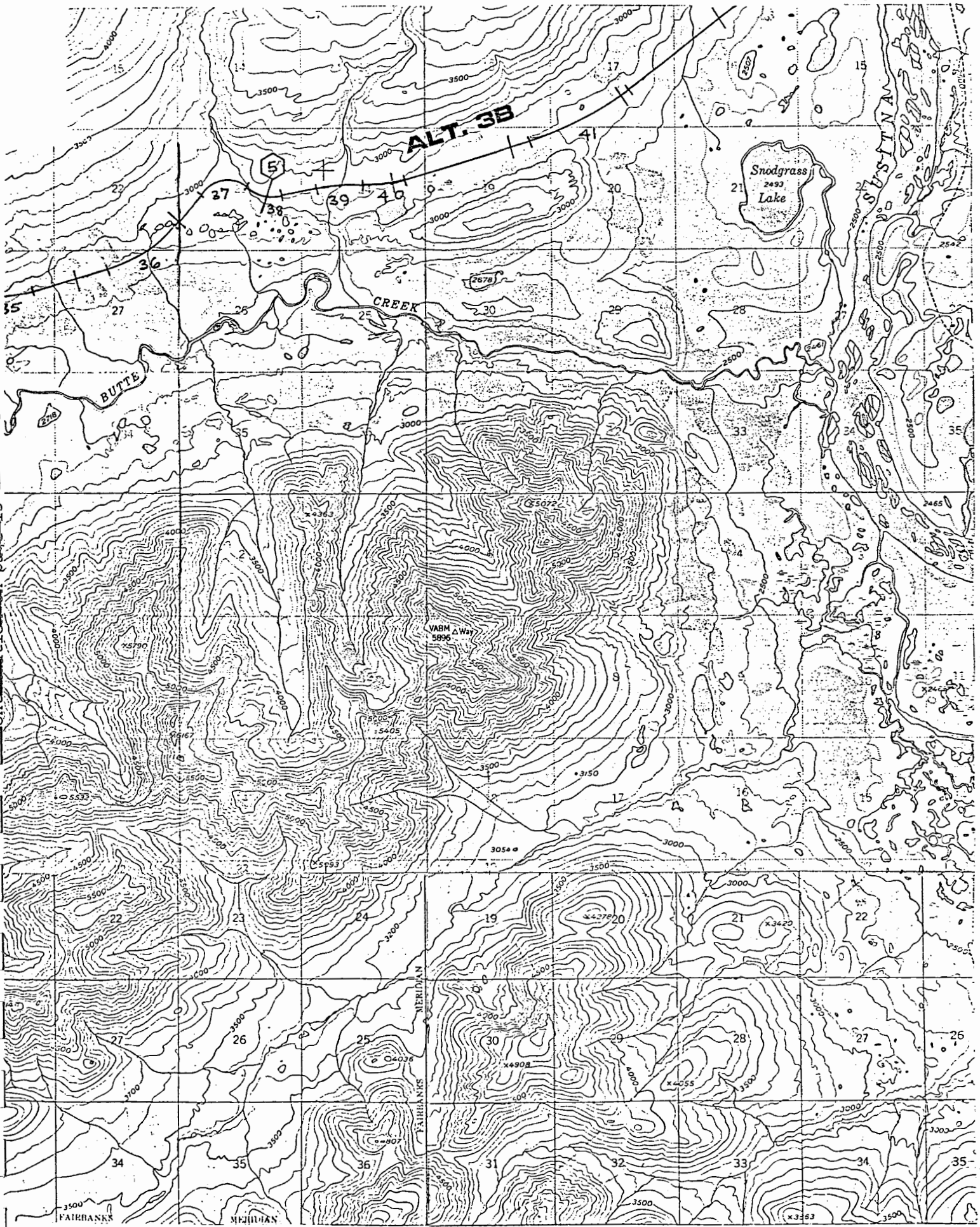

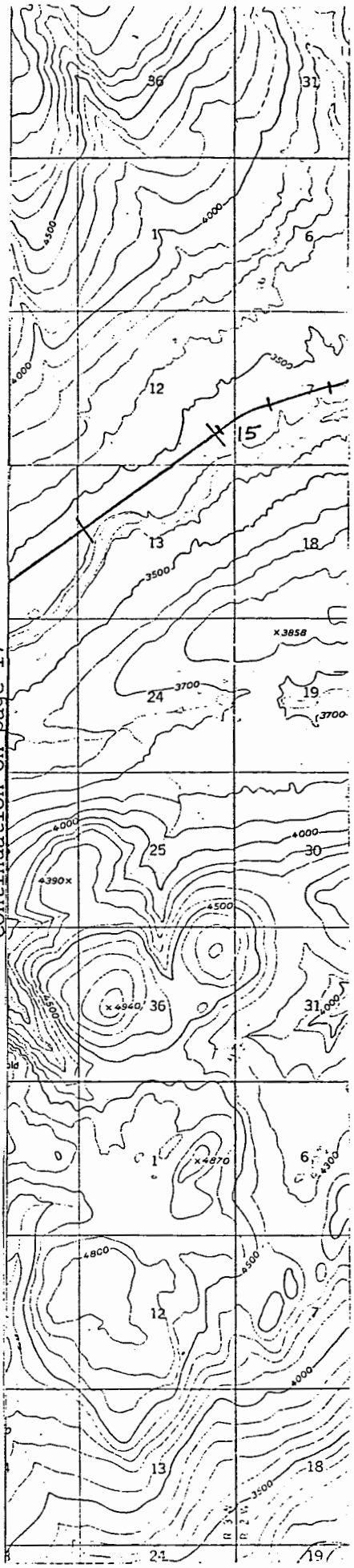

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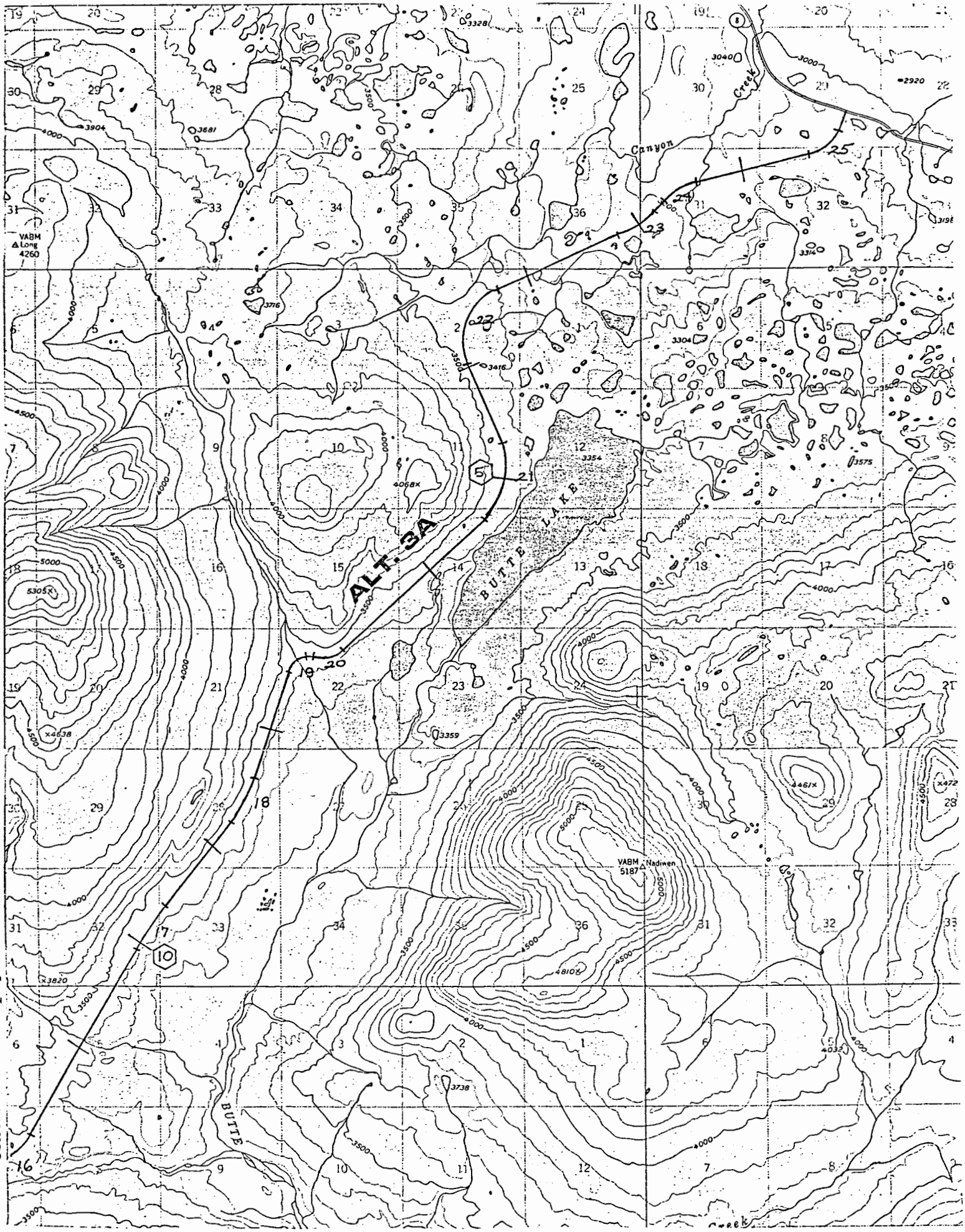

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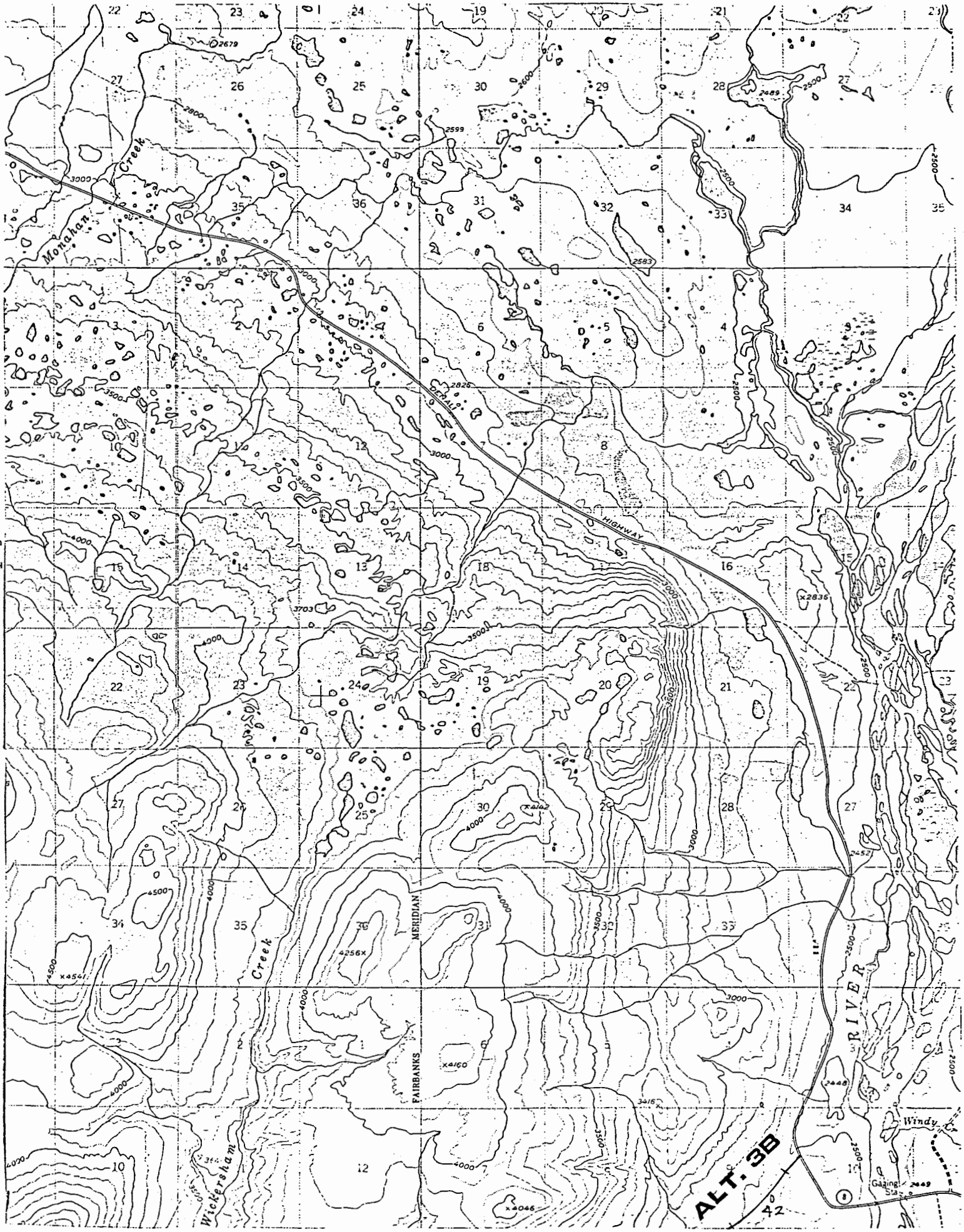

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APPENDIX B

ALTERNATIVE COMPARISON

	Distance (Miles)	Average Grade %	Sum of Deflections
Alternative 1-A	68.6 Miles	2.51%	492° 34.15'
Alternative 1-B	16.95 Miles	1.91%	57° 09.92'
Alternative 1-C	27.28 Miles	2.10%	163° 36.76'
Alternative 1-D	8.77 Miles	4.19%	125° 57.41'
Alternative 2-A	56.6 Miles	2.72%	154° 29.53'
Alternative 2-B	11.91 Miles	3.32%	79° 07.83'
Alternative 2-C	6.04 Miles	5.08%	26° 15.78'
Alternative 2-D	10.55 Miles	3.32%	16° 47.84'
Alternative 2-E	15.73 Miles	2.09%	35° 15.94'
Alternative 2-F	4.74 Miles	2.09%	22° 15.88'
Alternative 2-G	8.17 Miles	4.49%	152° 30.42'
Alternative 2-H	7.64 Miles	1.91%	24° 00.90'
Alternative 2-I	12.13 Miles	1.13%	18° 30.53'
Alternative 3-A	39.09 Miles	1.26%	59° 15.72'
Alternative 3-B	41.98 Miles	1.15%	93° 9.49'
Railroad (2R)	58.0 Miles	1.48%	299° 58.86'
Alternative 1-A - Curve 17 Three 41A	20.67 Miles	2.43%	89° 27'
Alternative 1-A - Curve 1 Three 41A	27.80 Miles	2.48%	111° 41.81'
Alttenative 1-A - Curve 63 To Hwy.	30.18 Miles	2.64%	155°9.85'

North of Susitna River Access Roads (Corridors 1 and 3)

	Distance (Miles)	Average Grade	Defl. Mile	Sum of Deflections
1. Alternative 1-A - Wastana Camp to Parks Hwy.	68.6 Mi.	2.51%	7° 10.82'	492° 34.15'
2. Alternative 1-A, 1-B - Watana Camp to Parks Hwy.	64.8 Mi.	2.37%	7° 05.66'	460° 17.07'
3. Alternative 1-A, 1-C - Watana Camp to Parks Hwy.	68.08 Mi.	2.35%	7° 59.86'	544° 29.10'
4. Alternative 1-A, 1-D Base Camp to Anch/Fbk. Hwy.	64.27 Mi.	2.70%	8° 29.59'	545° 51.13'
5. Alternative 1-A, 1-B, 1-D Watana Camp to Parks Hwy.	60.55 Mi.	2.58%	8° 28.90'	513° 34.04'
6. Alternative 1-A, 1-C, 1-D Watana Camp to Parks Hwy.	63.75 Mi.	2.54%	9° 22.61'	597° 46.07'
7. Alternative 1-A, 3-A - Devils Canyon to Denali Hwy.	77.50 Mi.	1.83%	5° 07.09'	396° 39.52'
8. Alternative 1-A, 1-B, 3-A - Devils Canyon to Denali	73.79 Mi.	1.67%	4° 56.29'	364° 22.94'
9. Alternative 1-A, 1-C, 3-A - Devils Canyon to Denali Hwy.	76.98 Mi.	2.22%	5° 49.63'	448° 34.47'
10. Alternative 3-A - Watana Camp to Denali Hwy.	39.09 Mi.	1.26%	1° 30.96'	59° 15.72'
11. Alternative 3-B - Watana Camp to Denali Hwy.	41.98 Mi.	1.15%	2° 13.15'	93° 09.49'
12. Alternative 1-A, 3-B - Devils Canyon to Denali Hwy.	80.39 Mi.	1.73%	5° 21.36'	430° 33.79'
13. Alternative 1-A, 1-B, 3-B - Devils Canyon to Denali Hwy.	76.68 Mi.	1.58%	5° 11.64'	398° 16.71'
14. Alternative 1-A, 1-C, 3-B - Devils Canyon to Denali Hwy.	79.86 Mi.	1.59%	6° 02.49'	482° 28.74'

South of Susitna River (Corridor 2)

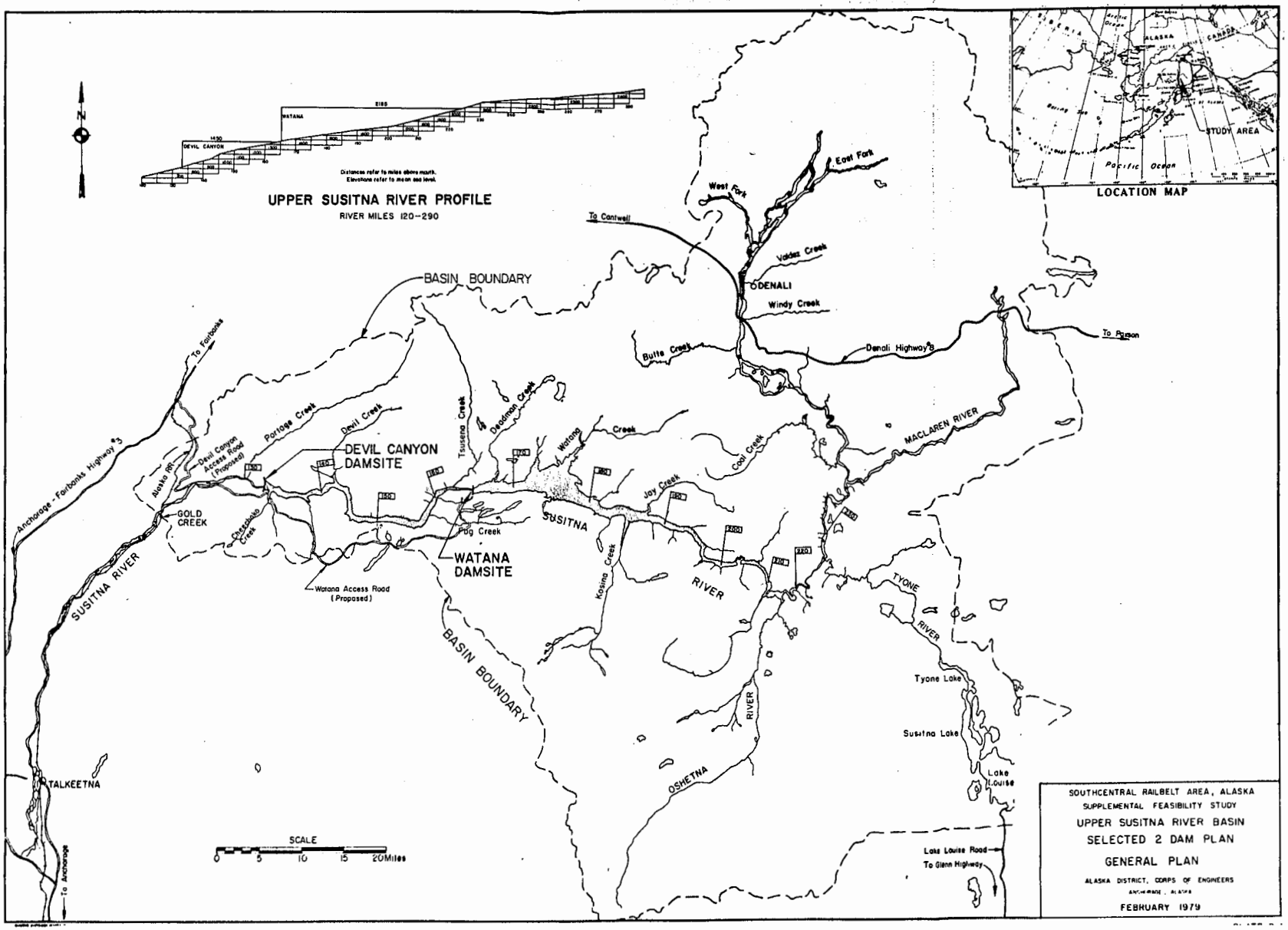
		Distance (Miles)	Average Grade	Defl. Mile	Sum of Deflections
15.	Alternative 2-A - Watana To Sherman	56.6 Mi.	2.72%	2° 43.77'	154° 29.53'
16.	Alternative 2-A, 2-D - Watana To Parks Hwy.	67.15 Mi.	2.81%	2° 33.05'	171° 17.37'
17.	Alternative 2-A, 2-E - Watana To Parks Hwy.	76.51 Mi.	2.52%	2° 33.11'	195° 14.77'
18.	Alternative 2-A, 2-F - Watana To Sherman	54.79 Mi.	2.81%	3° 00.09'	164° 26.93'
19.	Alternative 2-A, 2-F, 2-D - Watana To Parks Hwy.	65.34 Mi.	2.89%	2° 46.43;	181° 14.77'
20.	Alternative 2-A, 2-F, 2-E - Watana To Gold Creek	74.69 Mi.	2.58%	2° 44.84'	205° 12.17'
21.	Alternative 2-A, 2-B, 2-C - Watana To Sherman	59.47 Mi.	3.26%	4° 02.91'	240° 45.96'
22.	Atlternative 2-A, 2-F, 2-B, 2-C - Watana To Sherman	57.66 Mi.	3.36%	3° 57.73'	228° 27.48'
23.	Alternative 2-A, 2-B, 2-C, 2-D - Watana To Parks Hwy.	70.02 Mi.	3.85%	3° 40.71;	257° 33.80'
24.	Alternative 2-A, 2-F, 2-B, 2-C, 2-E - Watana To Parks Hwy.	77.56 Mi.	3.00%	3° 28.26'	269° 12.72'
25.	Alternative 2-A, 2-B, 2-G, 2-H - Watana To Gold Creek	51.66 Mi.	2.38%	5° 32.25'	286° 04.2'
26.	Alternative 2-A, 2-B, 2-G, 2-H, 2-D - Watana To Parks Hwy.	68.50 Mi.	2.09%	4° 04.18'	278° 46.48'

South of Susitna River (Continued)

	Distance (Miles)	Average Grade	Defl. Mile	Sum of Deflections
27. Alternative 2-A, 2-B, 2-G, 2-H, 2-E - Watana To Parks Hwy.	68.25 Mi.	2.17%	4° 36.27'	314° 15.28'
28. Railroad, Watana to Gold Creek	58.01 Mi.	1.48%	5° 10.27'	299° 58.86'
29. Alternative 2-A, 2-B, 2-C, 2-E - Watana To Parks Hwy.	79.37 Mi.	2.93%	3° 32.82'	281° 31.2'
30. Alternative 2-A, 2-F, 2-B, 2-G, 2-D - Watana To Parks Hwy.	68.21 Mi.	3.35%	3° 35.74'	245° 15.32'
31. Alternative 2-A, 2-F, 2-B, 2-G, 2-H - Watana To Gold Creek	49.85 Mi.	2.33%	5° 56.30'	296° 1.6'
32. Alternative 2-A, 2-F, 2-B, 2-G, 2-H, 2-D - Watana To Parks Hwy.	66.69 Mi.	2.41%	4° 54.59'	327° 26.39'
33. Alternative 2-A, 2-F, 2-B, 2-G, 2-H, 2-E, 2 -I Watana to Parks Hwy.	66.44 Mi.	2.22%	4° 50.79'	324° 12.18'

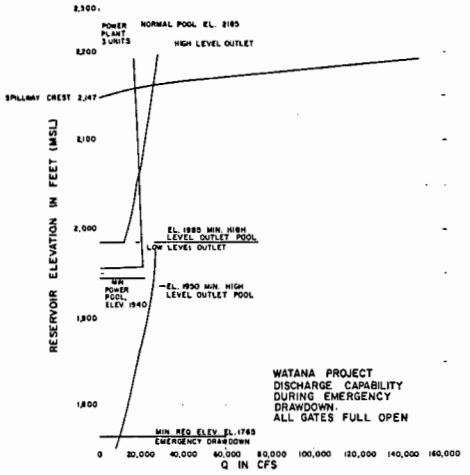
APPENDIX C

PRELIMINARY
DESIGN DEVELOPMENT

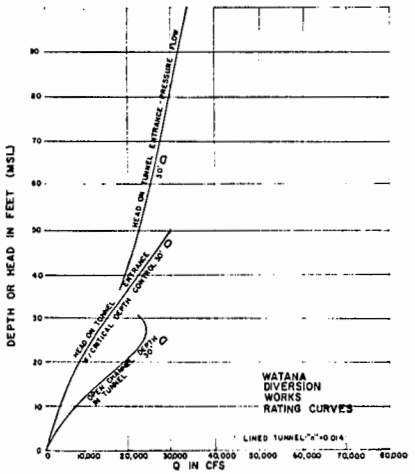

UPPER SUSITNA RIVER PROFILE
RIVER MILES 120-290
Distances refer to miles above mouth.
Elevations refer to mean sea level.
DEVIL CANYON
WATANA
LOCATION MAP
STUDY AREA
Pacific Ocean
ALASKA
CANADA
West Fork
East Fork
To Cantwell
Valdez Creek
DENALI
Windy Creek
To Paxson
Denali Highway
Butte Creek
BASIN BOUNDARY
To Fairbanks
Anchorage - Fairbanks Highway
Portage Creek
Devil Creek
Tsusena Creek
Deadman Creek
Watana Creek
Coal Creek
MACLAREN RIVER
Alaska RR
Devil Canyon Access Road (Proposed)
DEVIL CANYON DAMSITE
GOLD CREEK
Chacachabna Creek
Fog Creek
SUSITNA
Jay Creek
WATANA DAMSITE
Watana Access Road (Proposed)
Kosina Creek
SUSITNA RIVER
RIVER
TYONE RIVER
BASIN BOUNDARY
Tyone Lake
Susitna Lake
Lake Louise
OSHETNA RIVER
TALKEETNA
To Anchorage
Lake Louise Road
To Glenn Highway
SCALE
0 5 10 15 20 Miles
SOUTHCENTRAL RAILBELT AREA, ALASKA
SUPPLEMENTAL FEASIBILITY STUDY
UPPER SUSITNA RIVER BASIN
SELECTED 2 DAM PLAN
GENERAL PLAN
ALASKA DISTRICT, CORPS OF ENGINEERS
ANCHORAGE, ALASKA
FEBRUARY 1979

NOTES:

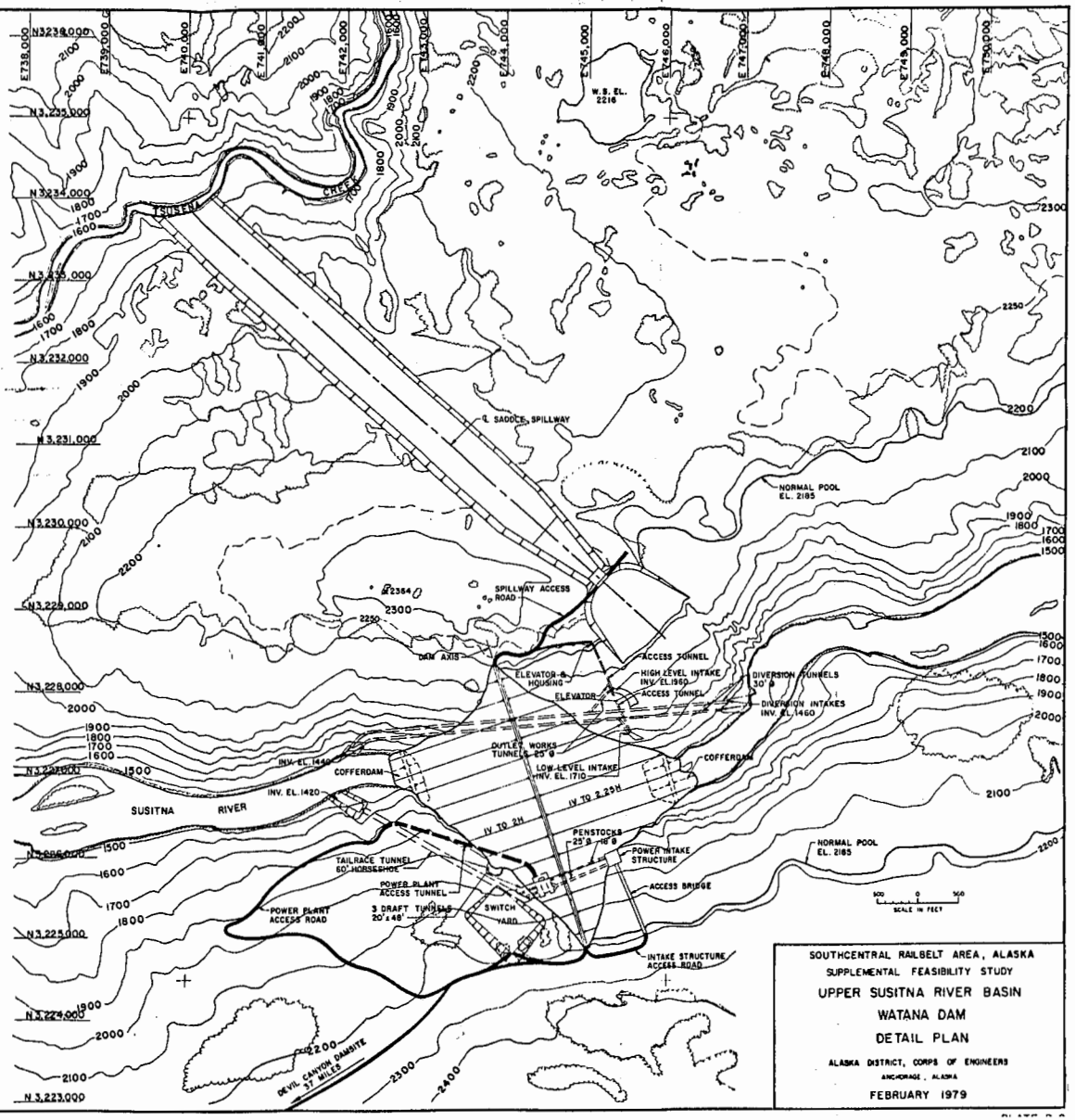
1. TOPOGRAPHIC CONTOURS ARE BASED ON AERIAL PHOTOGRAPHY DATED 10 JUNE 1978. VERTICAL DATUM IS MEAN SEA LEVEL (MSL)



WATANA PROJECT
DISCHARGE CAPABILITY
DURING EMERGENCY
DRAWDOWN.
ALL GATES FULL OPEN



WATANA
DIVERSION
WORKS
RATING CURVES

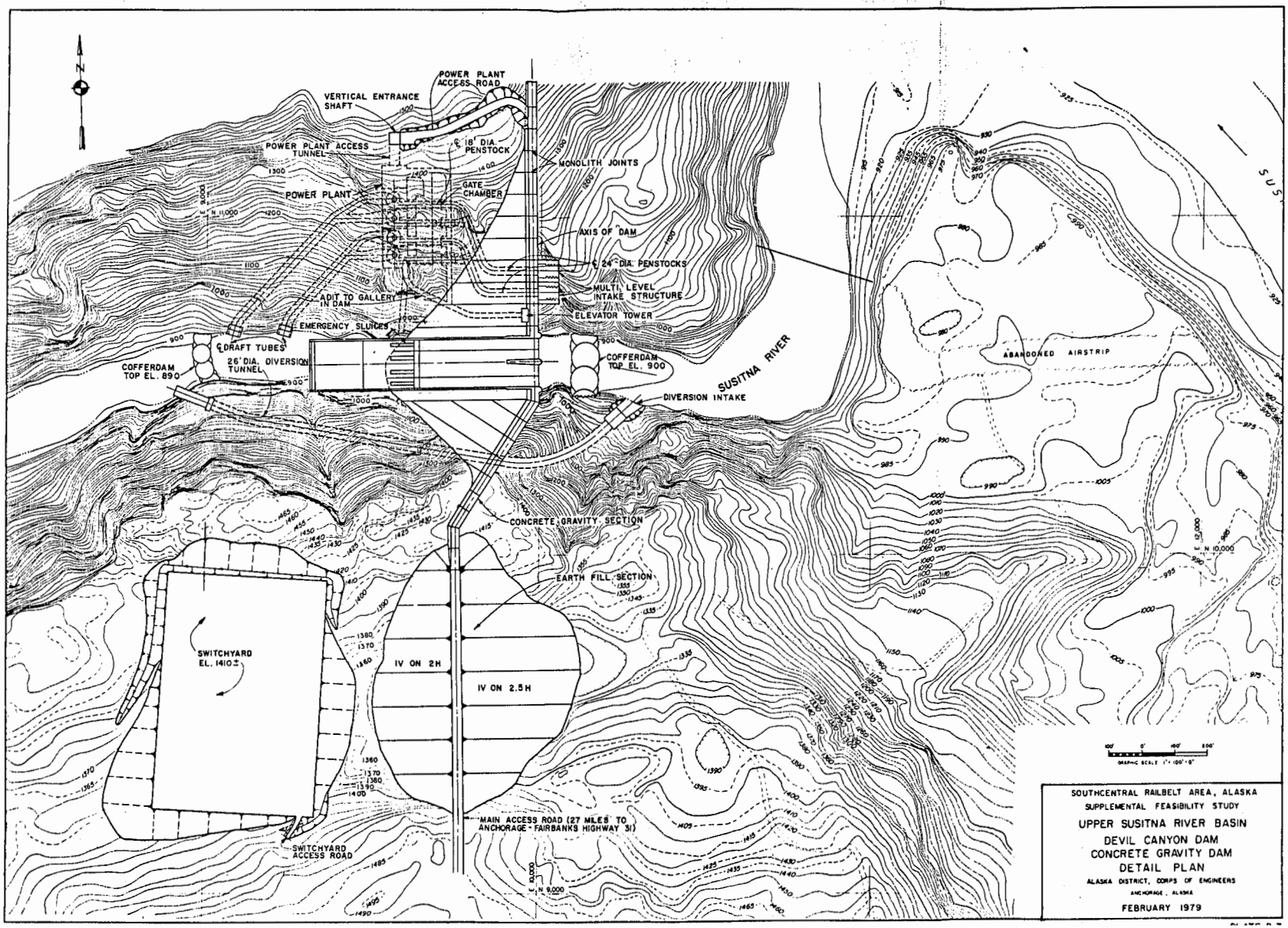


SOUTHCENTRAL RAILBELT AREA, ALASKA
SUPPLEMENTAL FEASIBILITY STUDY

UPPER SUSITNA RIVER BASIN
WATANA DAM
DETAIL PLAN

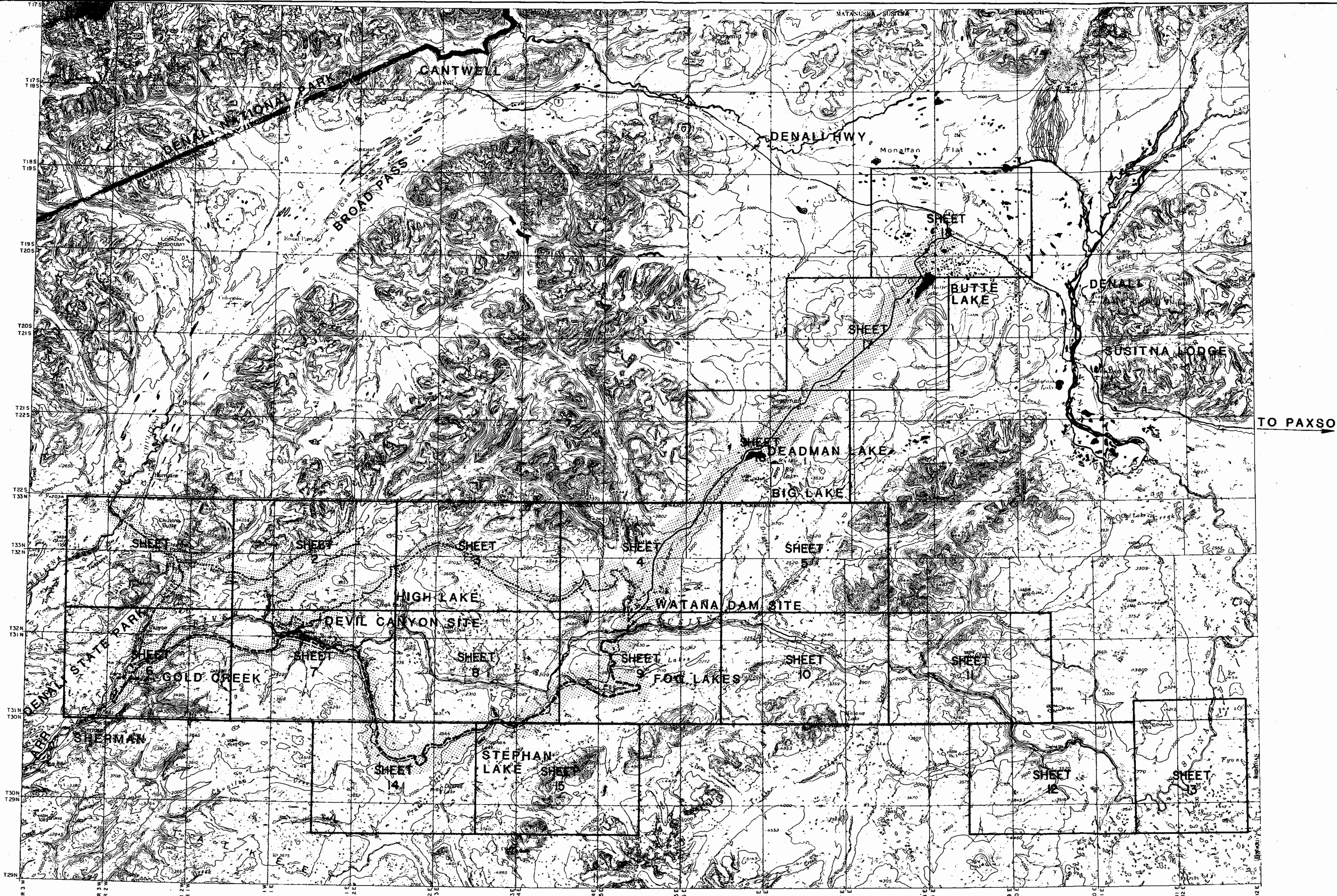
ALASKA DISTRICT, CORPS OF ENGINEERS
ANCHORAGE, ALASKA

FEBRUARY 1979


N
POWER PLANT ACCESS ROAD
VERTICAL ENTRANCE SHAFT
POWER PLANT ACCESS TUNNEL
℄ 18' DIA. PENSTOCK
MONOLITH JOINTS
POWER PLANT
GATE CHAMBER
AXIS OF DAM
℄ 24' DIA. PENSTOCKS
MULTI LEVEL INTAKE STRUCTURE
ADIT TO GALLERY IN DAM
ELEVATOR TOWER
EMERGENCY SLUICES
DRAFT TUBES
26' DIA. DIVERSION TUNNEL
COFFERDAM TOP EL. 890
COFFERDAM TOP EL. 900
SUSITNA RIVER
DIVERSION INTAKE
ABANDONED AIRSTRIP
CONCRETE GRAVITY SECTION
EARTH FILL SECTION
SWITCHYARD EL. 1410±
IV ON 2H
IV ON 2.5H
SWITCHYARD ACCESS ROAD
MAIN ACCESS ROAD (27 MILES TO ANCHORAGE - FAIRBANKS HIGHWAY 31)
E N 9,000
E N 10,000
E N 11,000
GRAPHIC SCALE 1" = 100'-0"
SOUTHCENTRAL RAILBELT AREA, ALASKA
SUPPLEMENTAL FEASIBILITY STUDY
UPPER SUSITNA RIVER BASIN
DEVIL CANYON DAM
CONCRETE GRAVITY DAM
DETAIL PLAN
ALASKA DISTRICT, CORPS OF ENGINEERS
ANCHORAGE, ALASKA
FEBRUARY 1979

APPENDIX D

MACROSCALE
ENVIRONMENTAL CONCERNS



LEGEND

- CORRIDOR 1
- CORRIDOR 2
- CORRIDOR 3
- RAILROAD

NOTE

SHEETS NO.; 5, 10, 11, 12, & 13 ARE OMITTED. NO ACCESS CORRIDORS ARE CONTAINED THEREIN.

5 4 3 2 1 0 5 10

GRAPHIC SCALE IN MILES

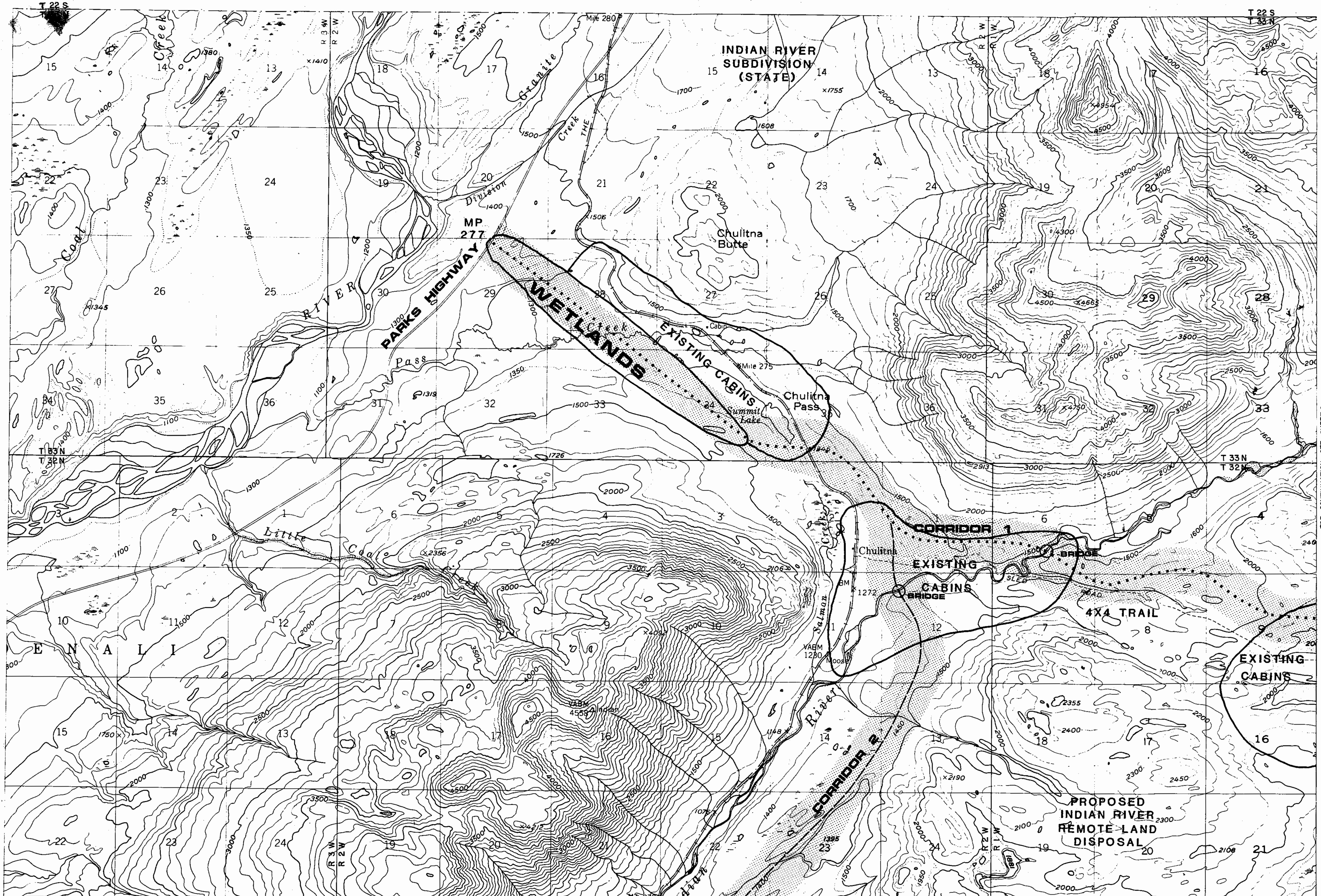
R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

PREPARED FOR: ACRES AMERICAN, INC.

INDEX MAP

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

DATE	1980
DESIGN	NKG
DRAWN	JIS
CHECKED	NKG
APPROVED	
PROJ NO	052210
	0 OF



FOR CONTINUATION, SEE SHEET 2

FOR CONTINUATION, SEE SHEET 6

SCALE 1" = 2000'

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

ACCESS CORRIDORS

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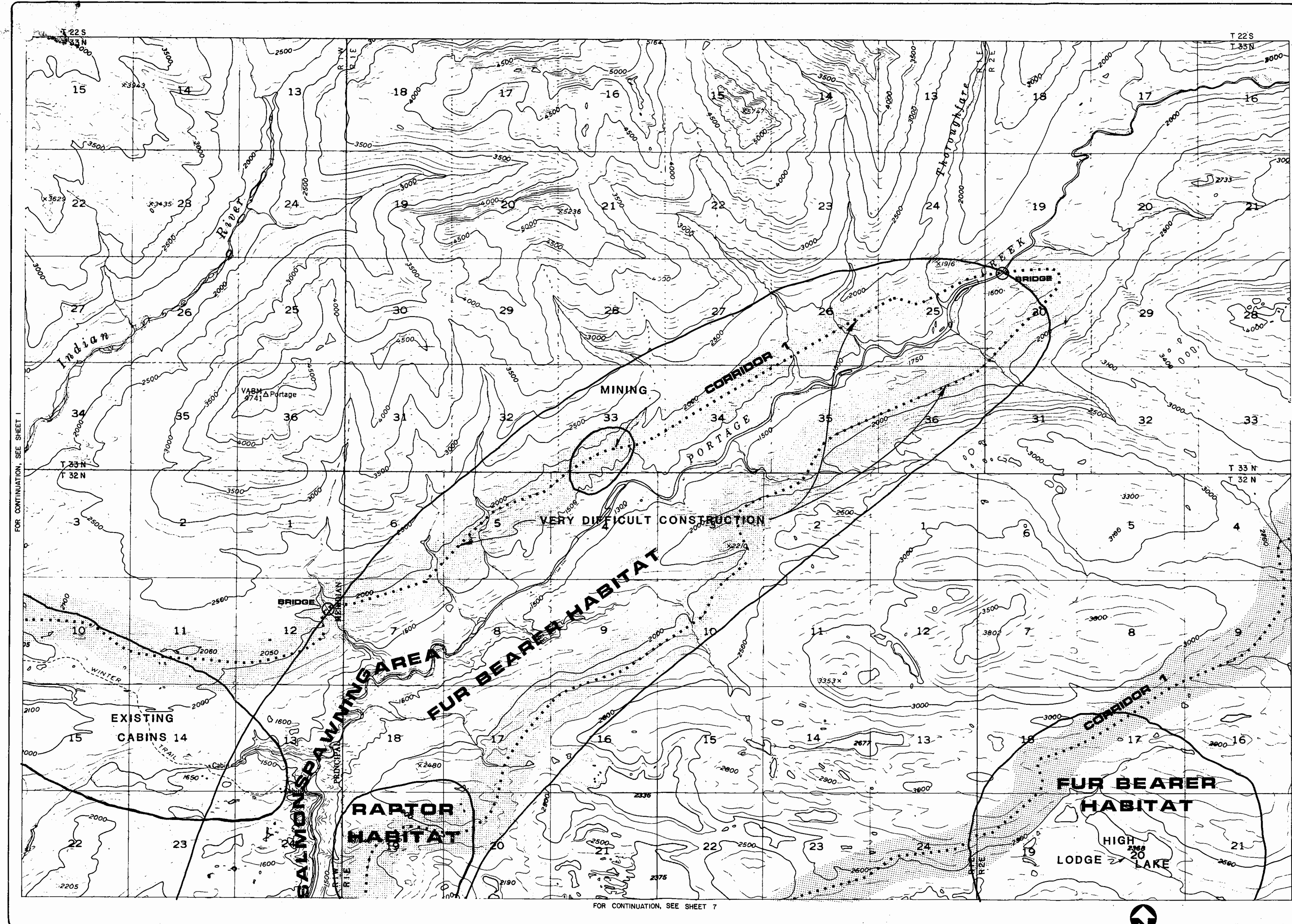
ACRES AMERICAN, INC.

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

1980	DATE
NKG	DESIGN
JIS	DRAWN
NKG	CHECKED
	APPROVED

052210
PROJ. NO.

1
OF



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ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

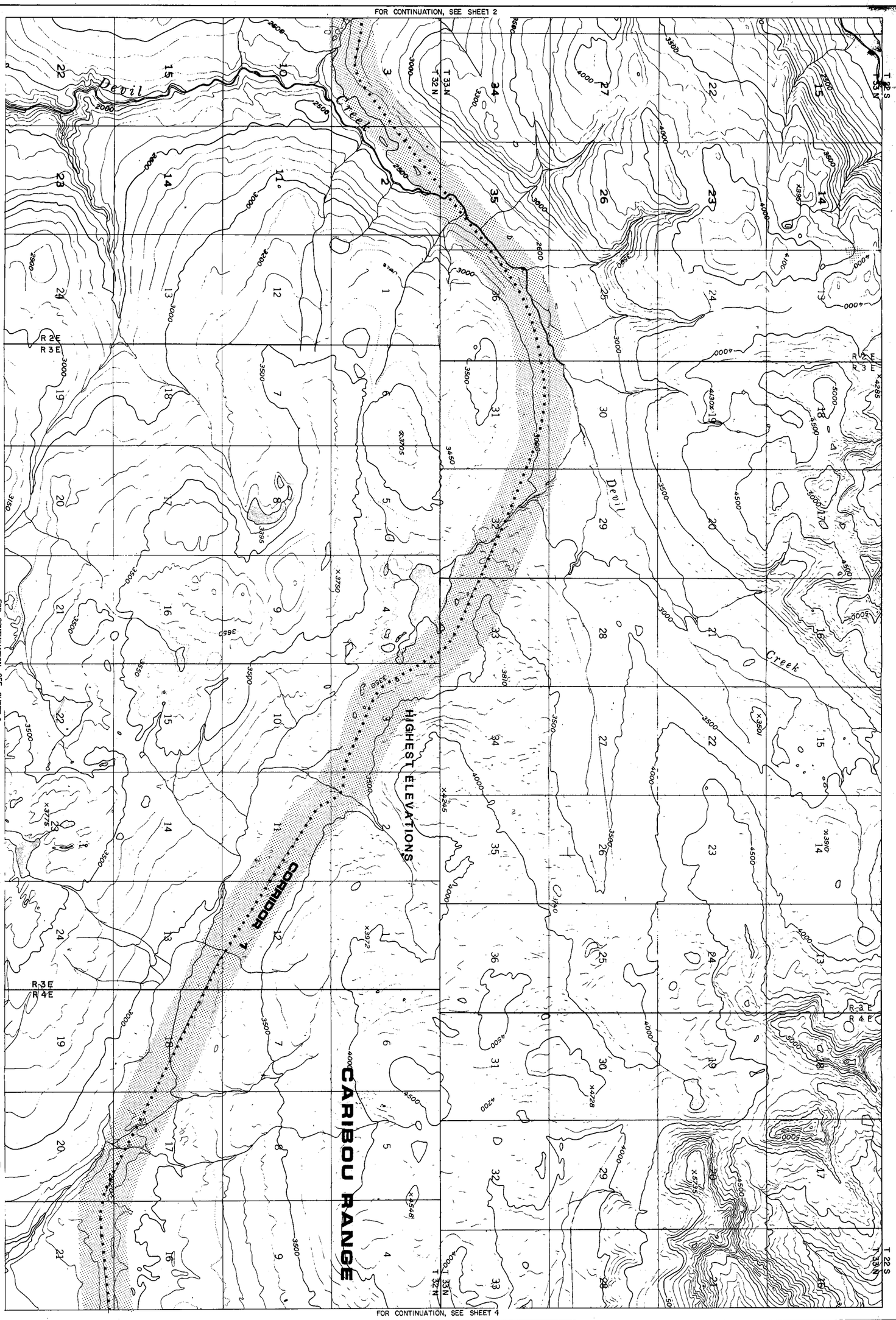
ACCESS CORRIDORS

PREPARED FOR:
ACRES AMERICAN, INC.

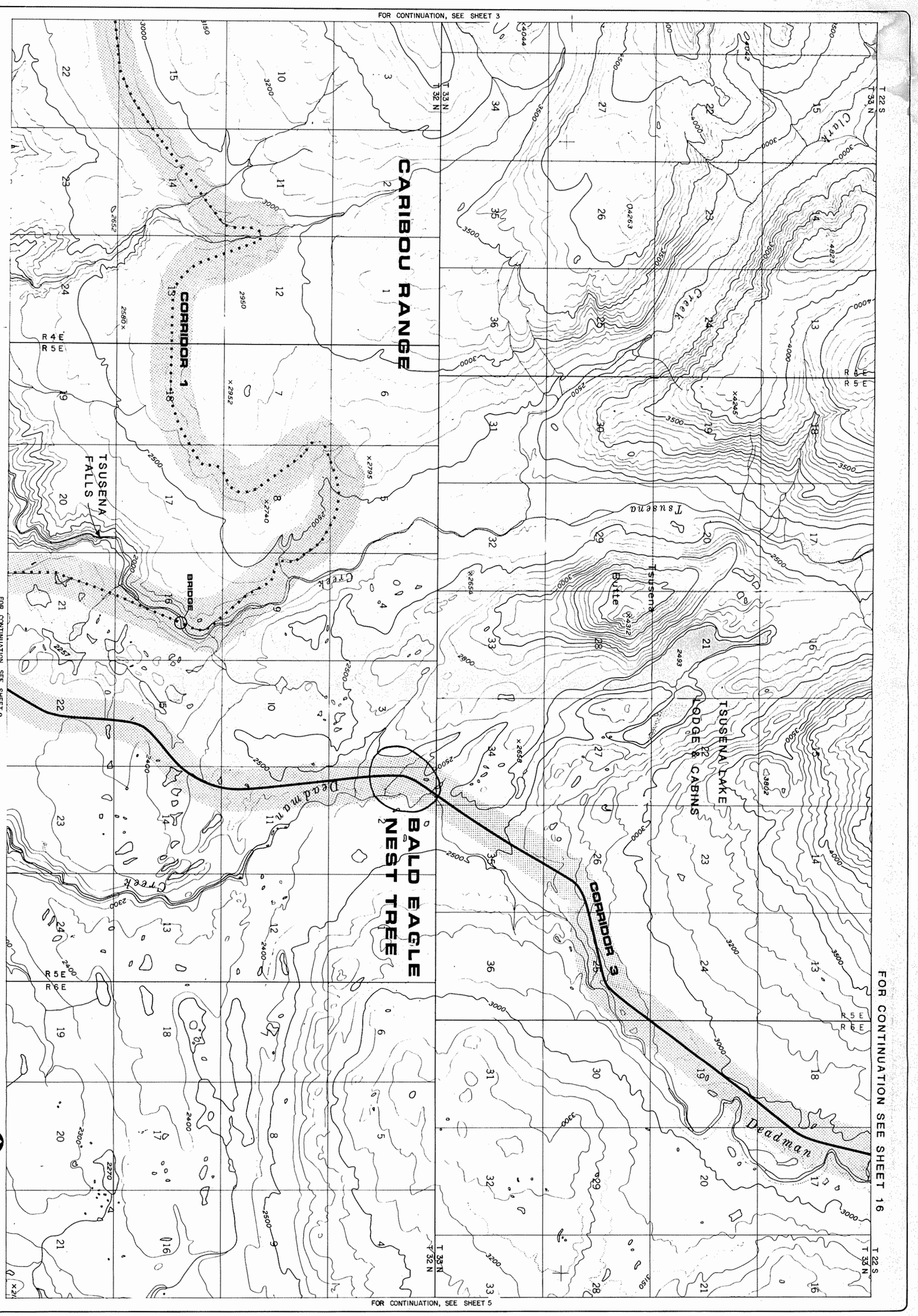
ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

1980 DATE
NKG DESIGN
JIS DRAWN
NKG CHECKED
APPROVED

052 PROJ NO
2 OF



1980 DRAWN MKG CHKD JJS APPROVED	R&M CONSULTANTS, INC. ENGINEERS GEOLOGISTS PLANNERS SURVEYORS	
3 OF 052210 PROJ. NO.	ALASKA POWER AUTHORITY SUSITNA HYDROELECTRIC PROJECT	**ACCESS CORRIDORS** PREPARED FOR: ACRES AMERICAN, INC.



SCALE 1" = 2000'

1980 DRN	R&M CONSULTANTS, INC. ENGINEERS GEOLOGISTS PLANNERS SURVEYORS	
052210 PROJ NO	ALASKA POWER AUTHORITY SUSITNA HYDROELECTRIC PROJECT	**ACCESS CORRIDORS**
4 OF		PREPARED FOR: ACRES AMERICAN, INC.

FOR CONTINUATION, SEE SHEET 4

WATANA CAMP

PROPOSED AIRSTRIP

MOOSE HABITAT

SUSITNA RIVER

WATANA DAM SITE

FOG LAKES-MOOSE CARIBOU & FUR BEARERS

WATERFOWL

EXISTING CABINS

RECREATIONAL USE

WETLANDS

ARCHEOLOGICAL SITES

RAPTOR HABITAT

CORRIDOR 2

ROAD

RAILROAD

BRIDGE

Fog Creek

FOG LAKES

T 32 N
T 31 N

T 31 N
T 30 N

R4E R5E R6E

FOR CONTINUATION, SEE SHEET 8

FOR CONTINUATION, SEE SHEET 10

FOR CONTINUATION, SEE SHEET 15

SCALE 1" = 2000'

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

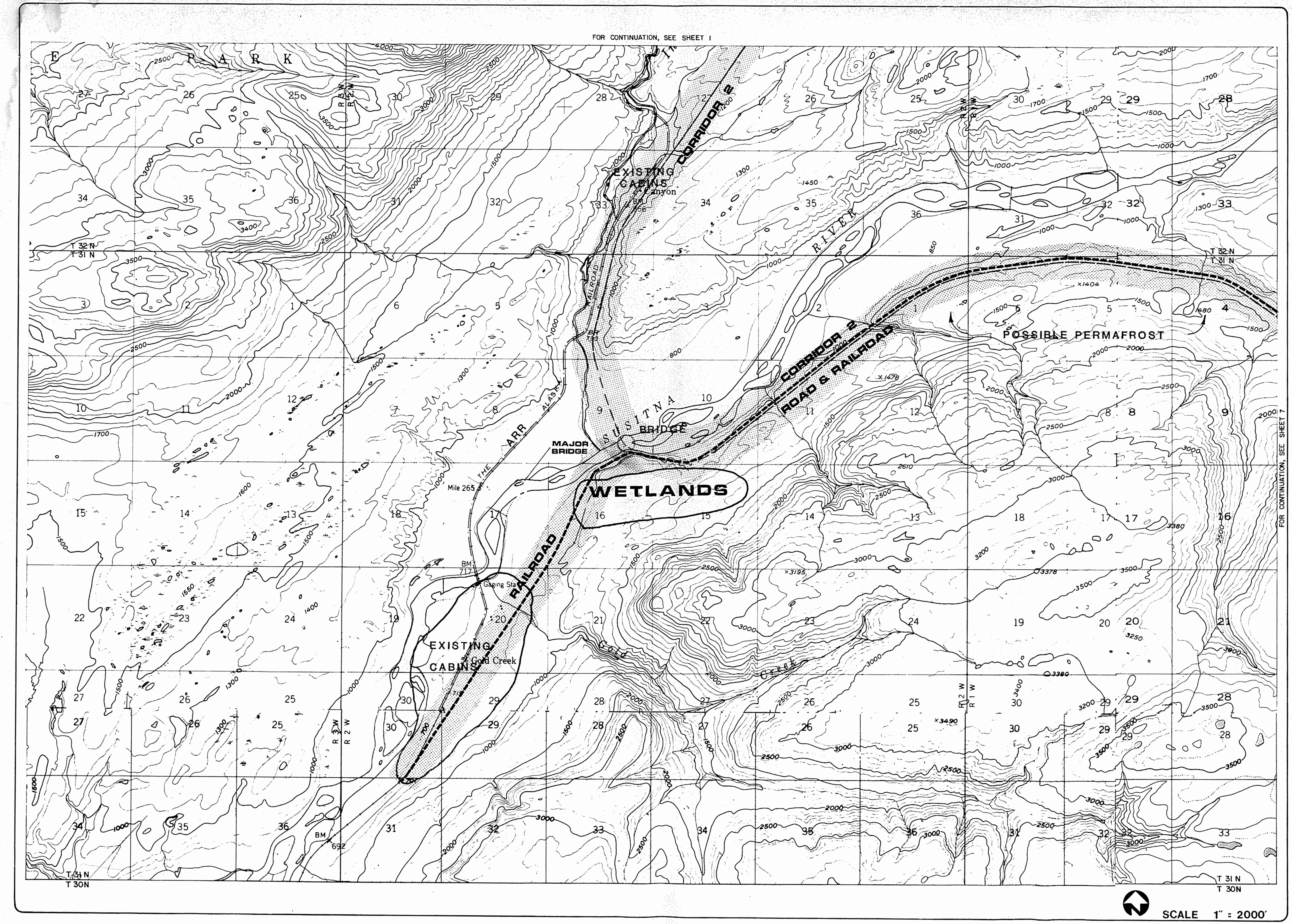
R&M

ACCESS CORRIDORS

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

PREPARED FOR :
ACRES AMERICAN, INC.

1980 DATE	052210 PROJ NO
NKG DESIGN	9 OF
JIS DRAWN	
NKG CHECKED	
APPROVED	



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PREPARED FOR:
ACRES AMERICAN, INC.

ACCESS CORRIDORS

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

1980 DATE	052210 PROJ. NO.
NKG DESIGN	6
JIS DRAWN	OF
NKG CHECKED	
APPROVED	

FOR CONTINUATION, SEE SHEET 2

HISTORICAL SITE

NO AVAILABLE STAGING AREA ON NORTH

POTENTIAL RAPTOR NESTING AREA

CORRIDOR 1

DEVILS CANYON DAM SITE

SUSITNA RIVER

STAGING AREA

BRIDGE

WETLANDS

CORRIDOR 2

ROAD & RAILROAD

POSSIBLE PERMAFROST

RAILROAD

ROAD

RAPTOR NESTING AREA

HARD ROCK FOUNDATION

CARIBOU WINTERING AREA

T 32 N
T 31 N

T 31 N
T 30 N

R1W R1E R2E

FOR CONTINUATION, SEE SHEET 8

FOR CONTINUATION, SEE SHEET 14

SCALE 1" = 2000'

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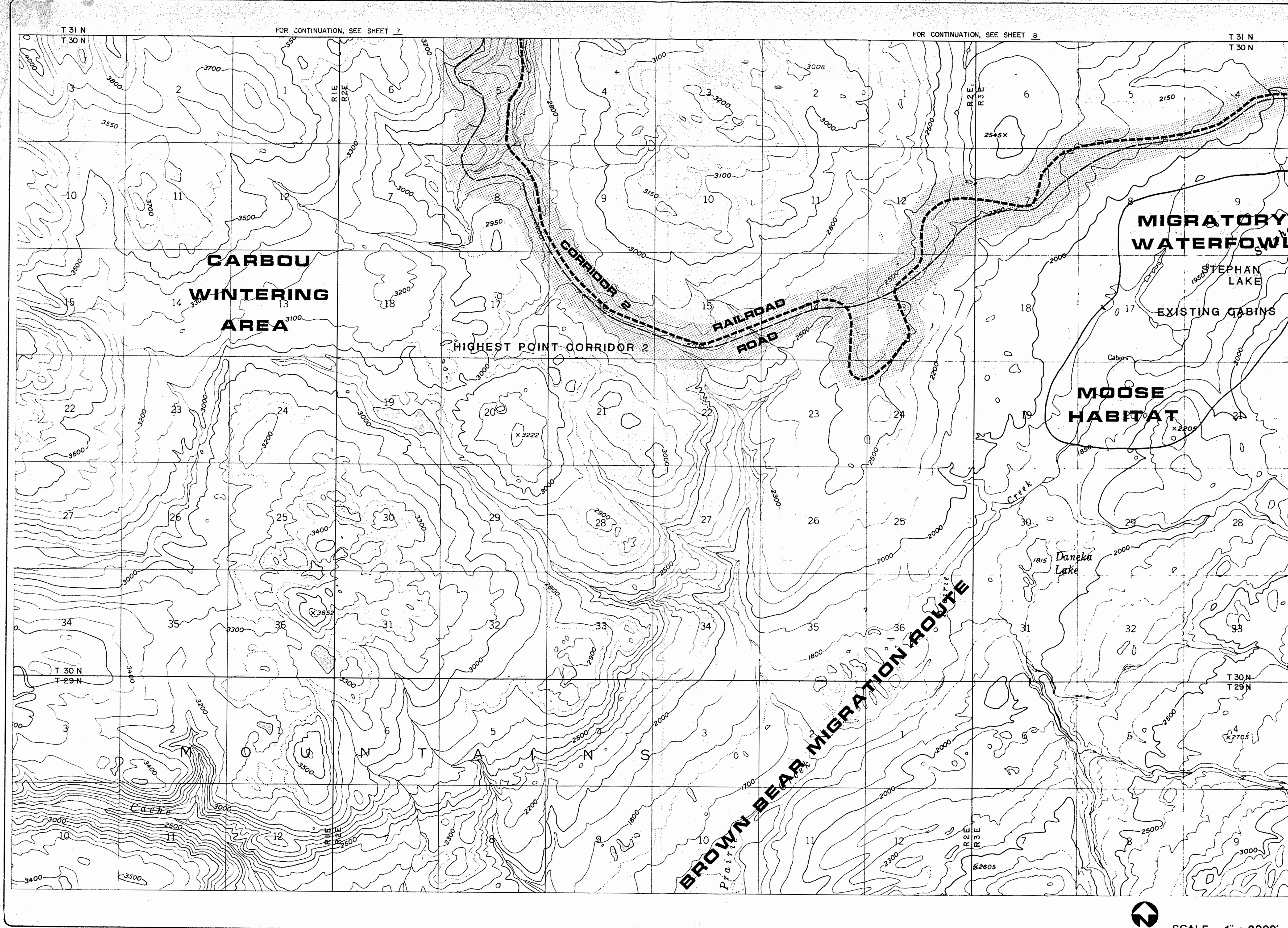
ACCESS CORRIDORS

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

1980 DATE	052210 PROJ. NO.
NKG DESIGN	7
JIS DRAWN	OF
NKG CHECKED	
APPROVED	



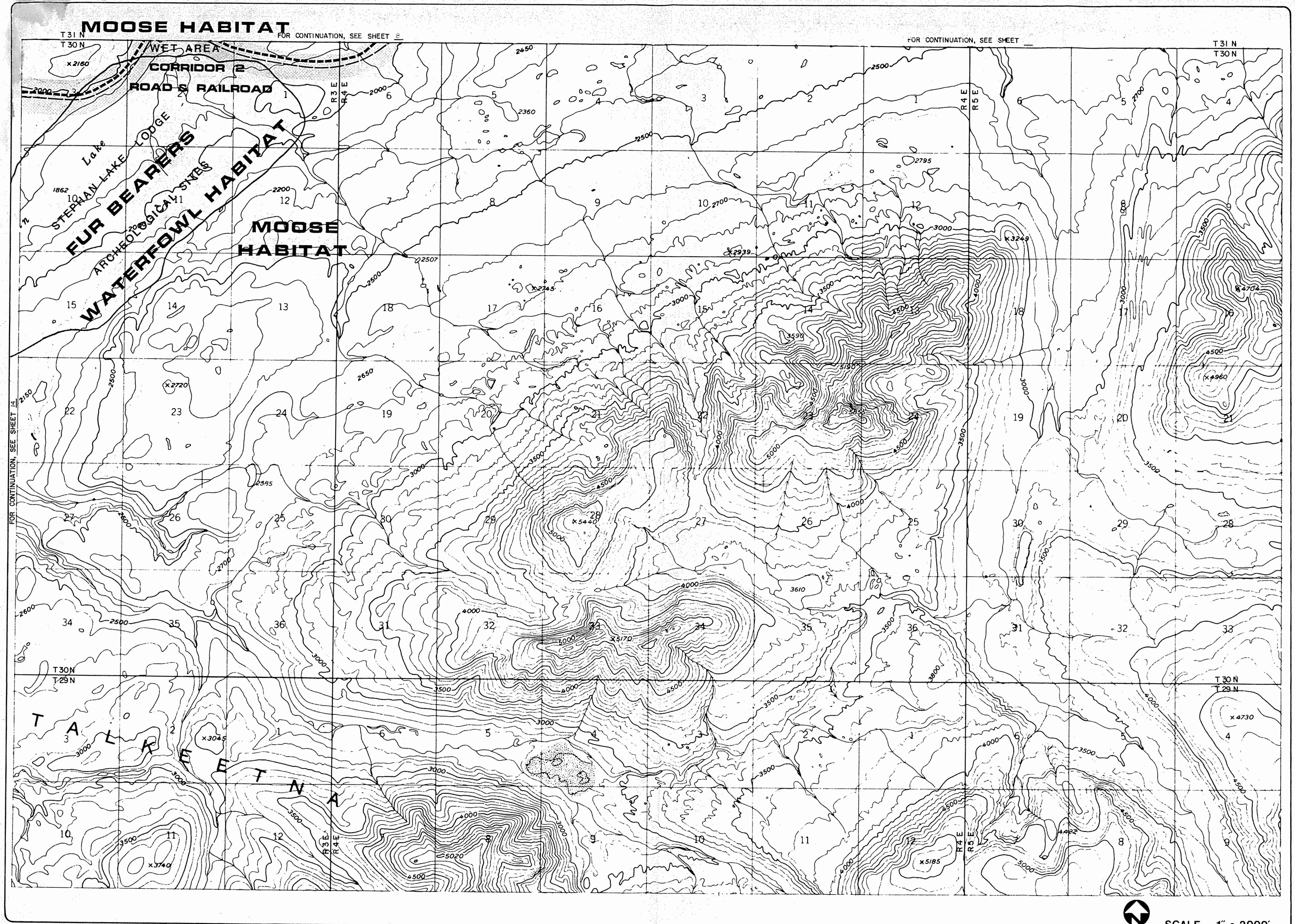
PREPARED FOR:
ACRES AMERICAN, INC.

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

ACCESS CORRIDORS

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

DATE	1980
DESIGN	NKG
DRAWN	JIS
CHECKED	NKG
APPROVED	
PROJ. NO.	052210
	14 OF



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ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

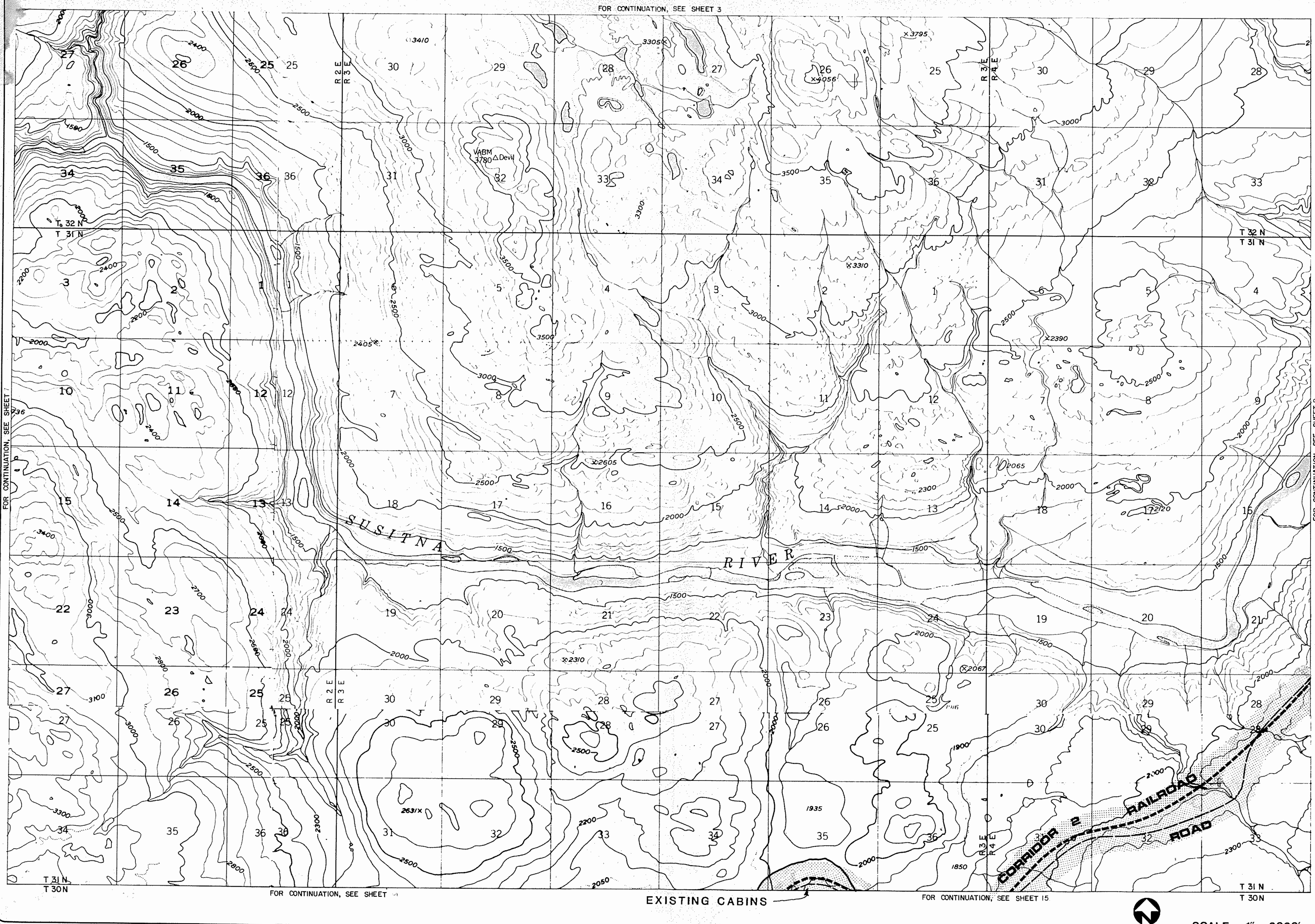
PREPARED FOR:
ACRES AMERICAN, INC.

ACCESS CORRIDORS

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

1980 DATE
NKG DESIGN
JIS DRAWN
NKG CHECKED
APPROVED

052210 PROJ NO
15 OF



R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

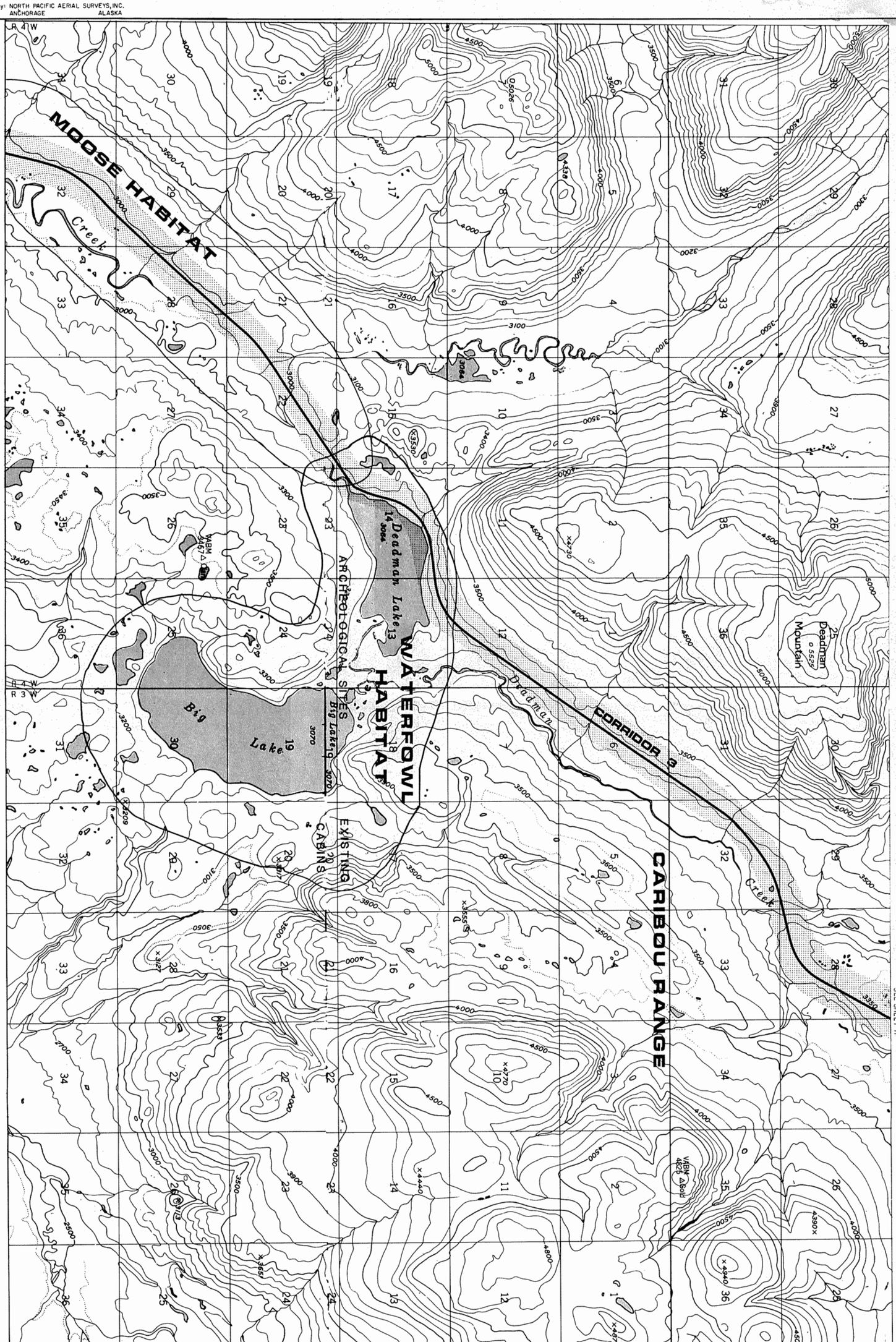
ACCESS CORRIDORS

PREPARED FOR:
ACRES AMERICAN, INC.

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

1980 DATE	052210 PROJ. NO.
NKG DESIGN	8
JJS DRAWN	OF
NKG CHECKED	
APPROVED	

Prepared by: NORTH PACIFIC AERIAL SURVEYS, INC.
ANCHORAGE ALASKA



SCALE 1" = 2000'

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

ACCESS CORRIDORS

PREPARED FOR:
ACRES AMERICAN, INC.

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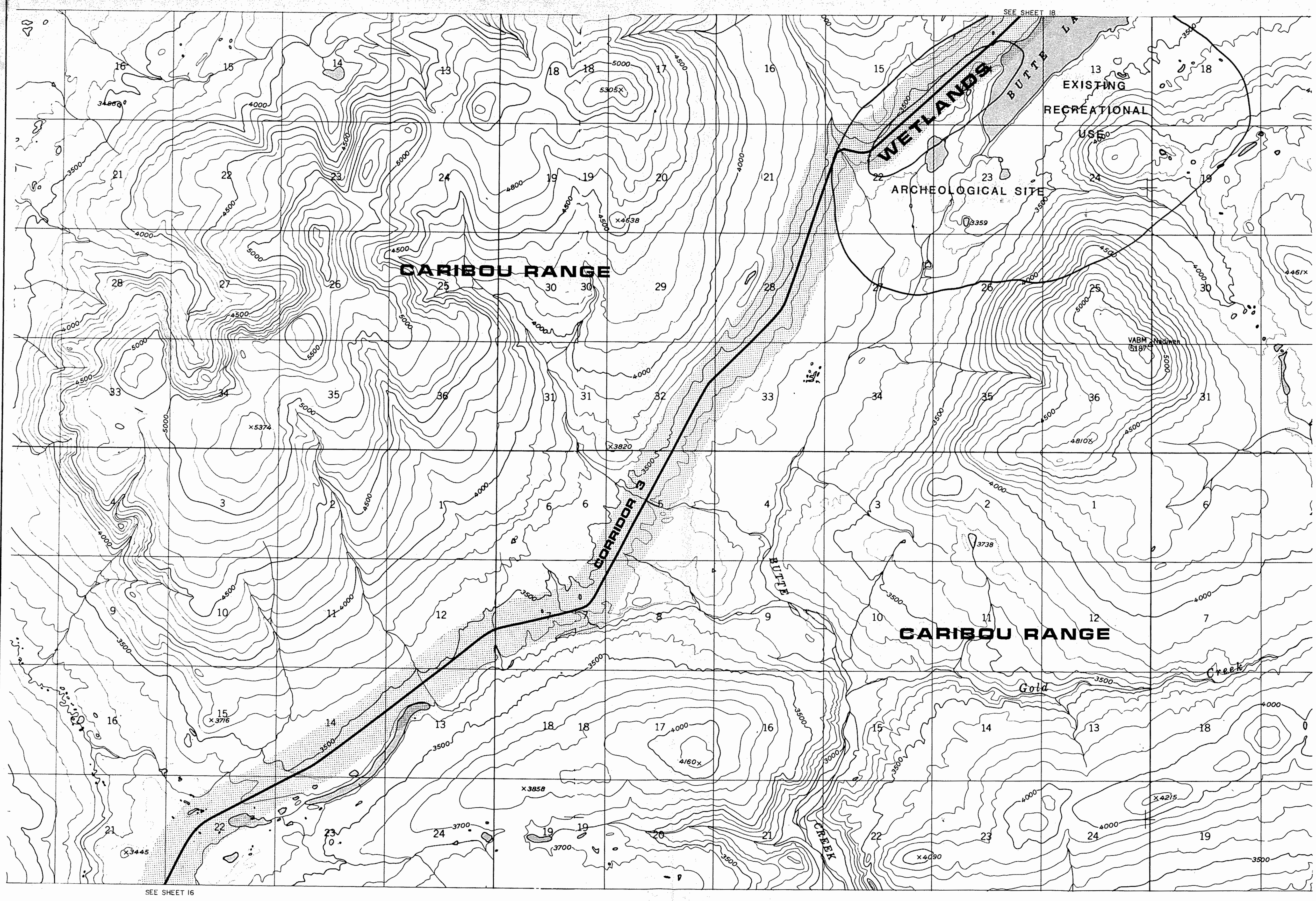


Prepared by: NORTH PACIFIC AERIAL SURVEYS, INC. ANCHORAGE ALASKA

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

PREPARED FOR: ACRES AMERICAN, INC.

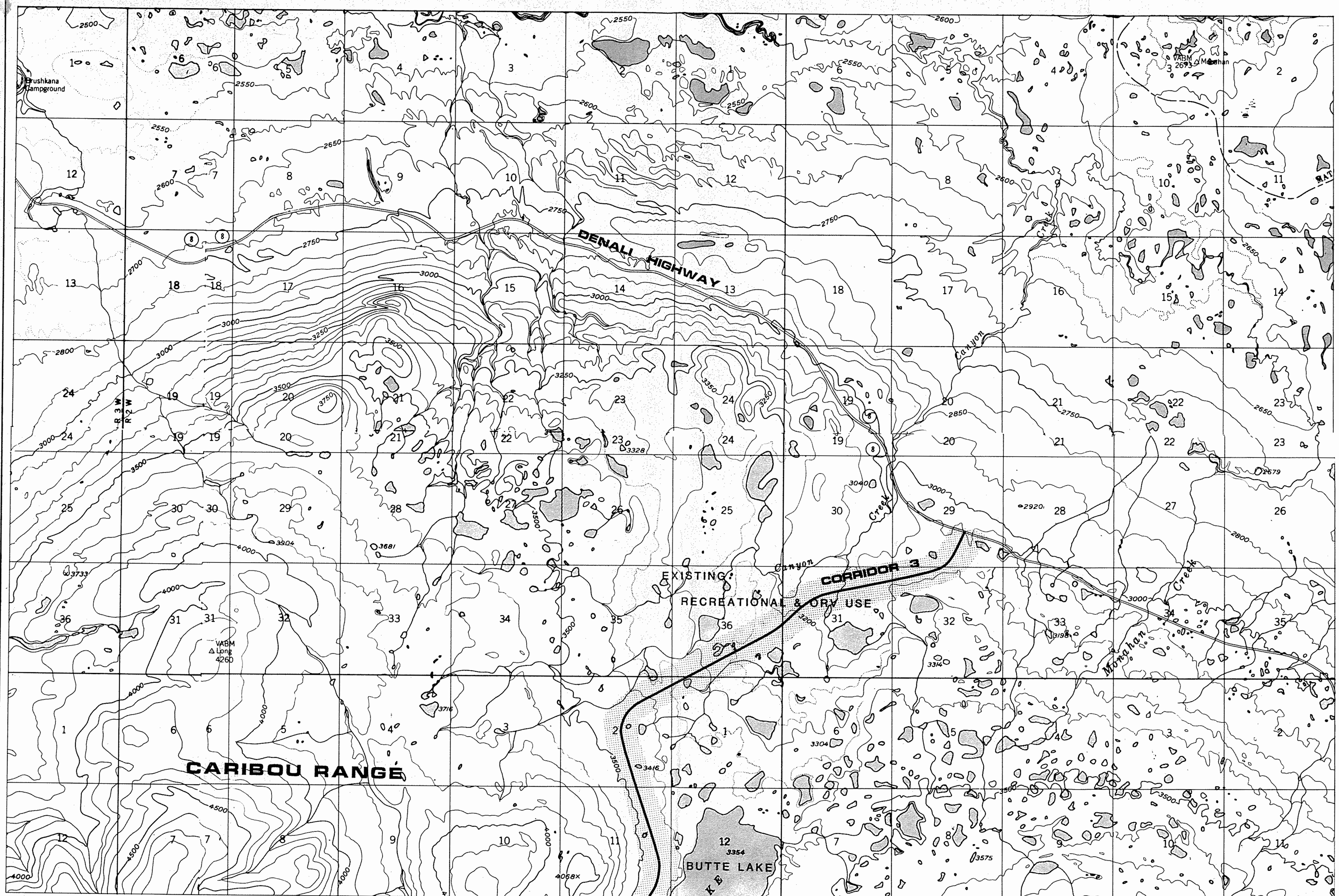
ACCESS CORRIDORS

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

1980 DATE
NKG DESIGN
JIS DRAWN
NKG CHECKED
APPROVED

052210 PROJ. NO.
17
OF

SCALE 1" = 2000'



Prepared by: NORTH PACIFIC AERIAL SURVEYS, INC. ANCHORAGE ALASKA

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

ACCESS CORRIDORS

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ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

DATE	1980
DRAWN	NKG
CHECKED	JJS
	NKG
APPROVED	

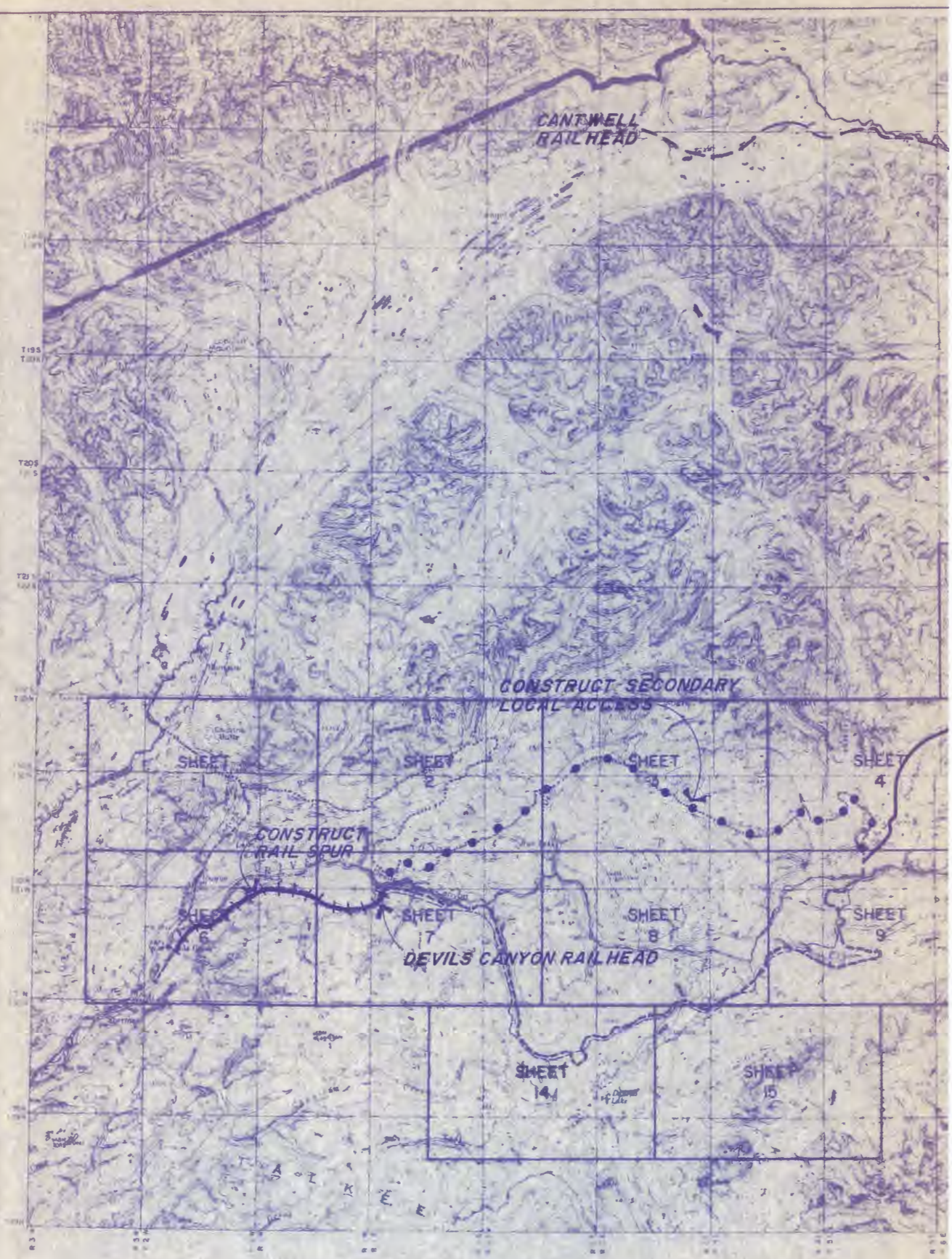
052210 PROJ. NO.

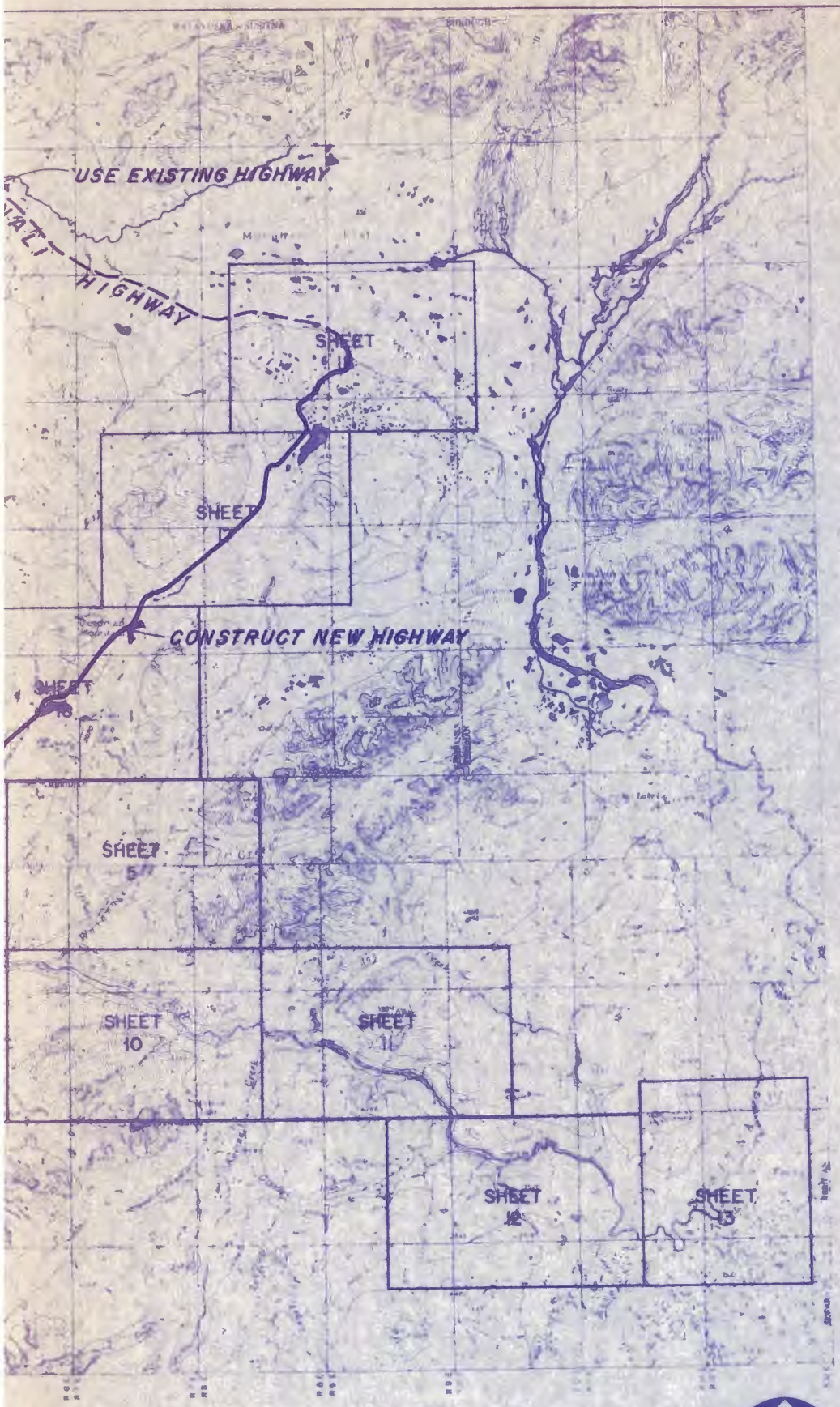
18 OF

SCALE 1" = 2000'

APPENDIX E

PROPOSED ACCESS PLAN


CANTWELL
RAILHEAD
CONSTRUCT SECONDARY
LOCAL ACCESS
SHEET 1
SHEET 2
SHEET 3
SHEET 4
CONSTRUCT
RAIL SPUR
SHEET 6
SHEET 7
SHEET 8
SHEET 9
DEVILS CANYON RAILHEAD
SHEET 14
SHEET 15
T A T K E E
LEGEND
GH ROAD
LOW ROAD
NORTH ROAD
RAILROAD



NOTE

SHEETS NOS. 1, 2, 11, 12, & 13 ARE LIMITED NO ACCESS CORRIDORS ARE CONTAINED THEREIN.

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PREPARED FOR:
ACRES AMERICAN, INC.

INDEX MAP

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

980	
NKG	
JHS	
NKG	
	0