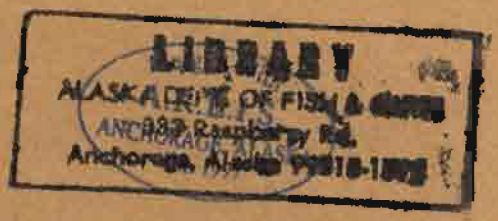


ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

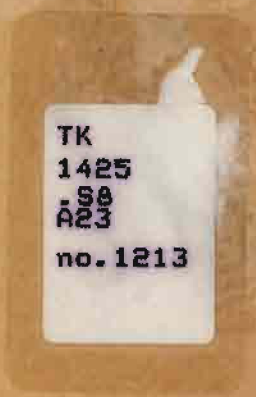
TASK 2 - SURVEYS AND SITE FACILITIES

SUBTASK 2.12
FIELD RECONNAISSANCE RESERVOIR AREA - TIMBER REPORT

FINAL

MARCH 1982

ACRES AMERICAN INCORPORATED
1000 Liberty Bank Building
Main at Court
Buffalo, New York 14202
Telephone: (716) 853-7525



ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT
FIELD RECONNAISSANCE RESERVOIR
AREA - TIMBER REPORT

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1 - INTRODUCTION

The purpose of this portion of Subtask 2.12 is to gain an understanding of the effort that will be required in clearing both the Devil Canyon and Watana reservoirs of vegetation prior to their inundation. The focus of attention has been on the nature of the vegetative cover, primarily forested, to include a description of the size, volume, stocking level and other stand characteristics within both of the reservoir basins (at maximum operating level). Attention has also been given to such factors as slope and slope stability as they relate to the operability of various logging systems that will be considered for the removal process.

Data gathered in this phase has been collected in such a manner so as to ultimately be relevant to the Marketability and Disposal Study (Subtask 2.13) and the Cost Estimates for Reservoir Clearing (Subtask 2.14).

2 - SUMMARY

2.1 - Scope of Work

This portion of Subtask 2.12 involved the organization and the quantification of the descriptive vegetative information already obtained (Subtask 7.12) into a format that ultimately could be translated into wood marketability/disposal considerations of value and cost. The Subtask 7.12 report was reviewed, aerial photographs and maps were consulted, an aerial overflight of both reservoir areas was made, and recent (1980 field season) forest inventory data collected from the U.S. Forest Service (2) was utilized in the preparation of this report.

2.2 - Previous Studies

Very little forest inventory work has been conducted in the Upper Susitna Basin. Only very general information (5) was available until the recent inventory of the U.S. Forest Service (2) which actually contained eight plots within the reservoir boundaries. It is this data that has been heavily relied upon for this analysis. A brief summary of relevant literature sources has been identified in the bibliography to this section.

2.3 - Timber Inventory

Most of the vegetative material within the reservoir areas consists of trees, very little in brush. There was essentially no literature base available for this subtask. The forest inventory data generated was based on recent (1980) field information collected by the U.S. Forest Service in the study area and by observations as a result of aircraft overflight. A table summary of some of these data are provided in Table 1. The trees are quite small, both in diameter and height, and the stands are not very dense.

Although total wood volume probably ranges between 23 and 40 million cubic feet, average volumes per acre are relatively low. Most of the wood volume is in white spruce. It is estimated hat some 43,850 acres will need to be cleared.

Several sources of error in the volume, acreage, and other parameters are discussed.

2.4 - Conclusions and Recommendations

In summary, there is a tremendous wood volume present, but it is of relatively low commercial quality in the traditional industrial sense. However, the opportunity of having approximately 20-40 million cubic feet of wood fiber available poses some interesting marketing/disposal questions. There are some very real logging operability problems posed by steep slopes and incised terrain (particularly on the southern slopes of the Watana Reservoir across from the High Lake Lodge area), and areas where slopes are unstable (as on the south-facing slope of Watana Reservoir just east of the confluence of Watana Creek and the Susitna River). Extensive stands of black spruce on poorly-drained south-facing slopes (east of Watana Creek) will also pose difficulties due to slope, poor drainage, and their extremely small size (less than four inches in diameter). Remoteness is also a major problem.

It is recommended that more detailed analysis be given to such factors as the species type, size class, quality, aereal distribution and logging operability in the costing portion of this feasibility study, particularly since such a large volume of fiber is involved. Since such a large clearing area and timber volume are involved, relatively small percentage differences in these factors can have a significant impact on marketability/salvage options and their associated costs. Inventory specialists at the Forestry Sciences Laboratory in Anchorage could perhaps help in this refinement.

The necessity to clear both reservoirs entirely of all vegetative material should perhaps be reconsidered.

3 - TIMBER INVENTORY

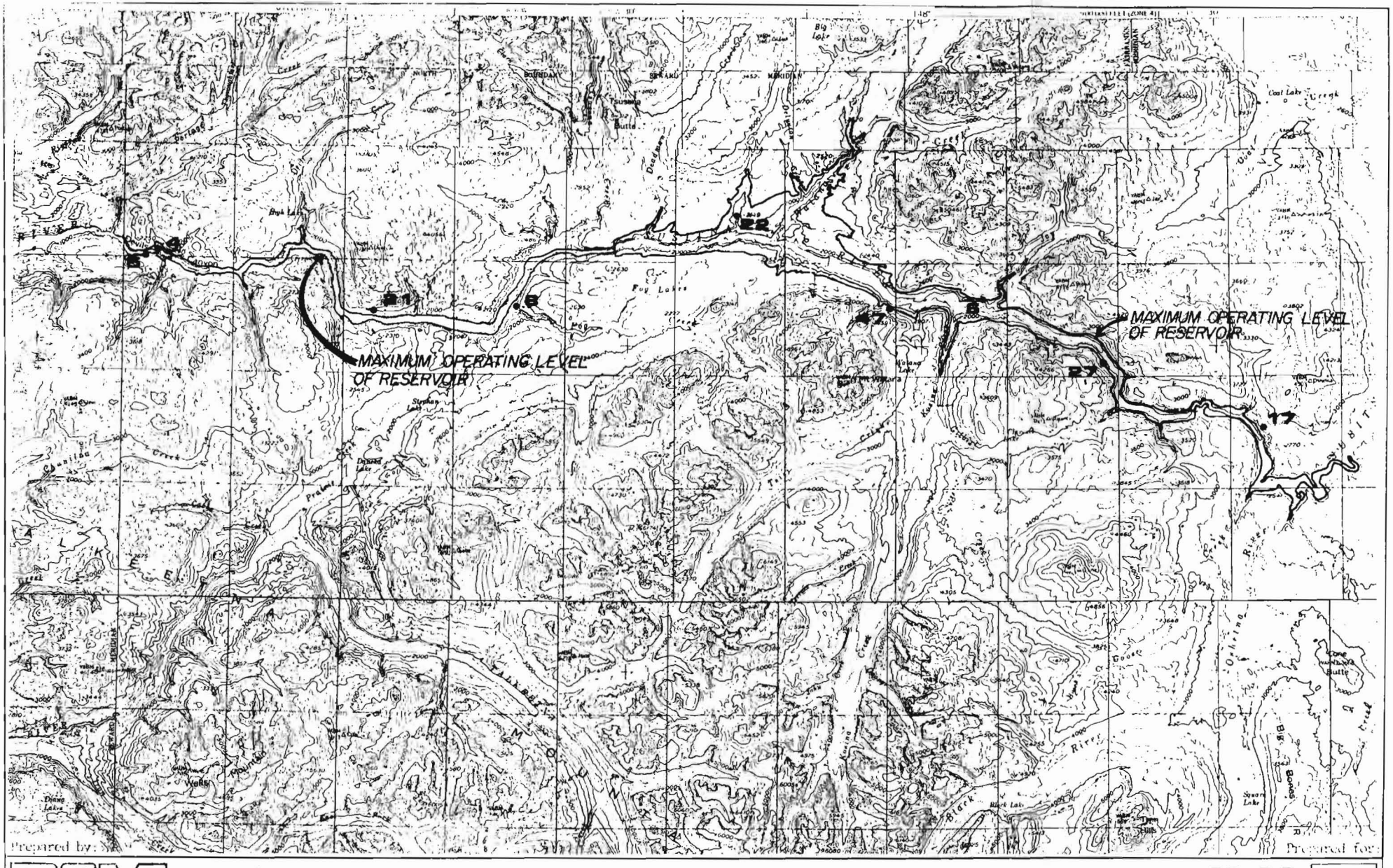
3.1 - Introduction

Most of the vegetative material within the Devil Canyon and Watana Reservoirs consists of trees. Very little is brush, like willow and alder, grass, and other plant forms. Consequently, this subtask focused on an inventory methodology to assess only the quantity, value, and costs of removal of the various tree species present.

3.2 - Methodology

There was essentially no literature base available providing timber inventory information. It was discovered that the Forestry Sciences Laboratory, U.S. Forest Service, Anchorage, Alaska, had conducted a field assessment of the vegetation of the Upper Susitna Basin in the summer of 1980. This assessment consisted of scores of detailed five acre plots taken within the area, where all vegetative matter present was identified and measured. These data were then summarized by computer according to a variety of parameters, and presented in a number of tables (2). Eight of these plots fell within the Devil Canyon and Wantana Reservoirs as shown on Figure 1 (others shown were just above the reservoir levels, but were included). These plot data provided the basis for the tabulations, estimates, and professional judgements that follow. Table 1 was prepared in a format to meaningfully summarize the plot data.

The geographic area of the two reservoirs requiring clearing was approximately determined by subtracting the estimated area occupied by the Susitna River (length multiplied by average width per segment) from the estimated area of each reservoir at the maximum operating level (7,800 acres, Devil Canyon; 42,000 acres, Watana - given project parameters). The eight 5-acre plots were then averaged to provide an average timber volume per acre, by



R&M

LOCATION OF 5 ACRE VEGETATIVE INVENTORY PLOTS USED IN THIS ANALYSIS

PG. 3.2

FIGURE 1

AGRIS

TABLE 1
FOREST INVENTORY PLOT SUMMARIES

Plot	Stocking[1] (average) trees/acre)	Average[2] Diameter (inches)	Average[2] Tree Height (feet)	Net Volume Per Acre (cubic feet)	Relative Composition[3] Hardwoods (percent by volume)	Softwoods
4	5.0	5.1	28	424	52	48
5*	3.8	7.1	38	587	0	100
6	6.4	6.2	32	493	9	91
8	2.8	10.2	54	938	5	95
21**	2.4	5.5	25	0	0	0
22	5.6	4.1	25	228	0	100
27	4.6	5.4	27	341	11	89
47**	3.0	3.0	16	0	0	0

Note:

1 Not including seedling trees - defined here as less than 1 inch in diameter.

2 Exclusive of seedlings.

3 Hardwoods include birch, aspen, cottonwood; softwoods include white and black spruce.

* Plot elevation 1,700 ft., but data included.

** Plot elevation 2,300 ft., but data included.

hardwoods and softwoods, with the estimated timber volume per reservoir then being determined by multiplying this average volume by the acreage per reservoir. A discussion of the errors involved with these assumptions is provided in the next section.

3.3 - Results

Plot summary information for each plot within the reservoir areas is shown in Table 1. The data presented is quite crude, but is presented to provide a general view of the nature of the treed ground cover that must be cleared. Additional time for this subtask would allow greater detail.

Summary comments about Table 1 are as follows:

- Not much data is available to apply over such a vast acreage as the reservoir inundation areas.

- The trees are generally quite small, and not particulary dense; although based upon aircraft overflight and the steepness of many of the slopes, actual stocking levels of most of the area is considerably greater than indicated by this table (U.S. Forest Service inventory data is based on "horizontal" acreages).

- Although total wood volume over both reservoir areas is very great, actual volumes per acre are relatively low.

- The bulk of the wood volume is in softwoods, primarily white spruce.

Other comments based upon aircraft overflight are appropriate at this time, as follows:

- Many of the timbered stands are mixtures of white spruce and birch, although relatively pure stands of each species occur quite frequently. Small pure stands of quaking aspen occur infrequently, and then essentially only on the south-facing slopes of the reservoirs. Their occurrence is not significant.

- Relatively large tracts of pure black spruce occur on the south-facing slopes of the Watana Reservoir. These trees are extremely small (less than 4 inches in diameter, and less than 10 feet in height), and in some areas quite sparsely scattered. Their presence increases as one heads east up the Susitna River.

Summarized gross estimates of the timber volumes present by reservoir are provided in Table 2. Based upon overflights of the inundation areas made at the reservoir elevation levels, it appears that the volume estimates could be quite low, perhaps by a factor of two. Some 40 million cubic feet of fiber could be present. Possible reasons why the calculated volumes (22,013,000 cubic feet) are considerably below this are identified in the following section on inventory errors. Most of the volume is white spruce.

3.4 - Sources of Error

There are several sources of error in this report's simplistic approach in describing the volume and type of timber that needs to be removed. Firstly, and as indicated previously, there are far too few data plots to provide an adequate sampling frame. Review of the U.S. Forest Service inventory data (2) indicates that the sampling error on some of the computerized volume estimates is ±80 percent.

TABLE 2
TIMBER TOTALS BY RESERVOIR

	DEVIL CANYON	WATANA
Reservoir Elevation	1,450 feet	2,200 feet
Reservoir Area - Maximum Operating Level	7,800 acres	42,000 acres
Estimated River Area	1,450 acres	4,500 acres
Estimated Timbered Reservoir Area	6,350 acres Total = 43,850 acres	37,500 acres
Average Wood Volume Per Acre*	502 cu.ft./acre	502 cu.ft./acre
Total Estimated Wood Volume	3,188,000 cu.ft. Total = 22,013,000 cu.ft.	18,825,000 cu.ft.

Estimated Proportion of Softwoods and Hardwoods*	DEVIL CANYON SW	DEVIL CANYON HW	WATANA SW	WATANA HW
	87%	13%	87%	13%

Notes:

* average of plot data in Table 1, excluding high elevation plots 21 and 47 considered unrepresentative.

SW Softwoods

HW Hardwoods

Since most of the slopes in the study area are steep, actual timber volumes would be greater than those of the plots since plot data are based on "horizontal acres." Visual overflights reveal that actual stocking levels over most of the area are greater than the few trees per acre indicated in Table 1. The method of determining the acreage of each of the inundation areas is quite crude. Also, as one travels east up the river, the proportion of black spruce increases considerably at the Watana Reservoir. Plot samples have probably not adequately sampled this vegetation type. Since the trees are very small, their not being adequately represented would tend to overestimate fiber volumes present.

In summary, all factors considered, the volumes actually present probably exceed those predicted by projecting the sample data.

4 - CONCLUSIONS AND RECOMMENDATIONS

In summary, there is a tremendous wood volume present, but it is of relatively low commercial quality in the traditional industrial sense. Trees tend to be quite small, and not densely stocked. Both of these factors coupled with the steep terrain make handling the wood very difficult, inefficient, and costly. However, the opportunity of having approximately 20-40 million cubic feet of wood fiber available poses some interesting marketing/disposal questions. There are some very real logging operability problems posed by steep slopes and incised terrain (particularly on the southern slopes of the Watana Reservoir across from the High Lake Lodge area), and areas where slopes are unstable (as on the south-facing slope of Watana Reservoir just east of the confluence of Watana Creek and the Susitna River). As trees are removed in some areas, slope erosion will increase dramatically, particularly at the Watana Reservoir. Extensive stands of black spruce on poorly-drained south-facing slopes (east of Watana Creek) will also pose harvesting difficulties due to slope, poor drainage, and their extremely small size (less than four inches in diameter). Remoteness is also a major problem.

It is recommended that more detailed analysis be given to such factors as the species type, size class, quality, aereal distribution and logging operability in the costing portion of this feasibility study, particularly since such a large volume of fiber is involved. Since such a large clearing area and timber volume are involved, relatively small percentage differences in these factors can have a significant impact on marketability/salvage options and their associated costs. Inventory specialists at the Forestry Sciences Laboratory in Anchorage could perhaps help in this refinement. The necessity to clear both reservoirs entirely of all vegetative material should perhaps be reconsidered. The effort and costs involved in such an undertaking will be tremendous.

BIBLIOGRAPHY

1. U.S. Department of the Interior, Bureau of Land Management, Oregon State Office, J.K. Pearce, Forest Engineering Handbook, 1961.

2. U.S. Forest Service, Forestry Sciences Laboratory, Computerized Field Data from 1980 Field Inventory, Upper Susitna Basin, Anchorage, Alaska, 1981.

3. U.S. Forest Service, Pacific Northwest Forest and Range Experiment Station, Hegg K.M. and R.M. Dippold, Areas of Nonforest and Noncommercial Forest Lands by Cover Type and by Topographic Site for Interior Alaska, Resource Bulletin PNW-47, Portland, no date.

4. U.S. Forest Service, Institute of Northern Forestry, L.F. Hanks and C.W. Swanson, Lumber Grade Yields from Paper Birch and Balsam Poplar Logs in the Susitna River Valley, Alaska, Research Paper PNW-51, Juneau, 1967.

5. U.S. Forest Service, Institute of Northern Forestry, O.K. Hutchison, Alaska's Forest Resource, Resource Bulletin PNW-19, Juneau, 1967.

6. U.S. Forest Service, Institute of Northern Forestry, K.M. Hegg, Forest Resources of the Susitna Valley, Alaska, Resource Bulletin PNW-32, Juneau, 1970.

7. U.S. Forest Service, Institute of Northern Forestry, W.A. Farr, Growth and Yield of Well-Stocked White Spruce Stands in Alaska, Research Paper PNW-53, Juneau, 1967.

8. U.S. Forest Service, Institute of Northern Forestry, L.A. Viereck and C.T. Dyrness, A Preliminary Classification System for Vegetation of Alaska, General Technical Report PNW-106, Fairbanks, 1980.

9. University of Alaska, Agricultural Experiment Station and Terrestrial Environmental Specialists, Inc., Susitna Hydroelectric Project - Environmental Studies Annual Report 1980, Subtask 7.12 Plant Ecology Studies, May, 1981.

10. University of Alaska, School of Agriculture and Land Resources Management, Alaska Humanities Forum, U.S. Forest Service, Bureau of Land Management, North American Forest Lands at Latitudes North of 60 Degrees, Proceedings of a Symposium at the University of Alaska, Fairbanks, September 19-22, 1977.

11. Zasada, J.C., Alaska's Interior Forests, Journal of Forestry 74(6):333-341, June, 1976.