

Appraisal Assessment of Tributary  
Storage Potentials  
Kittitas Valley, Washington

June 2, 1989

**CHM HILL**

This Document Has Been Prepared Under the Direction  
of a Registered Professional Engineer



The cost estimates in this document have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding fees must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding.

By  
CH2M HILL  
June 1989

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## BACKGROUND

On May 15, 1989 CH2M HILL was hired by the United States Bureau of Reclamation (USBR) to perform an Appraisal Assessment of Tributary Storage Potentials in the Kittitas Valley, Washington by purchase order No. 9-PG-10-10680. The project scope, as contracted, is attached as Appendix A. The purpose of the study was to ascertain if any potential exists for storing spring run-off in the headwaters of tributary streams to the upper Yakima River for release in low flow months to enhance anadromous fish spawning in the system.

## PHASE I

Phase I of the assignment consisted of performing a map reconnaissance of six stipulated tributaries to the upper Yakima River, identifying any possible storage sites with a probable storage potential of 5,000 acre-feet or more, and estimating the developable reservoir capacity of each of those sites. The information which was developed was presented in matrix form to the Enhancement Technical Activities Group (ETAG) on May 18th, see Appendix B. A mosaic map made of United States Geological Survey (USGS) topographic maps showing the location of the candidate sites was also furnished to the ETAG.

The map reconnaissance had located 18 sites on the six streams for discussion and screening. During the May 18th meeting, 12 of the sites were provisionally discarded from further consideration due to various factors including locations too low on the tributary stream, minimal watershed run-off area, or remoteness.

After the May 18th meeting of the ETAG, two senior CH2M HILL engineers made a reconnaissance tour of all the sites (16) which were accessible by road. During these visits the authenticity of the USGS topographic maps was examined as it related to the general topographic accuracy of the maps at the selected sites. With the exception of the Buck Meadows site on Manastash Creek, the terrain matched the topographic maps quite well. Since the contour intervals on the USGS maps were 80 feet in most cases, it was decided that an actual field survey of a profile along the axis of each proposed dam site would be required to allow cost estimates to have reasonable validity.

On May 24th, another orientation meeting was held with the ETAG as well as some additional agency representatives to discuss the impressions gathered during the reconnaissance tour. See Appendix C for meeting attendance roster. At that meeting, a site in the lower reaches of Swauk Creek which has exceptionally good physical characteristics was discussed, but eliminated because of existing commercial

development and the fact that the site is located relatively low on the tributary.

The Washington Department of Game representative discussed the big game habitats that are present in the mountain meadows at are the proposed reservoir pool sites. It was suggested that the contractor should observe both the North Fork and South Fork sites on Taneum Creek to see if the North Fork site, which apparently has less wetlands habitat, could be substituted for the South Fork site. An aerial fly-over of those two sites was then performed on May 24th. The weather was not conducive to mountain flying, but we were able to observe the North Fork tributary and could not identify a site there with the storage potential of the South Fork site.

During the air reconnaissance tour, color slides were photographed of each of the final four study sites. These sites are shown in Figure 1 and are as follows:

Teanaway River - Middle Fork

Taneum Creek - South Fork

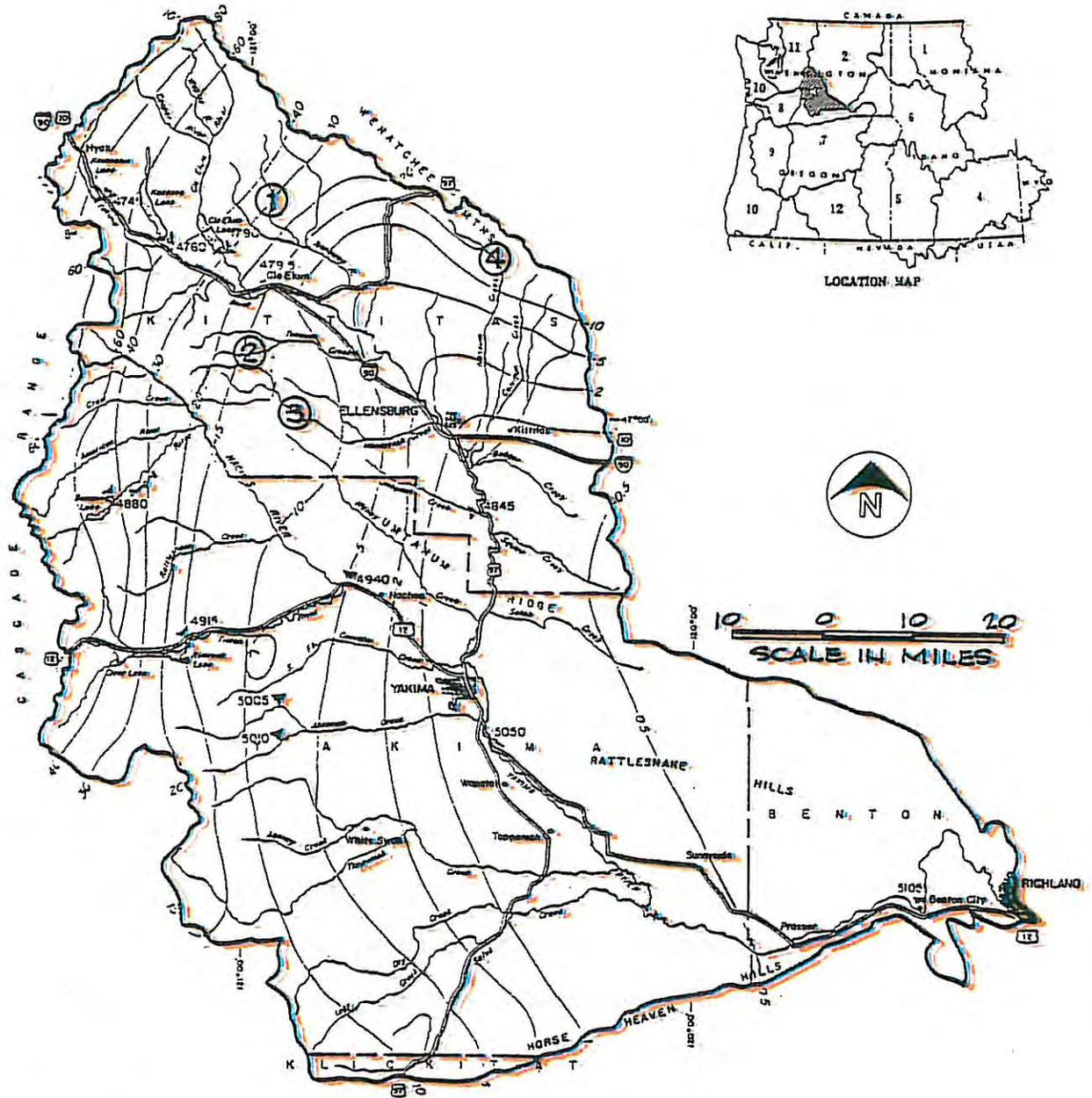
Manastash Creek - Buck Meadows

Naneum Creek - Walter Flat

With the reduction of the study locations to four sites, Phase I of the assessment was complete.

RESERVOIR SITES:

1. TEANAWAY RIVER - MIDDLE FORK
2. TALEUM CREEK - SOUTH FORK
3. MANASTASH CREEK - BLICK MEADOWS
4. NANEUM CREEK - WALTER FLAT



**Figure 1**  
**SITE LOCATION MAP**

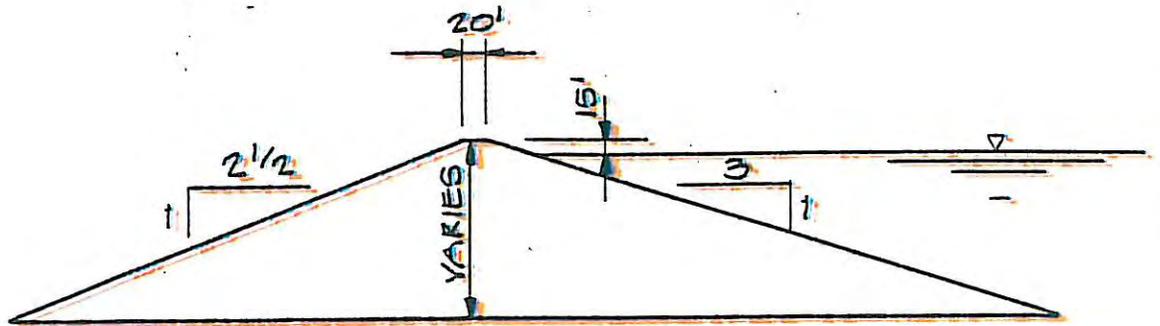
## PHASE II

### METHODOLOGY

#### ESTIMATES

The four sites which were selected for study were each visited again by a senior civil engineer and survey crew. Observations were made and measurements taken as the basis for the quantity and cost estimates. Unit price cost allowances were made for the major components of a dam, i.e. clearing, site development, foundation treatment, dam embankment, spillway and stilling basin (where applicable), control tower, outlet pipe, valves and gates. Typical dam cross-sections are shown in Figure 2. To the total of these budget allowances, we added a 25 percent contingency factor. To that subtotal, we added a 20 percent allowance for administration, legal, and engineering costs.

These order of magnitude cost estimates were made for dams of both 100 feet and 150 feet in height for all four of the sites. In addition, at the Teanaway River site we estimated costs in 50-foot increments for dams up to and including 350 feet in height. These rough estimates are presented in the summary fact sheet for each site and in a summary matrix in the closing text.

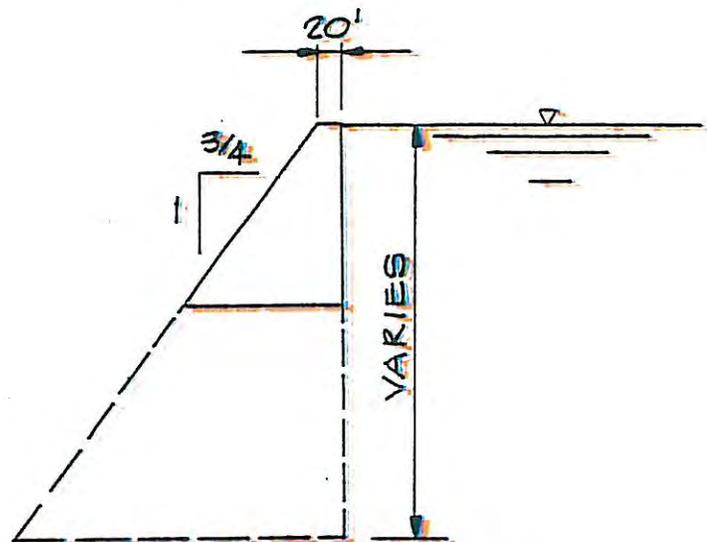


TYPICAL CROSS SECTION

EARTHFILL DAM

NTS

TANEUM CREEK - SOUTH FORK  
 MANASTASH CREEK - BUCK MEADOWS



TYPICAL CROSS SECTION

ROLLCRETE DAM

NTS

TEANAWAY RIVER - MIDDLE FORK  
 NANEUM CREEK - WALTER FLAT

Figure 2

TYPICAL DAM CROSS SECTIONS

## ANNUAL RUN-OFF

Hydrological information was developed by measuring the area of each watershed upstream of the proposed dam site and calculating the mean annual run-off using the isopleths developed for that area by the Pacific Northwest River Basin Commission, see Appendix D. The wet year (maximum) and dry year (minimum) run-offs were computed by pro-rating the normal year (mean) in the same ratio as historical records show these relationships to exist at the Cle Elum River stream flow gage. The estimated run-off is shown for each site in the summary fact sheets.

## GEOLOGY

The geological characteristics of the selected areas were obtained from a review of the published available geologic literature and maps. References used include:

1. Cushman, D.C., 1984, Geology and Sedimentary Petrology of the Taneum/Manastash Creeks Area, Kittitas County, Washington, Masters Thesis, Eastern Washington University, Cheney, Washington.
2. Tabor, R.W.; Waitt, R.B.; Frizzell, V.A.; Swanson, D.A.; Byerly, G.R.; and R.D. Bentley, 1982, Geologic Map of the Wenatchee 1:100,000 Quadrangle, Central Washington, U.S. Geological Survey, Miscellaneous Investigations Series, Map I-1311.

3. Walsh, T.J.; Korosec, M.A.; Phillips, W.A.; Logan, R.L.; and H.W. Schasse, 1987, Geologic Map of Washington Southwest Quadrant, Washington Division of Geology and Earth Resources, Geologic Map GM-34, Scale 1:250,000.

Sites visits were also made by a senior dam design engineer.

The existence of any faults and slides is of special interest to the USBR and is discussed below:

Faults have been mapped in the vicinity of both the South Fork Taneum Creek and the South Fork Manastash Creek sites. None of the faults are believed to be active. Additional studies concerning the faults should only be undertaken after it has been determined that the site is a desirable location for a dam.

Landslides have been identified in close proximity to each of the dam sites or in or adjacent to the future reservoirs of the dams. Additional field studies will be required to establish what effects, if any, the landslides may have on the proposed dam sites. Only those slides which are within the excavation area for the dam should be studied first.

Landslides within the reservoir areas should be studied after the dam site has been proven feasible. At any site selected for further study, the geology should be studied in detail to determine the feasibility of the project and the inherent risks involved with construction near or on landslides.

Future geotechnical explorations should be conducted in the following order:

1. Prove the adequacy of the dam location.
2. Locate potential construction materials.
3. Determine potential effects of landsliding.
4. Determine seismic potential for the dam site.

There is no point in studying subsequent items if a dam site is unsuitable.

#### Teaway River - Middle Fork

The Teaway River - Middle Fork dam site is located in Township 21 North, Range 15 East, in the southwest quarter of Section 15 across the Middle Fork of the Teaway River. Bedrock at this location consists of basalt with interbedded tuff and breccia. A landslide has been mapped on the right abutment. The left abutment will be on rock. Small landslides have been mapped upstream and construction of the dam may inundate and initiate movement on these landslides. No faults have been mapped at this location.

#### Taneum Creek - South Fork

The Taneum Creek - South Fork dam site is located in Township 19 North, Range 15 East, in the east central portion of

Section 32 across the South Fork of Taneum Creek. A fault approximately 1-1/2 miles in length has been mapped above the left abutment and additional fault traces may be encountered along the dam axis and within the pool area. Both abutments appear to be founded on andesite, a volcanic rock which has been described as being weathered and interbedded with tuffs and breccias. Directly upstream from the dam axis a large landslide has been mapped. Construction of a dam at this location would flood the base of the landslides and could potentially re-initiate movement of the slide.

#### Manastash Creek - Buck Meadows

The Manastash Creek - Buck Meadows dam site is located in Township 18 North, Range 15 East, in the central portion of Section 26 across the South Fork of Manastash Creek. Fault traces are present within a mile of the dam site, but none have been mapped at the dam site. At this site, a large portion of the surrounding area has been mapped as a massive landslide. At the proposed site, the left abutment has been mapped as basalt with interbeds of sandstone, siltstone and conglomerate. The right abutment and the areas to be flooded by the construction of the dam is part of the massive landslide.

#### Naneum Creek - Walter Flat

The Naneum Creek - Walter Flat dam site is located in Township 20 North, Range 19 East, in the northeast quarter of

Section 22. At this location, both abutments appear to be located on basalt. Thin interbeds of sandstone or siltstone may also be present. Another massive landslide occupying many square miles of land area is present upstream of this location in the Naneum Basin. Depending on the height and exact location of the dam, the pool area may flood portions of this landslide. No faults have been mapped at this location.

TEANAWAY RIVER - MIDDLE FORK

TEANAWAY RIVER - MIDDLE FORK



Trail head approximately 1/2 mile  
to possible dam site



Middle Fork - showing ledge rock  
in canyon

TEANAWAY RIVER - MIDDLE FORK



Middle Fork - downstream from dam site



Ledge rock in Middle Fork Canyon

TĒANAWAY RIVER - MIDDLE FORK



Aerial view of reservoir impoundment  
area just upstream from narrow canyon



Aerial view of possible dam site

TEANANWAY RIVER - MIDDLE FORK

SITE DISCUSSION

The proposed dam site for the Teanaway River - Middle Fork is located on property owned by Boise Cascade Logging Company in Section 15, Township 21 North, Range 15 East W.M. There is a reach of river over 1,000 feet in length in a rather narrow canyon where a structurally sound dam site may be located. The specific location of a dam would be determined only after detailed geological investigations were satisfactorily completed. The reservoir pool (assuming a 150-foot depth at the dam) would extend northerly across Section 10. Section 10 is unique in ownership in that the center 160 acres is in private ownership (Mr. Chester Taylor) while the balance of the section is U.S. Forest Service land. If a deeper pool is created at this Teanaway site, the reservoir will extend farther to the north on Forest Service land.

At present, access to the possible dam site area is by foot or horse trail only. There is "jeep road" access to the Taylor property via an old logging road that drops down into the valley from the Teanaway Butte logging access road which is controlled by Boise Cascade Logging Company (locked gate). There are two cabins on the Taylor property, one of which is quite close to the river. As can be seen in the photos, vegetation in the dam and reservoir areas varies from heavily

timbered to open rock bluffs and river bottom meadows. Pine and fir trees are present, as are cottonwoods and various types of willows. At present recreation use is quite light. However, during the big game hunting season a number of hunters enter the area on horseback.

#### FIGURES AND TABLE

The Teanaway River site is located at Mile Point 6.2 on the Middle Fork of the Teanaway River. Figures 3, 4, and 5 show the Site Map, Dam Site Profile, and Area/Capacity Curve respectively. They are followed by a Summary Fact Sheet.

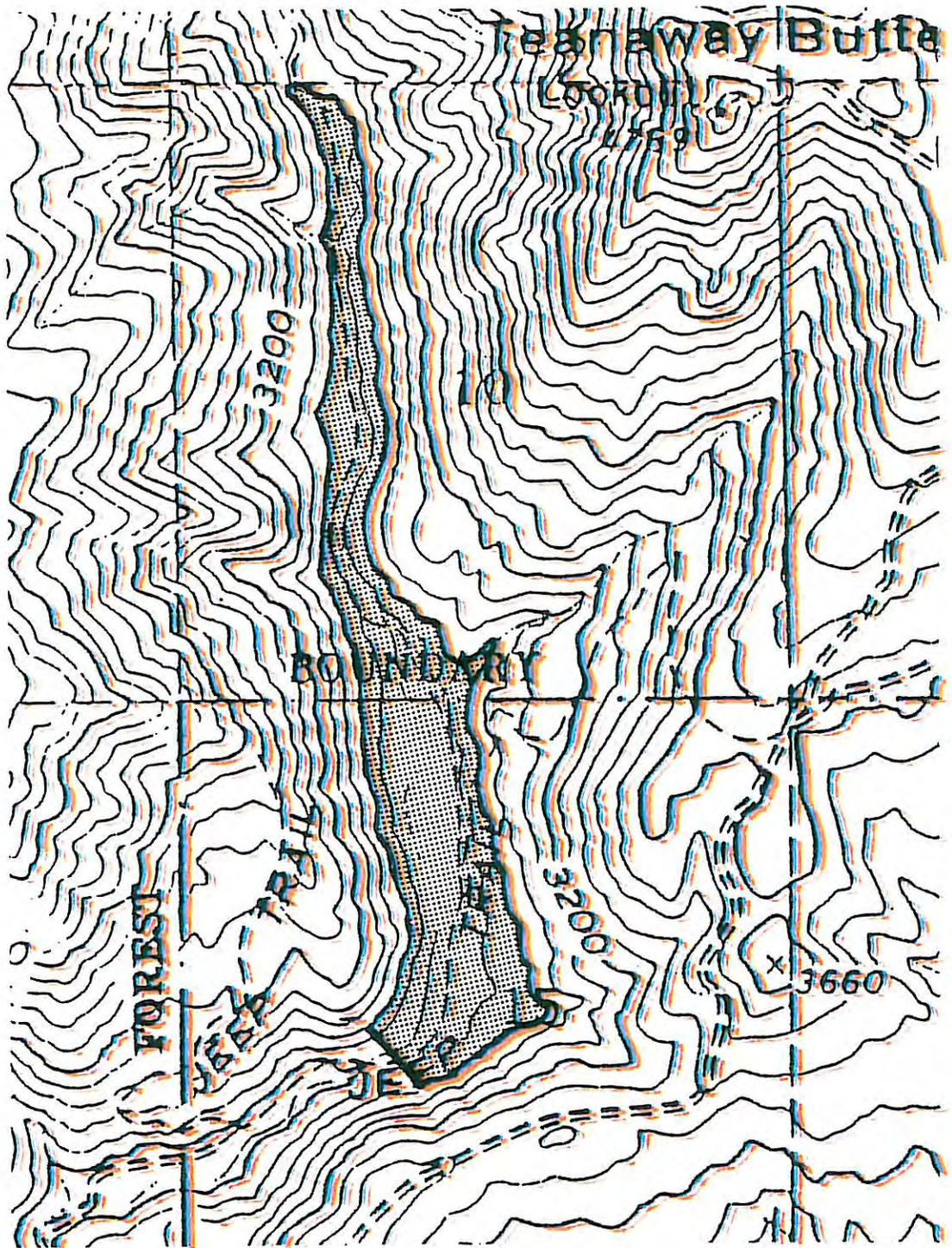
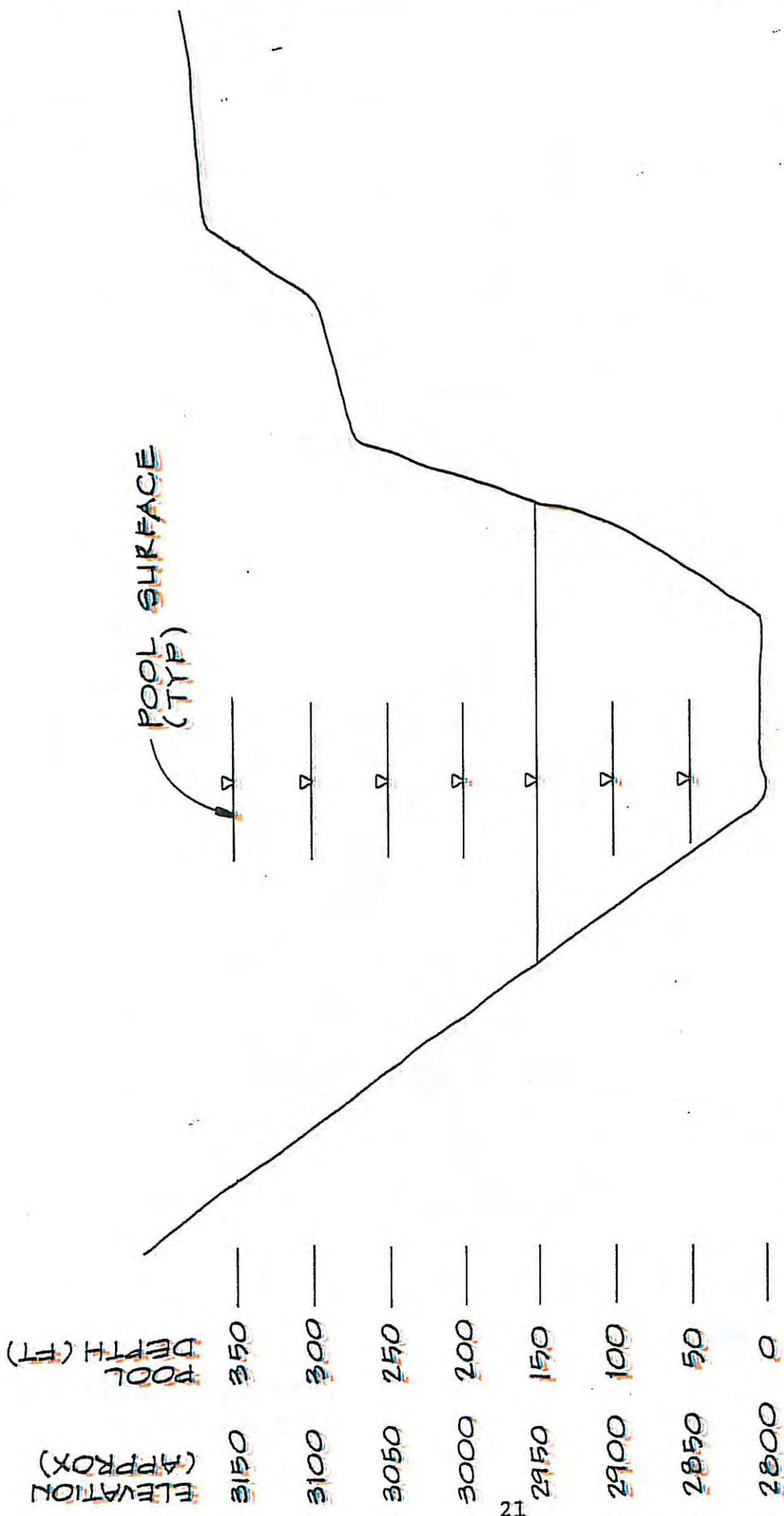


Figure 3  
**TEANAWAY RIVER - MIDDLE FORK  
SITE MAP**



VERT: 1" = 100'  
 HORIZ: 1" = 200'

Figure 4  
 TEAMAWAY RIVER - MIDDLE FORK  
 DAM SITE PROFILE (Axis)  
 (Looking Downstream)

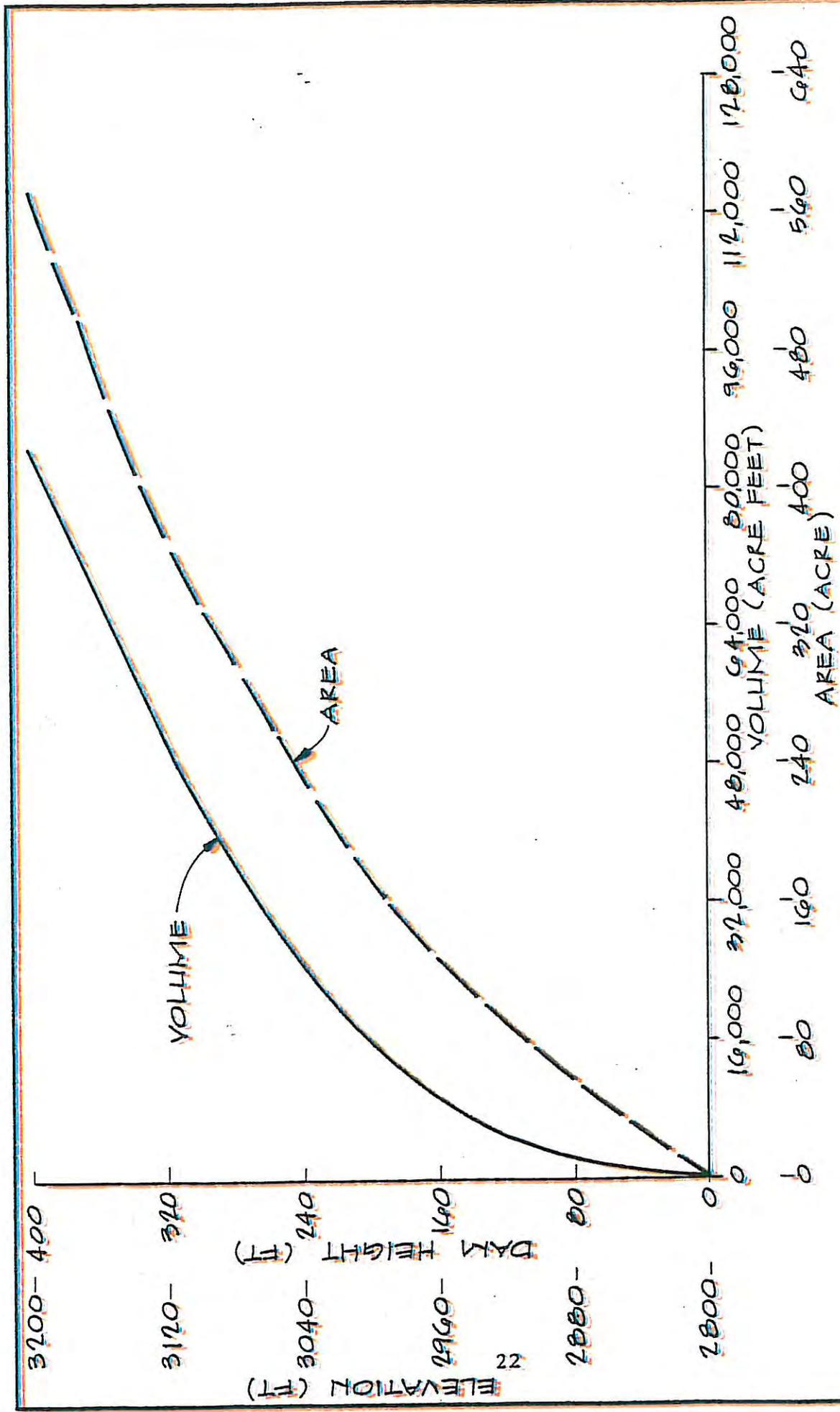


Figure 5  
 TEANAWAY - MIDDLE FORK  
 AREA / CAPACITY CURVE

SUMMARY FACT SHEET

Stream:	Teanaway River									
Site:	Middle Fork									
Location:	Mile Point 6.2									
	Sec. 15, T. 21 North, R. 15 East W.M.									
Type of Dam:	Rollcrete									
Reservoir Pool Depth (ft)	50	100	150	200	250	300	350			
Approximate Base Elevation	2800	2800	2800	2800	2800	2800	2800			
Reservoir Spillway Elevation	2850	2900	2950	3000	3050	3100	3150			
Dam Height (ft)	50	100	150	200	250	300	350			
Dam Crest Elevation	2850	2900	2950	3000	3050	3100	3150			
Dam Crest Length (ft)	360	490	594	695	796	1067	1207			
Reservoir Capacity (ac-ft)	1200	3600	8400	16,800	27,200	42,270	62,430			
Acres Inundated (ac)	35	72	118	172	252	335	445			
Length of Stream Inundated (mi)	.7	1.15	1.70	2.10	2.45	2.80	3.20			
Estimated Dam Cost (Mil dollars)	--	\$6.07	\$12.27	\$21.45	\$33.99	\$55.98	\$80.77			
Cost per Acre-Foot (dollars)	--	\$1700	\$1460	\$1280	\$1310	\$1330	\$1300			
Watershed Area (sq mi)	23.90									
Estimated Annual Run-off:										
Mean (ac-ft)	50,986									
Maximum (ac-ft)	90,755									
Minimum (ac-ft)	29,572									

Note: All measurements and quantities are approximate. They are taken from available USGS maps, other published data, and field reconnaissance. This data was developed for the purpose of comparing the sites to each other as guidance to the ETAG.

TANEUM CREEK - SOUTH FORK

-- TANEUM CREEK -- SOUTH FORK



Reservoir impoundment area



Impoundment area -- looking upstream  
from possible left abutment

TANEUM CREEK - SOUTH FORK



Possible right abutment area



South Fork Taneum Creek in meadows

## TANEUM CREEK - SOUTH FORK

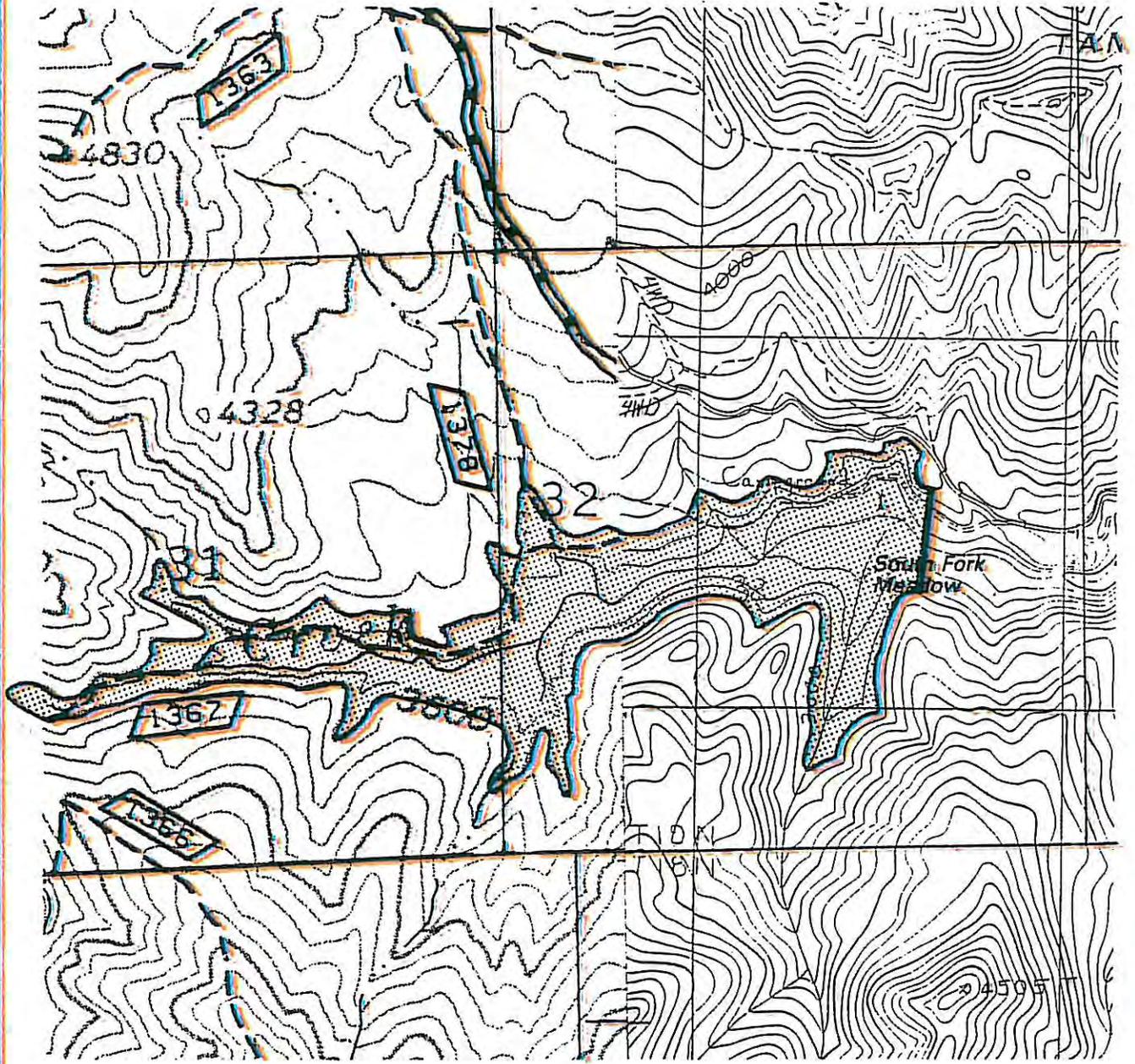
### SITE DISCUSSION

Access to the Taneum Creek - South Fork site is via an excellent quality forest road--portions have an asphalt surface while all of the road is well graded and gravelled to a point a few thousand feet from the site. The improved road then extends for many miles into an area currently being logged by Plum Creek Timber Company. A short unimproved section of road branches off the main road and drops down into the proposed reservoir area and dead ends within a few hundred feet of the proposed dam site at a U.S. Forest Service campground which is improved with a pit toilet and a couple of picnic tables. The upper end of the reservoir would be on Plum Creek property. Big game hunting no doubt goes on in this general area. No logging road would have to be relocated.

Pine and fir trees are in the vicinity as well as some tamarack. As is usually the case, deciduous trees and brush are growing along the stream in the meadow--primarily aspen and various willows. At present, there are some ponds and marshes along the creek in the meadow. This is an indication of how flat the valley floor is at the site. The site appears quite good from the terrain point of view. However, the mean annual run-off is not as great as at the sites located closer to the crest of the mountain ranges.

## FIGURES AND TABLE

The Taneum Creek site is located at Mile Point 2.8 on the South Fork of Taneum Creek. Figures 6, 7, and 8 show the Site Map, Dam Site Profile, and Area/Capacity Curve respectively. They are followed by a Summary Fact Sheet.



**Figure 6**  
**TANEUM - SOUTH FORK**  
**SITE MAP**

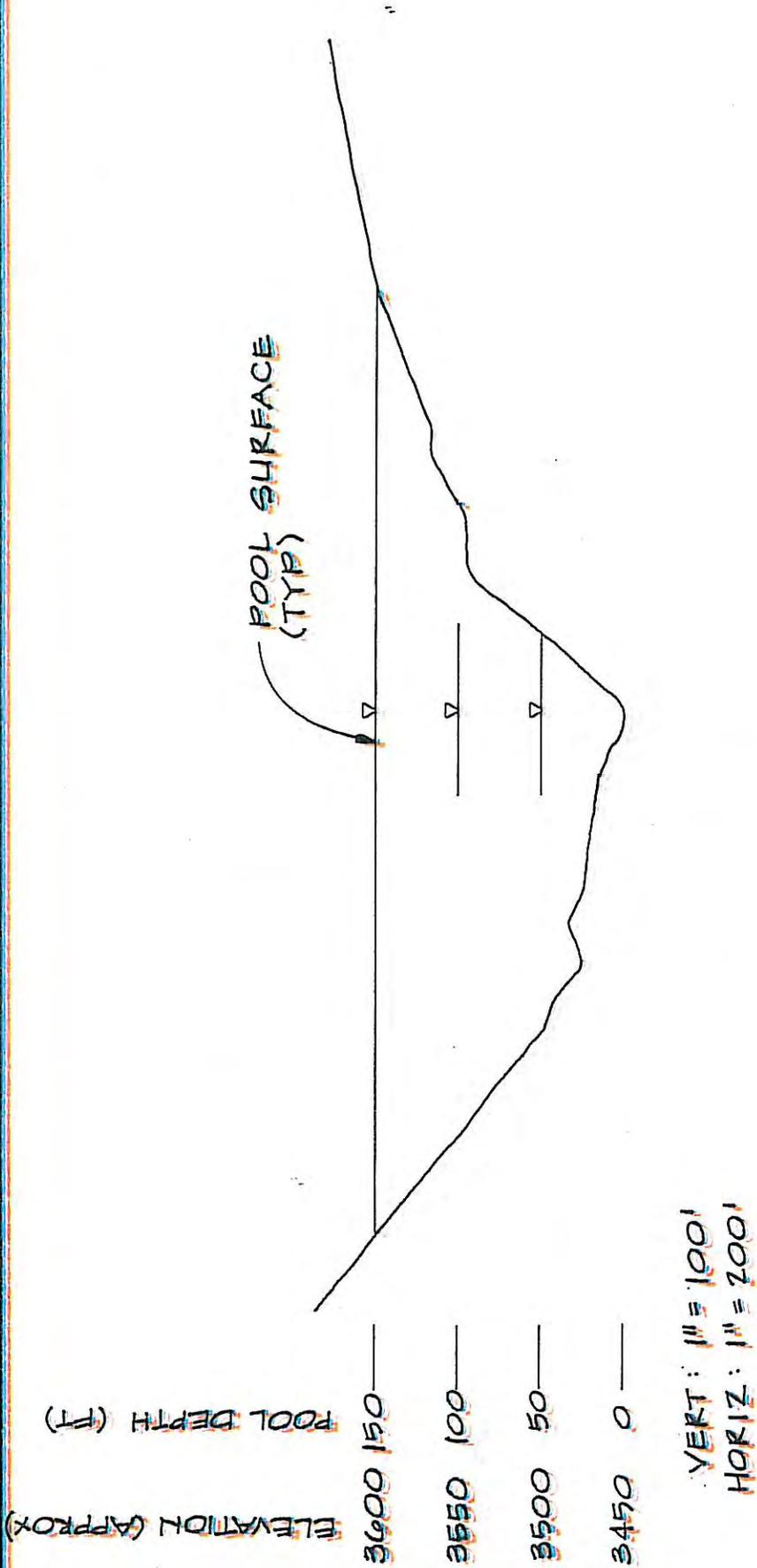


Figure 7  
 TANEUM CREEK - SOUTH FORK  
 DAM SITE PROFILE (AXIS)  
 (Looking Downstream)

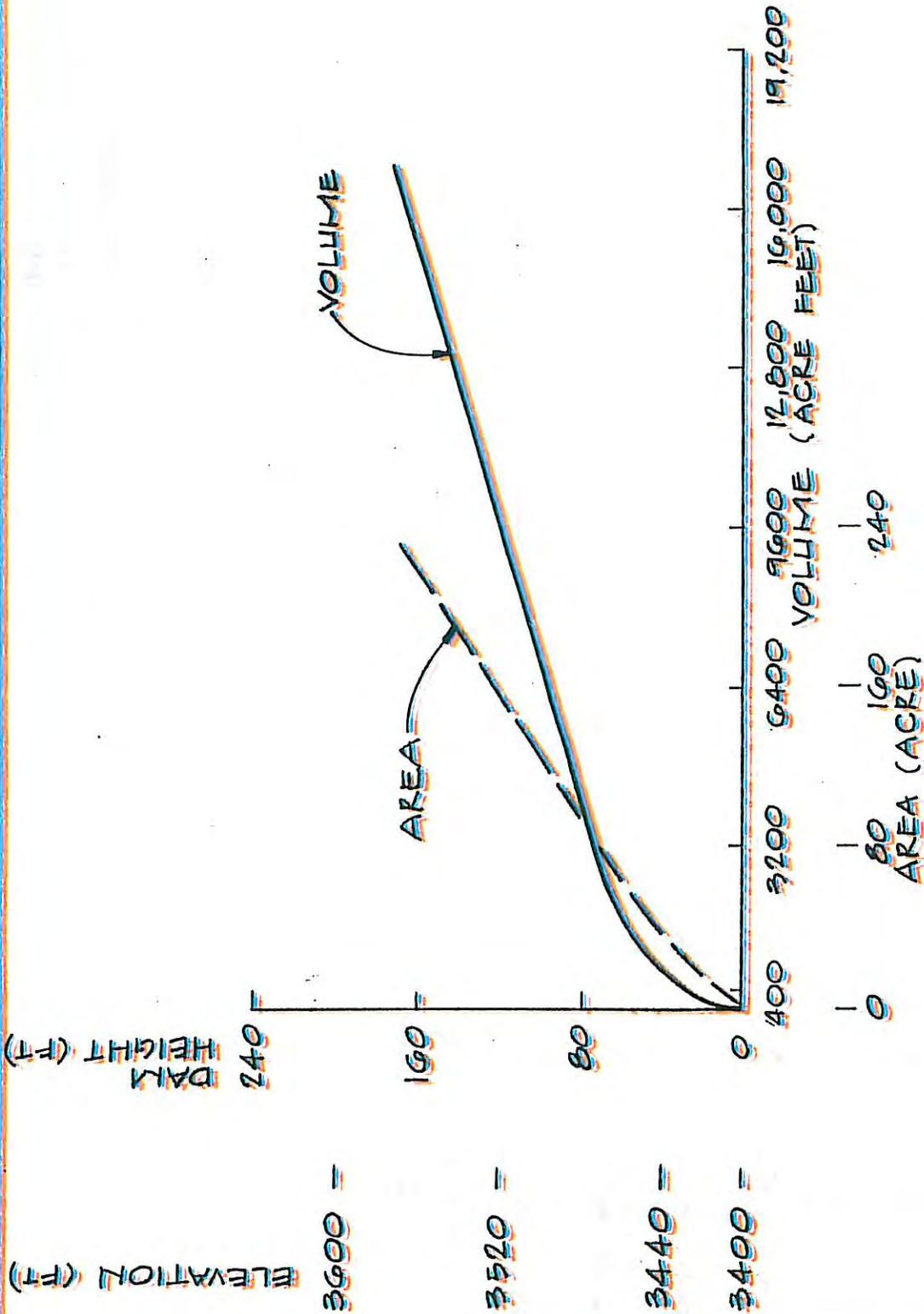


Figure 8  
 TANEYUM CREEK - SOUTH FORK  
 AREA / CAPACITY CURVE

SUMMARY FACT SHEET

Stream: Taneum Creek  
 Site: South Fork  
 Location: Mile Point 2.8  
 Sec. 32, T. 19 North, R. 15 East W.M.  
 Type of Dam: Earthfill

Reservoir Pool Depth (ft)	50	100	150
Approximate Base Elevation	3450	3450	3450
Reservoir Spillway Elevation	3500	3550	3600
Dam Height (ft)	65	115	165
Dam Crest Elevation	3515	3565	3615
Dam Crest Length (ft)	470	750	1200
Reservoir Capacity (ac-ft)	1200	6800	13,770
Acres Inundated (ac)	46	123	200
Length of Stream Inundated (mi)	.9	1.5	1.9
Estimated Dam Cost (Mil dollars)	--	\$6.6	\$13.78
Cost per Acre-Foot (dollars)	--	\$2060	\$1670
Watershed Area (sq mi)	12.56		
Estimated Annual Run-off:			
Mean (ac-ft)	10,048		
Maximum (ac-ft)	17,885		
Minimum (ac-ft)	5,828		

Note: All measurements and quantities are approximate. They are taken from available USGS maps, other published data, and field reconnaissance. This data was developed for the purpose of comparing the sites to each other as guidance to the ETAG.

MANASTASH CREEK - BUCK MEADOWS

MANASTASH CREEK - BUCK MEADOWS



Upper Manastash watershed



Buck Meadows - looking downstream  
toward dam site

MANASTASH CREEK - BUCK MEADOWS



Manastash Creek in dam site area



Aerial view of possible dam site

## MANASTASH CREEK - BUCK MEADOWS

### SITE DISCUSSION

Manastash Creek - Buck Meadows is the largest of the four open areas which are being evaluated. It is easily reached by a well maintained gravelled U.S. Forest Service road. The entire site is within the National Forest. Clear-cut logging has occurred on some of the watershed adjacent to the meadow.

Significant discrepancies were discovered between the USGS topographic maps dated 1958 and the new ones prepared in 1985. Land forms which appear definite on the maps do not correlate well with those observed in the field. A better dam site than the one which was surveyed may well exist downstream from the meadow. Again, as is the case at Naneum Creek, a higher dam with a shorter crest length may be possible to locate during the geologic testing that must occur if the Manastash site is selected for further study.

Because of the location of the Manastash watershed in relation to the crest of the Cascade Mountain Range, the mean run-off from the basin is not as productive per square mile as is the case at the sites which are farther north and west.

Pine and fir trees are mixed together in the area. Timber stands are quite dense on the hillsides, but sparse on the meadow floor. Cottonwoods and willows abound along the stream bank. The proposed reservoir would inundate some forest service road and an established campground. Road relocation would not be expensive however as the terrain is not difficult. All of the meadow habitat would not be inundated unless a very high dam is constructed.

#### FIGURES AND TABLE

The Manastash site is located on the South Fork at Mile Point 8.7 on the South Fork of Manastash Creek. Figures 9, 10, and 11 show the Site Map, Dam Site Profile, and Area/Capacity Curve respectively. They are followed by a Summary Fact Sheet.

SEC. 22, 23, 26; T. 18 N.; R. 15 E.

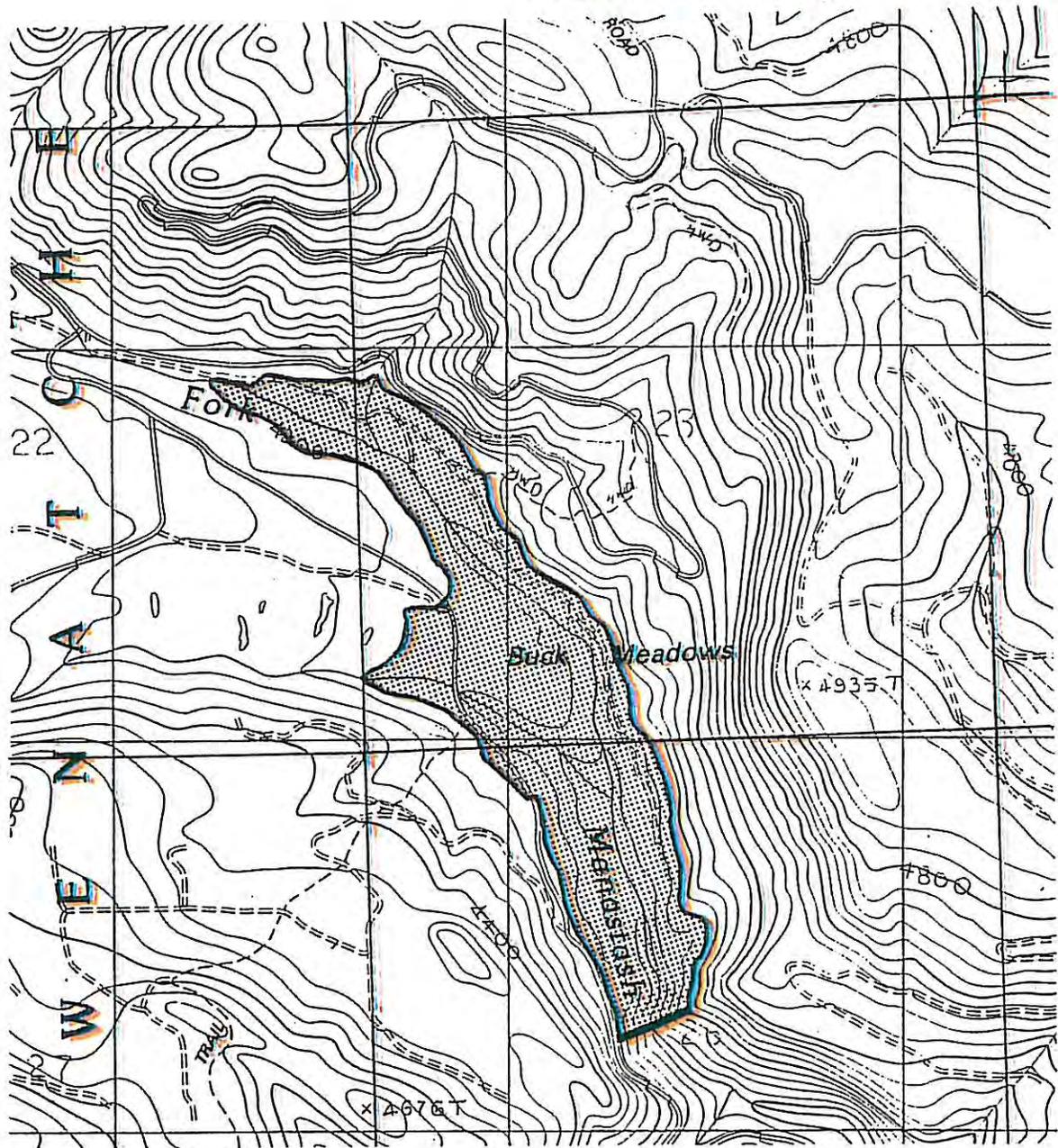


Figure 9  
MANASTASH - BUCK MEADOWS  
SITE MAP

ELEVATION (APPROX)	POOL DEPTH (FT)
4230	150
4180	100
4130	50
4080	0

VERT: 1" = 100'  
 HORIZ: 1" = 200'

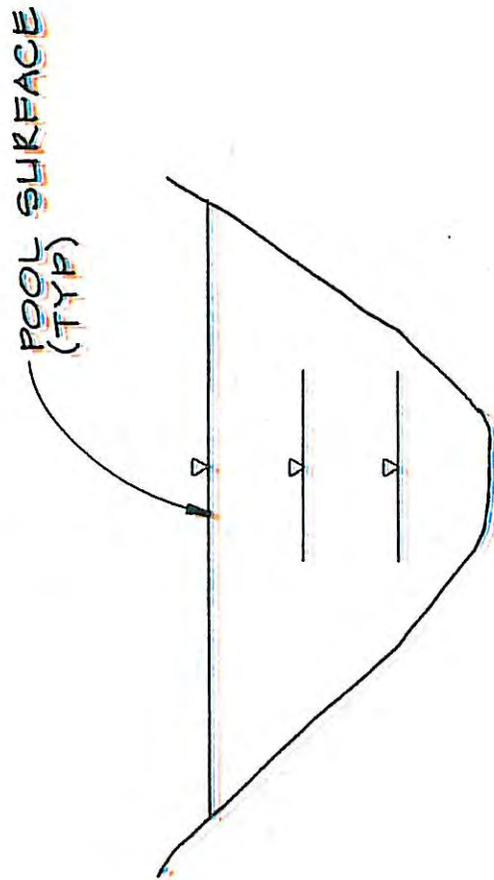


Figure 10  
 MANASTASH CREEK - BUCK MEADOWS  
 DAM SITE PROFILE (Axis)  
 (Looking Downstream)

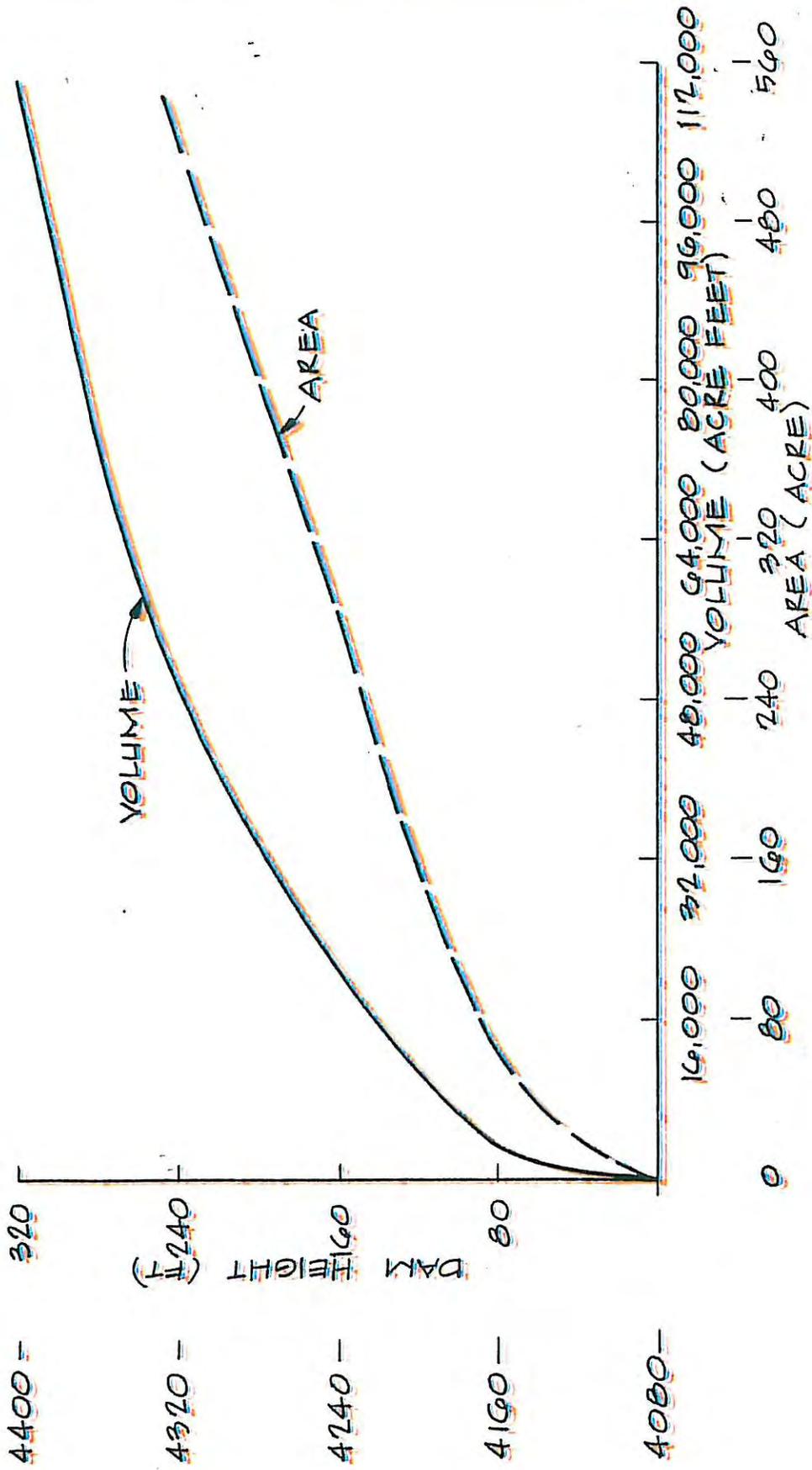


Figure 11  
 MANASTASH CREEK - BUCK MEADOWS  
 AREA / CAPACITY CURVE

SUMMARY FACT SHEET

Stream: Manastash Creek  
 Site: Buck Meadows  
 Location: Mile Point 8.7  
 Sec. 26, T. 18 North, R. 15 East W.M.  
 Type of Dam: Earthfill

Reservoir Pool Depth (ft)	50	100	150
Approximate Base Elevation	4080	4080	4080
Reservoir Spillway Elevation	4130	4180	4230
Dam Height (ft)	65	115	165
Dam Crest Elevation	4145	4195	4245
Dam Crest Length (ft)	360	590	730
Reservoir Capacity (ac-ft)	1500	7000	17,500
Acres Inundated (ac)	30	100	250
Length of Stream Inundated (mi)	.9	1.5	2.4
Estimated Dam Cost (Mil dollars)	--	\$8.73	--
Cost per Acre-Foot (dollars)	--	\$1240	--
Watershed Area (sq mi)	17.62		
Estimated Annual Run-off:			
Mean (ac-ft)	14,096		
Maximum (ac-ft)	25,091		
Minimum (ac-ft)	8,173		

Note: All measurements and quantities are approximate. They are taken from available USGS maps, other published data, and field reconnaissance. This data was developed for the purpose of comparing the sites to each other as guidance to the ETAG.

NANEUM CREEK - WALTER FLAT

NANEUM CREEK - WALTER FLAT



Walter Flat - looking downstream



Walter Flat - looking upstream

NANEUM CREEK - WALTER FLAT



Naneum Creek at entrance to canyon



Looking down on Naneum Creek  
in possible dam site area

## NANEUM CREEK - WALTER FLAT

### SITE DISCUSSION

The area proposed for the dam and reservoir on Naneum Creek has excellent access via an improved logging road jointly controlled by Boise Cascade Lumber Company and Washington State Department of Natural Resources. Boise is presently logging in an area upstream of the reservoir site on DNR land. If a reservoir is constructed at the Walter Flat site, a couple of miles gravelled road will have to be re-located. However, the terrain and geology in the area are not difficult for road building, so that would not be an expensive item.

Pine trees and fir trees are both present in the vicinity of the proposed site. There are cottonwoods and other various members of the willow family growing along the stream banks. A large percentage of the reservoir floor would not require clearing since it is in open meadow. The meadow extends upstream considerably above any possible inundated area so a considerable amount of meadow habitat would remain.

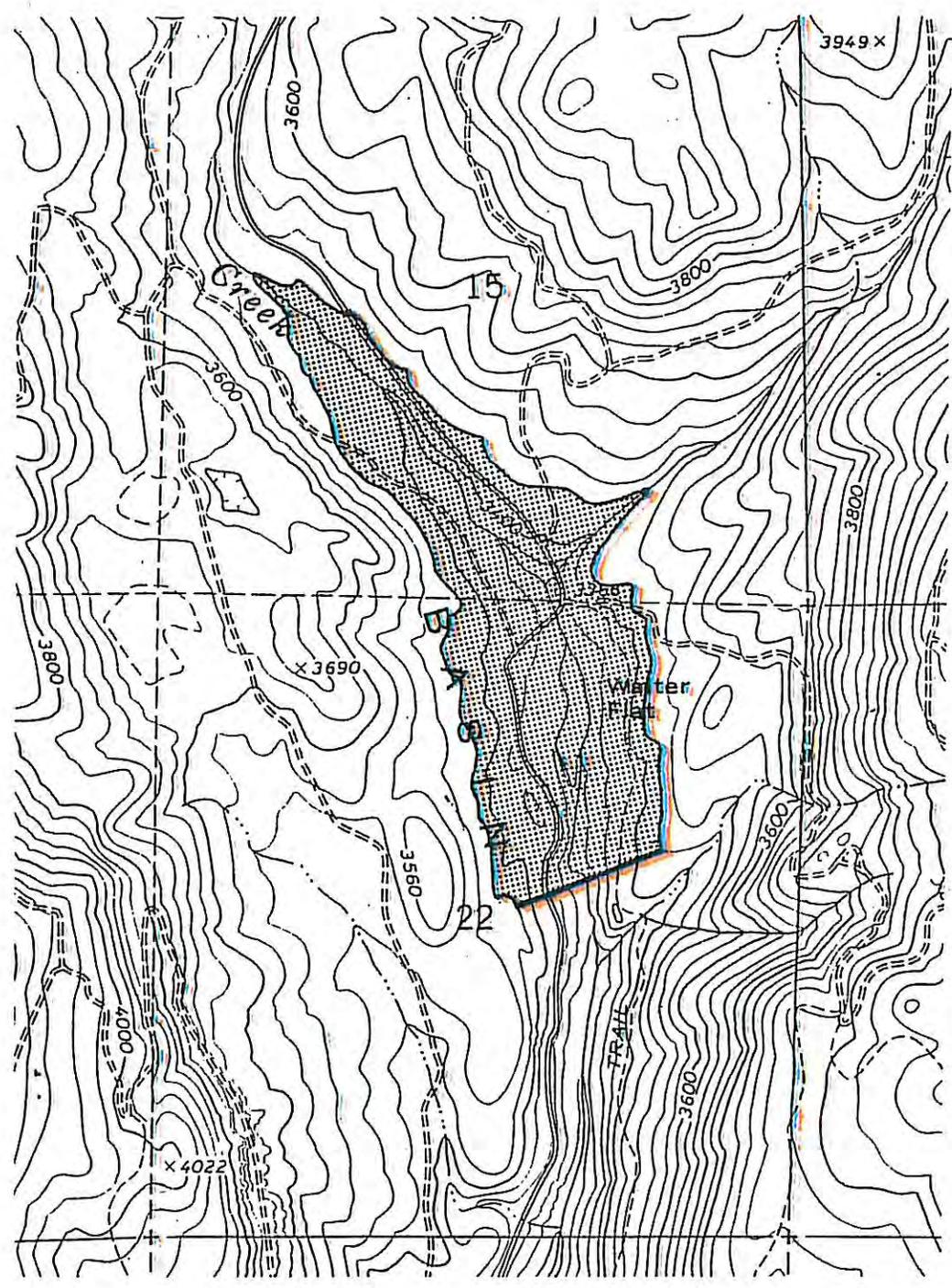
The measurements upon which the estimate for this site was made were taken right where the meadow ends at the entrance to a rather narrow valley or canyon. About 1,500 feet downstream the canyon is even narrower but a dam would have to

be about 60 feet higher to produce the same water surface elevation. As is the case for each of the study sites, some extensive geological testing will be required to select the best dam site in the corridor available for a dam downstream from Walter Flat.

#### FIGURES AND TABLE

The Naneum site is located at Mile Point 20.4 on the Naneum Creek. Figures 12, 13, and 14 show the Site Map, Dam Site Profile, and Area/Capacity Curve respectively. They are followed by a Summary Fact Sheet.

SEC. 15, 22 ; T. 20 N. ; R. 19 E.



**Figure 12**  
**NANEUM CREEK - WALTER FLAT**  
**SITE MAP**

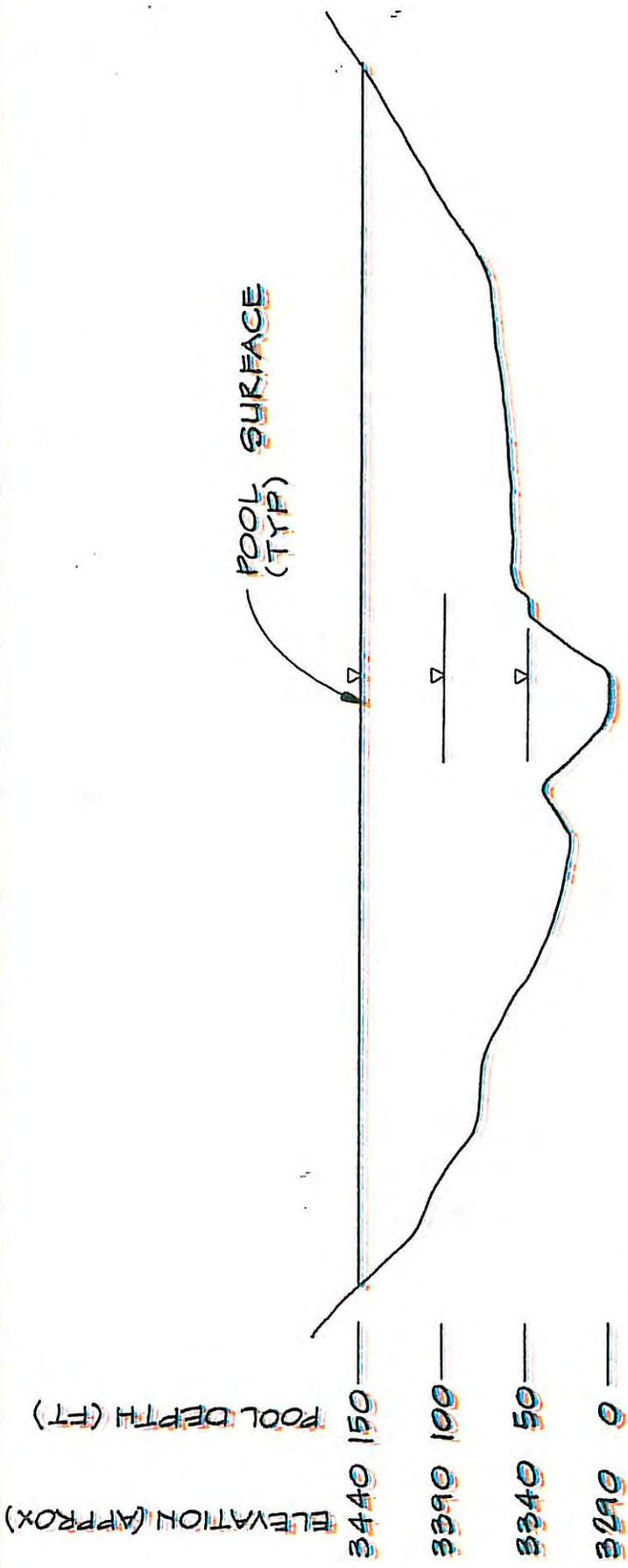


Figure 13  
 NANEUM CREEK - WALTER FLAT  
 DAM SITE PROFILE (Axis)  
 (Looking Downstream)

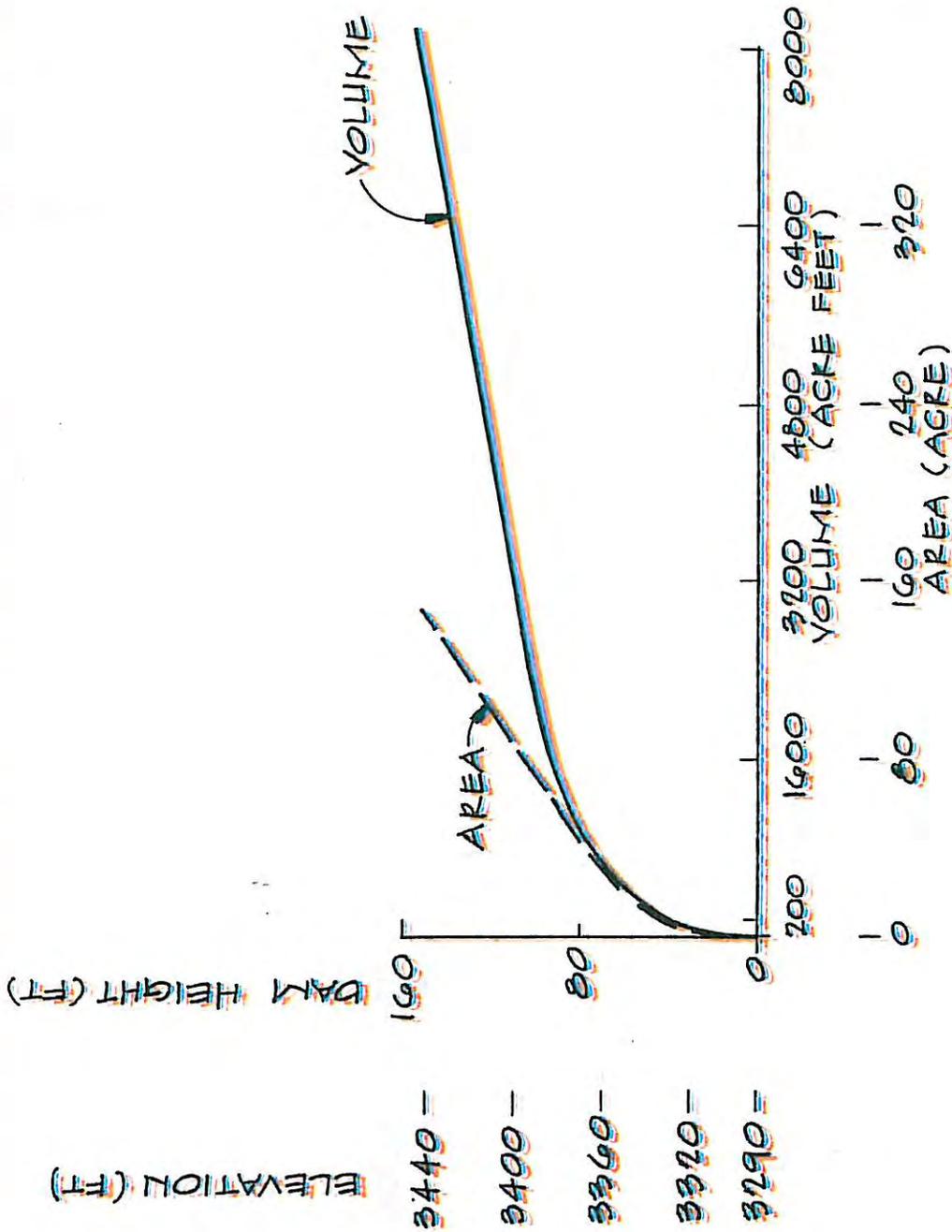


Figure 14  
 NANEUM CREEK - WALTER FLAT  
 AREA / CAPACITY CURVE

SUMMARY FACT SHEET

Stream: Naneum Creek  
 Site: Walter Flat  
 Location: Mile Point 20,4  
 Sec. 22, T, 20 North, R. 19 East W.M.  
 Type of Dam: Rollcrete

Reservoir Pool Depth (ft)	50	100	150
Approximate Base Elevation	3290	3290	3290
Reservoir Spillway Elevation	3340	3390	3440
Dam Height (ft)	50	100	150
Dam Crest Elevation	3340	3390	3440
Dam Crest Length (ft)	457	1166	1462
Reservoir Capacity (ac-ft)	300	2000	7500
Acres Inundated (ac)	10	70	144
Length of Stream Inundated (mi)	.6	.7	1.2
Estimated Dam Cost (Mil dollars)	--	\$6.60	\$16.51
Cost per Acre-Foot (dollars)	--	\$3300	\$2200
Watershed Area (sq mi)	46.43		
Estimated Annual Run-off:			
Mean (ac-ft)	44,572		
Maximum (ac-ft)	79,338		
Minimum (ac-ft)	25,852		

Note: All measurements and quantities are approximate. They are taken from available USGS maps, other published data, and field reconnaissance. This data was developed for the purpose of comparing the sites to each other as guidance to the ETAG.

APPENDIX A

Project Scope

APPRAISAL ASSESSMENT OF TRIBUTARY STORAGE POTENTIALS  
KITTITAS VALLEY, WASHINGTON

Extent of Assessment: The work described herein shall be limited to the identification and evaluation of potential storage sites on the following Kittitas Valley tributaries:

1. Big Creek
2. Taneum Creek
3. Manastash Creek
4. Teanaway River, upstream of the forks
5. Swauk Creek
6. Naneum Creek

Process: The work shall be divided into two phases: Phase I site identification, and Phase II site evaluation.

Information to be Provided:

Phase I--Potential storage sites, with a capacity of 5,000 acre-feet and greater, shall be identified on a topographical map, and an estimated "order of magnitude" of reservoir capacity indicated. This information shall be provided to the Enhancement Technical Activities Group who, in consultation with the contractor, shall specify those sites that it desires the contractor to proceed with Phase II work.

Phase II--For the potential storage sites specified by the Enhancement Technical Activities Group a reproducible documentation report of the information discussed below shall be provided for each site.

1. Identification and delineation of legal description and mile location of potential storage sites.
2. The estimated annual runoff (long-term average and wet year, dry year, and normal runoff year) at the potential damsites and information on how determined (from historical measurements or correlation).
3. The range of reservoir capacities at the site indicating:
  - a. dam crest elevation
  - b. dam height
  - c. reservoir capacity
  - d. acres inundated
  - e. vegetation inundated (types and acres)
  - f. length of stream inundated

An area-capacity curve shall be prepared for each site showing the relationships among reservoir pool elevation, dam height, acres inundated, and reservoir storage capacity.

4. Land ownership, roads, railroads, dwellings, current vegetative conditions, current and anticipated special designations of area, proximity to national forests, wild and scenic areas, and wilderness areas.

5. Anticipated type of structure that could be constructed and estimated storage construction costs for a range of reservoir capacities and a storage/cost curve for each damsite.

6. A description of the geological characteristics of the area specifically as it relates to any faults and slides.

7. Topographical maps of each potential damsite indicating the location of the dam and the maximum reservoir capacity.

8. If possible, photographs of each potential reservoir area.

In addition to the documentation report, summary fact sheets and a reproducible drawing indicating the location of all storage sites specified in Phase II shall be prepared.

Field Review: Where possible, a field review of potential storage sites shall be conducted for orientation of the Enhancement Technical Activities Group. The field tour may, if necessary, be made after June 2, but prior to June 10.

Time Frame: Draft documentation reports and the summary fact sheets shall be provided as completed. The final documentation reports, summary fact sheets, and the composite location drawing shall be provided not later than June 2, 1989, to the designated Contracting Officer.

APPENDIX B

Phase I Matrix

SUBJECT: YAKIMA RIVER BASIN  
 STORAGE RESERVOIRS - DATA

BY: JES DATE: 5-12-69  
 SHEET NO. --- OF ---  
 PROJECT NO. ---

NUMBER	RESERVOIR SITE NAME	DAM HEIGHT						WATERSHED AREA (SQ.MI.)	NOTES	HABITAT ENHANCED (MI)
		50'		100'		150'				
		DAM CREST LENGTH (FT)	VOLUME (AC-FT)	DAM CREST LENGTH (FT)	VOLUME (AC-FT)	DAM CREST LENGTH (FT)	VOLUME (AC-FT)			
1	BIG CREEK	200	700	530	2500	790	6800	11.34		
2	TANEUM CREEK :									
2a	UPPER SITE	860	1300	990	4300	1190	11,300	60.23		
2b	LOWER SITE	790	1800	860	6300	1120	14,000	70.78		
2c	NORTH FORK	530	400	570	2000	710	5,500	14.25		
2d	SOUTH FORK	260	400	330	3200	1060	8,400	12.56		
3	MANASTASH CREEK :									
3a	BUCK MEADOWS	360	1500	590	7000	730	17,500	17.62		
3b	ISLAND	320	320	450	1550	580	4,050	32.89		
3c	LOWER	240	350	420	2000	890	5,100	41.09		
4	TEANAWAY RIVER :									
4a	MIDDLE FORK	330	1200	490	3600	650	8,400	23.90		
4b	INDIAN CREEK	460	600	880	2400	1150	6,950	5.07		
4c	BEAR CREEK	870	600	690	2200	1010	6,400	15.36		
4d	STAFFORD JUNCTION	690	900	910	5050 *	-	CABINS	48.52	* CABINS	
4e	DE ROUX CAMP	850	800	1120	2730	1280	6700	7.60		
5	SWAUK CREEK :									
5a	YAKIMA RIVER SIPHON	300	2800	450	9600	600	22,000	95.30		
5b	HIDDEN VALLEY	390	3900	390	13,160 *	-	CABINS	85.10	* CABINS	
5c	HURLEY CREEK	540	800	490	3000	700	6700	3.08		
6	NANEUM CREEK :									
6a	CITY SITE	790	985	1010	3770	1170	8370	68.21		
6b	WALTER FLAT	520	300	780	2000	1300	7500	46.43		

APPENDIX C

Attendance Roster



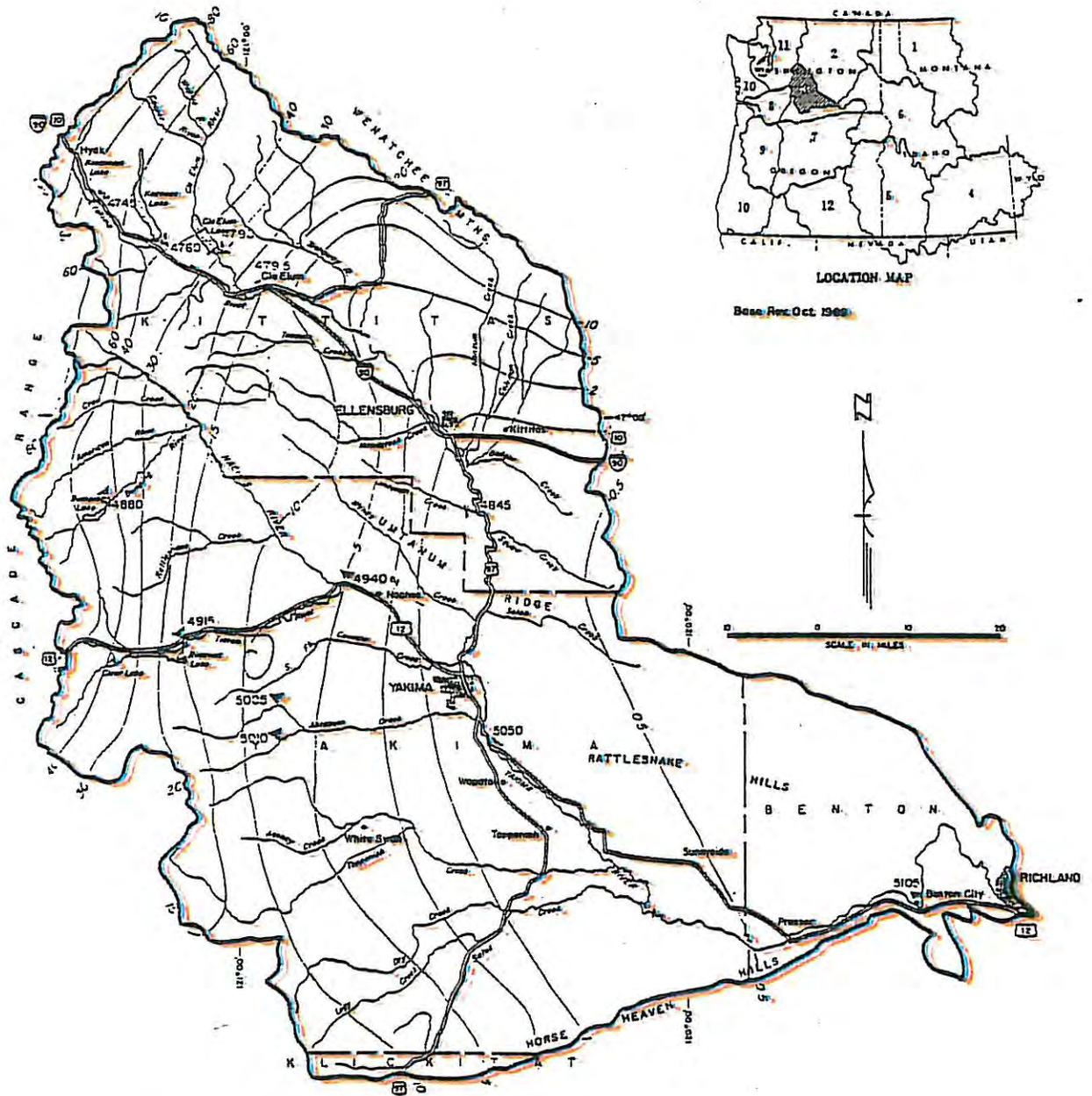
MEETING MAY 24, 1989 8:00 AM  
AT CH2M HILL

## ATTENDANCE

<u>NAME</u>	<u>AGENCY</u>
Walter Lerrick	Irrigation District
Bob Tuck	YFN
T.C. Richmond	Governor's Office
Brent Penfrum	WOW
John Easterbrooks	WDF
LARRY KINSON/HALEK	BR
Ken Slattery	Ecology
STU TREERY	WSIDA
JOHN MAMO	CH2M
MAY ST GEORGE	"

APPENDIX D

Run-off Isopleths



**EXPLANATION**

 **3980** STREAM GAGE-RECORDING

**Notes**

(1) MEAN ANNUAL RUNOFF ISOPLETHS FOR NATURAL FLOW CONDITIONS WERE DERIVED USING OBSERVED STREAM FLOWS, CLIMATOLOGICAL DATA, DEPLETIONS, AND PHYSIOGRAPHIC FEATURES OF THE BASIN FOR THE PERIOD 1931-1960.

(2) STREAM GAGING STATIONS SHOWN ARE SELECTED STATIONS AND ARE NOT THE ONLY STATIONS USED IN PREPARING THE RUNOFF MAP.

COLUMBIA-NORTH PACIFIC  
COMPREHENSIVE FRAMEWORK STUDY  
**MEAN ANNUAL RUNOFF**  
**IN INCHES**  
YAKIMA SUBREGION 3

1968

FIGURE 186



