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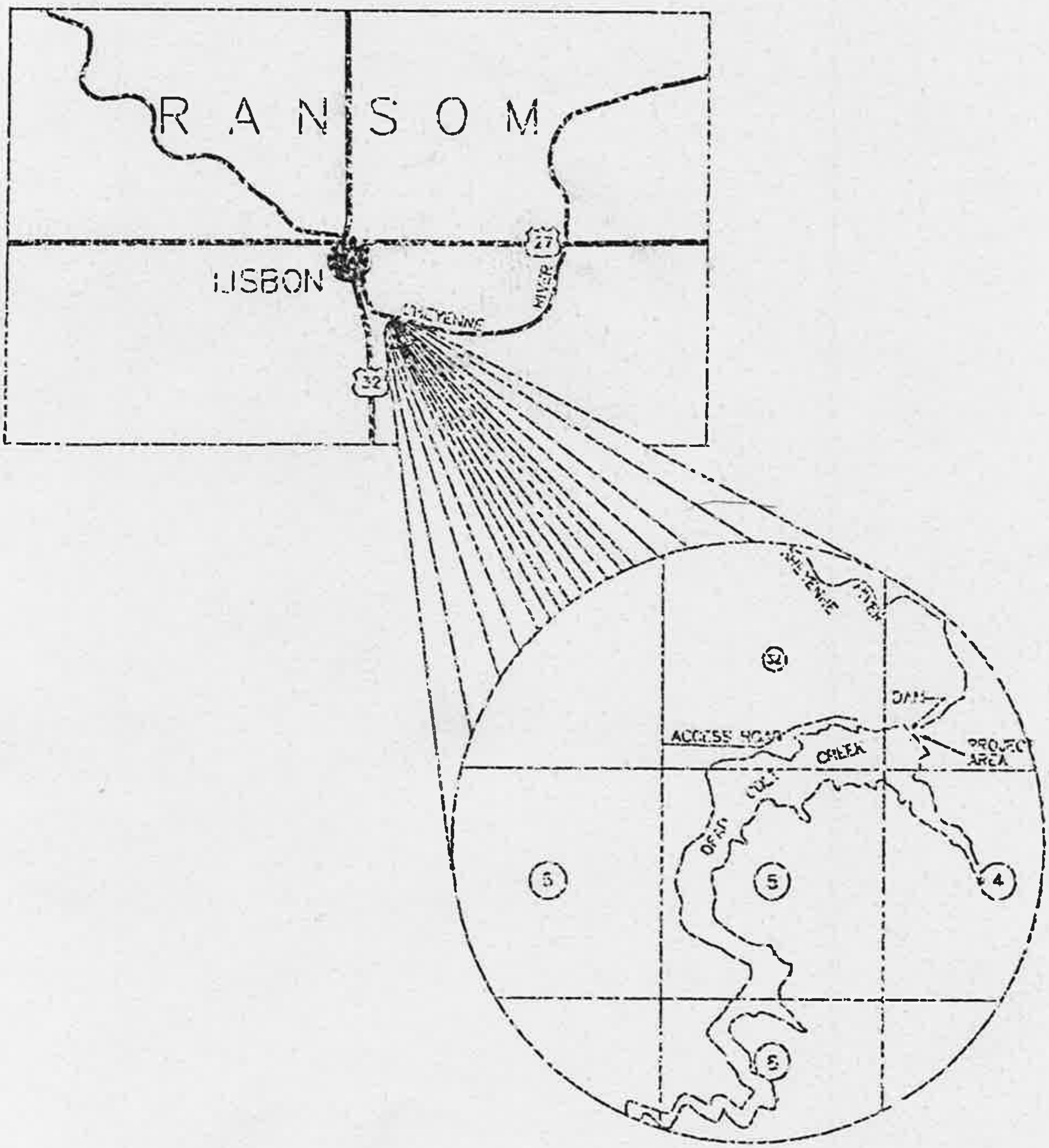
FEASIBILITY STUDY
FOR SEEPWATER PUMPING SYSTEM
DEAD COLT CREEK DAM
SWC #1671
RANSOM COUNTY



NORTH DAKOTA
STATE WATER COMMISSION

SEPTEMBER 1981

PRELIMINARY ENGINEERING REPORT

Dead Colt Creek
Feasibility Study for
Seep Water Pump Back System
SWC Project #1671

September 1991

North Dakota State Water Commission
900 East Boulevard
Bismarck, North Dakota 58505-0850

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DEAD COLT CREEK DAM
SEEP WATER PUMP BACK SYSTEM STUDY
SWC PROJECT #1671

Purpose and Scope:

Since Dead Colt Creek Dam was constructed in 1983, it has proved to be a popular water resource facility. An extensive recreation complex has been developed. However, because of this low runoff situation, the reservoir has been unable to maintain a steady pool level. This results in a reduction in the surface area and volume of the reservoir.

Besides the obvious effects of the loss of pool area for recreational purposes, there is also a less visible factor. This is the resultant shortage of water to operate the low-level drawdown system. This feature is provided to remove poor quality, eutrophic, contaminated water from the bottom of the reservoir. The low-level drawdown should ideally be operated twice a year, in late winter and in late summer, to discharge the stratified eutrophic layer from the bottom of the reservoir. This regular flushing action serves to release the accumulated nutrient laden layer and greatly improves the reservoir water quality. However, during the current dry cycle, there has not been any excess water available to accomplish this clean out function. One idea that has been presented by the water resource district is to capture the seepage water flow from the downstream channel.

Physiography and Geology:

The entire reservoir area is part of the Glaciated Plains, a glaciated slope east of the Missouri Coteau. This area is characterized by a surface of nearly level to undulating topography. The topography was produced by glacial erosion and deposition, but is controlled in part by the preglacial bedrock surface.

Most of Ransom County is drained by the Sheyenne River, which is part of the Red River of the North drainage system. The Sheyenne River valley is the most prominent physiographic feature in the area. At its confluence, with Dead Colt Creek in the NW1/4 of Section 33, Township 134 North, Range 55 West, the valley depth ranges between 75 to 100 feet and the valley width is approximately 2,500 feet.

Dead Colt Creek, an intermittent stream, occupies one of the larger tributary valleys of the Sheyenne River in Ransom County. The rolling to steep land found along the Sheyenne River also extends back into the Dead Colt Creek reservoir. The slopes, which are part of a deeply-incised topography, have been eroded by slope wash and small streams. The valley ranges from about 1,300 to 1,500 feet wide, with approximately 85 feet of relief at the dam site. Some of the steep valley walls are cut in till, while others have exposed sand and gravel deposits. Boulders are locally abundant.

Post construction surveillance of the seep water flows collecting in the downstream channel varied from about 0.35 cfs to about 1 cfs; well within the anticipated range. While this information tends to provide satisfactory details regarding the long-term safety status of the dam, it also reveals the magnitude of the losses from the reservoir. The objective of this study is to determine if this seep water can be collected and pumped back into the reservoir in order to preserve its level.

<u>Reservoir Losses</u>:

The losses previously mentioned appear to average about 200 gallons per minute (0.4456 cfs), equivalent to 322.62 acre-feet per year or approximately 3 feet off the top of the pool. This would be in addition to the evaporative losses which could be expected to be approximately another 1 1/2 feet.

The capability of being able to recapture some of the lost water could serve to replenish the reservoir during dry periods. The recycling of this lost water may be enough to sustain the reservoir during mild droughts. Other benefits may include the option of using the low-level drawdown system at more frequent intervals. These potential benefits may justify the cost of the pump back system.

<u>Seep Water Pump Back</u>:

The objective of this study is to evaluate the feasibility of installing a seep water pump back system. This would entail major advantage of offering about 23 feet less of total dynamic head to pump against, but would have some critical engineering and installation problems to surmount. The route over the dam would present a more straightforward installation problem, but would provide a continuously higher operating cost for a smaller rate of return flow because of the larger operating head. Calculations sheets for both alternatives are provided in the appendix.

The anticipated discharges of 180 GPM for the first case and 170 GPM for the second would appear to be both in the range where the seep water rate of flow could provide a constant source for a continuous pumping operation.

Reservoir Capacity:

The attached area-capacity curve shows the storage of the reservoir at the various elevations. The two pumping options could return about 190 acre-feet per year and 180 acre-feet per year, respectively. These figures indicate that approximately 2 feet of reservoir storage could be recaptured each year. This would improve the situation somewhat during a mild drought, but could not stop the inevitable drawdown.

The return flows may create a condition where the operators are more willing to regularly use the low-level drawdown. This would improve the water quality by draining off the bad quality bottom layer.

there may be a restriction against pumping during low flow periods.

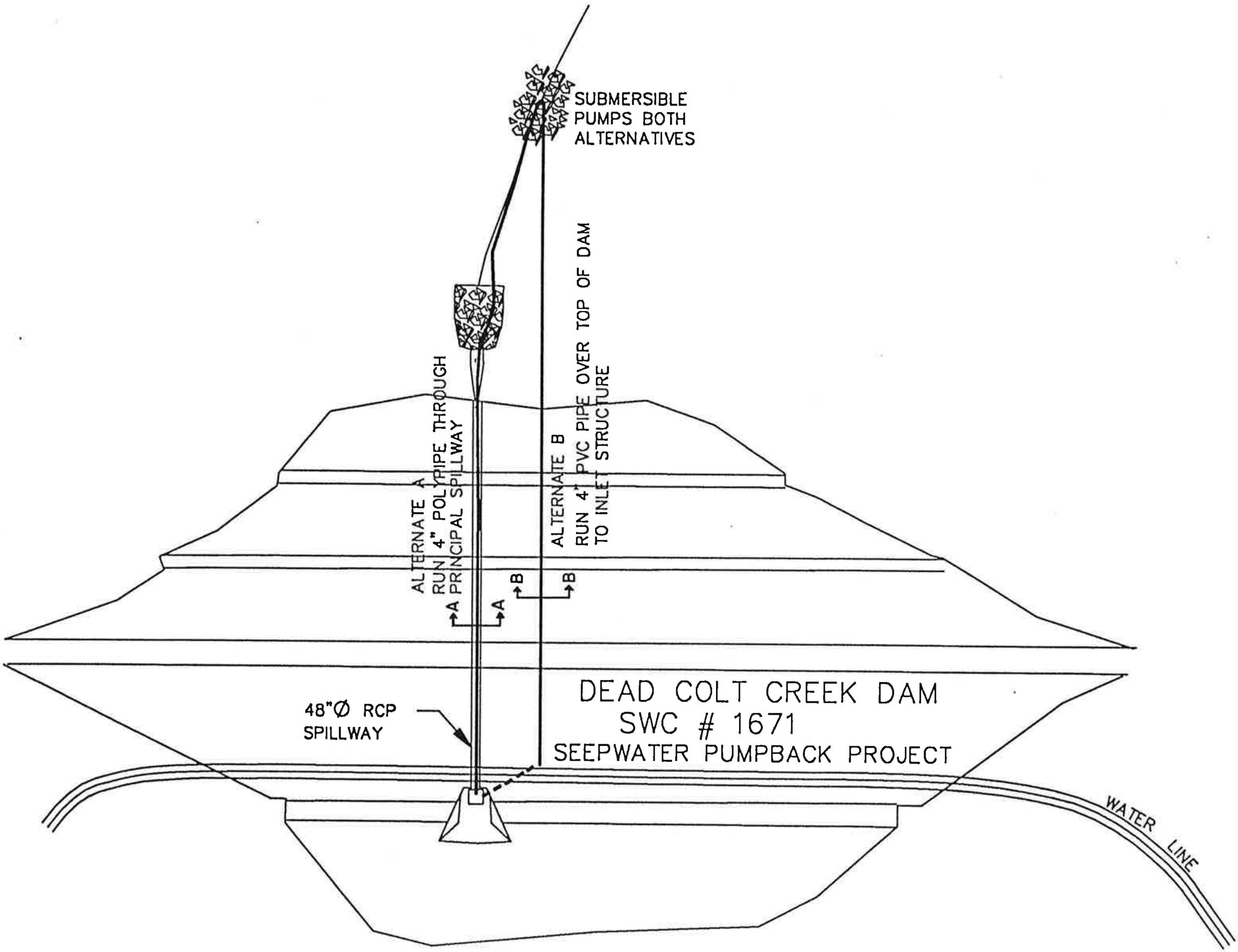
Overall, the project should be evaluated on the basis of whether either option is really needed and if either is worth the anticipated cost, and upon the benefit to cost ratio.

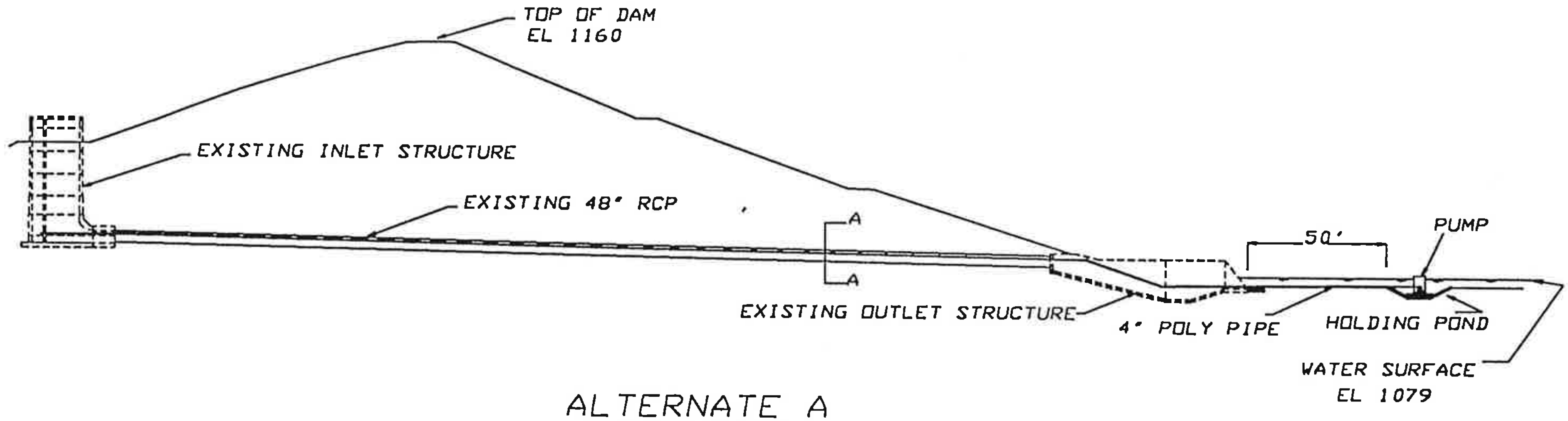
<u>Benefit to Cost Ratio</u>:

The estimated initial constructed cost of the preferred Alternative B is $28,400, and the annual pumping is estimated to be $1,121.17. Using the methods of engineering economy to evaluate the annualized cost of the initial investment, based upon an interest rate of 6 percent and a 25 year anticipated project life, the annual cost is determined to be $2,221.73. If the annual maintenance cost is assumed to be 3 percent of the initial cost, it is found to be $852.00, therefore, the total annualized costs are:

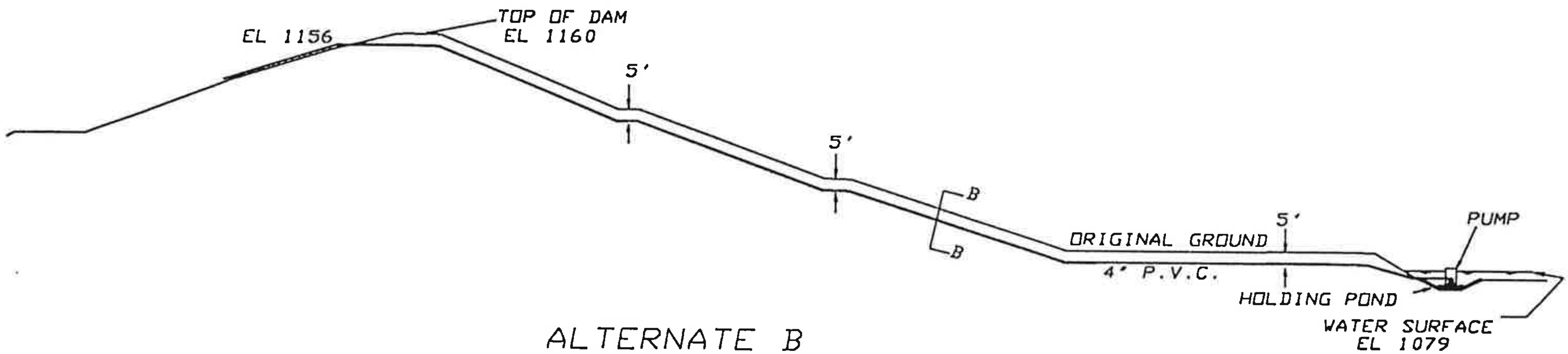
Annualized Construction Cost	$2,221.73
Annual Pumping Cost	1,121.17
Annual Maintenance Cost	852.00
Total Annual Cost	$4,149.90

The benefits of the project would be related to the additional recreational capability of the reservoir if the project were installed. It would appear that the pool would have a surface area of about 90 acres during a dry season without the pumping facility, but if it were used, the pool could be maintained about 2 feet higher with about 99 acres or


SUBMERSIBLE
PUMPS BOTH
ALTERNATIVES
ALTERNATE A
RUN 4" POLYPIPE THROUGH
PRINCIPAL SPILLWAY
ALTERNATE B
RUN 4" PVC PIPE OVER TOP OF DAM
TO INLET STRUCTURE
A
A
B
B
48"Ø RCP
SPILLWAY
DEAD COLT CREEK DAM
SWC # 1671
SEEPWATER PUMPBACK PROJECT
WATER LINE

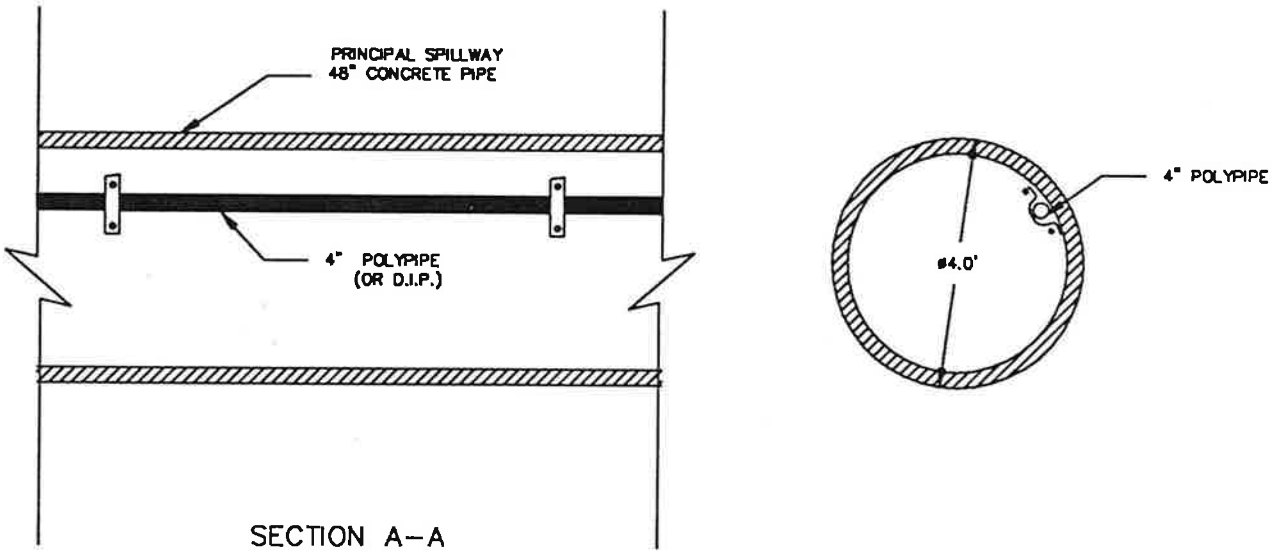


ALTERNATE A
POLYPIPE THROUGH
PRINCIPAL SPILLWAY



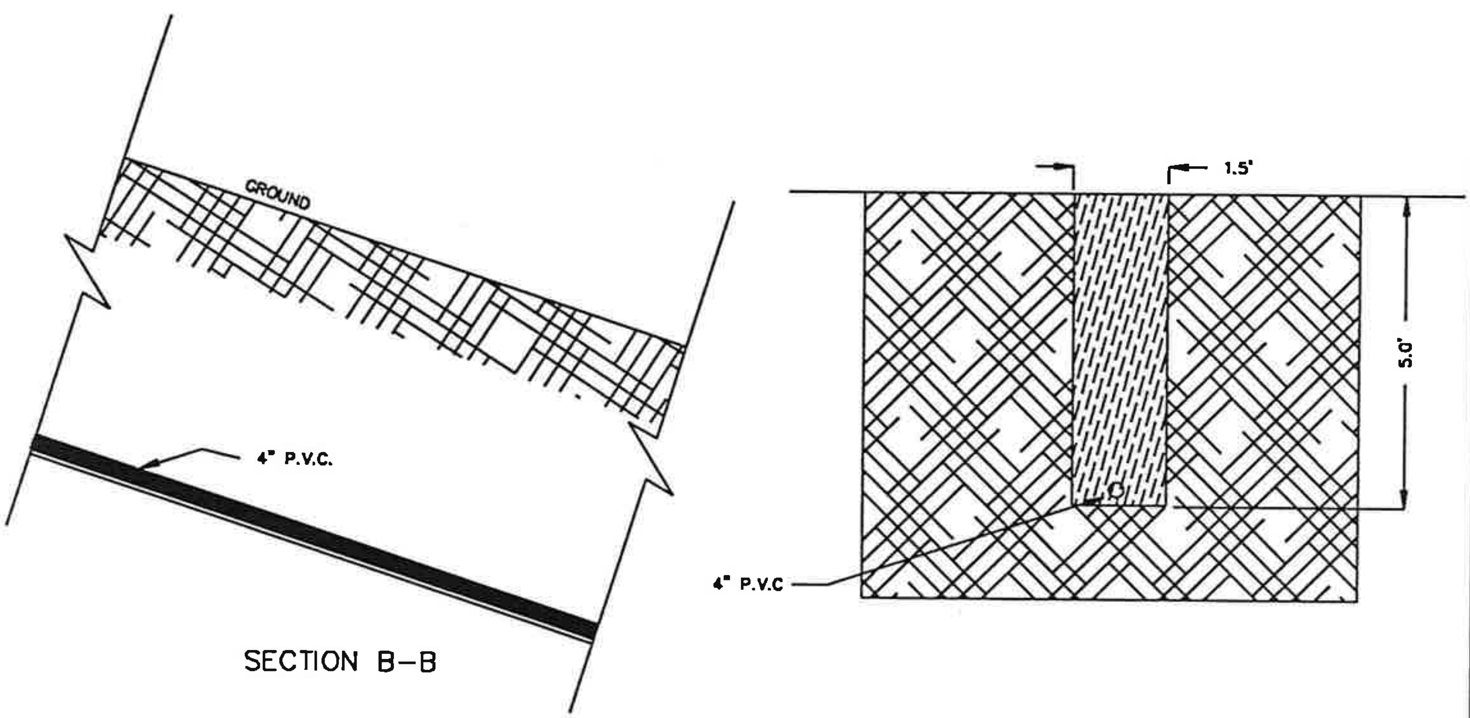
ALTERNATE B
P.V.C. TRENCHED IN
OVER TOP OF DAM

DEAD COLT CREEK DAM
SWC #1671



ALTERNATE A

PIPE INSIDE
PRINCIPAL SPILLWAY

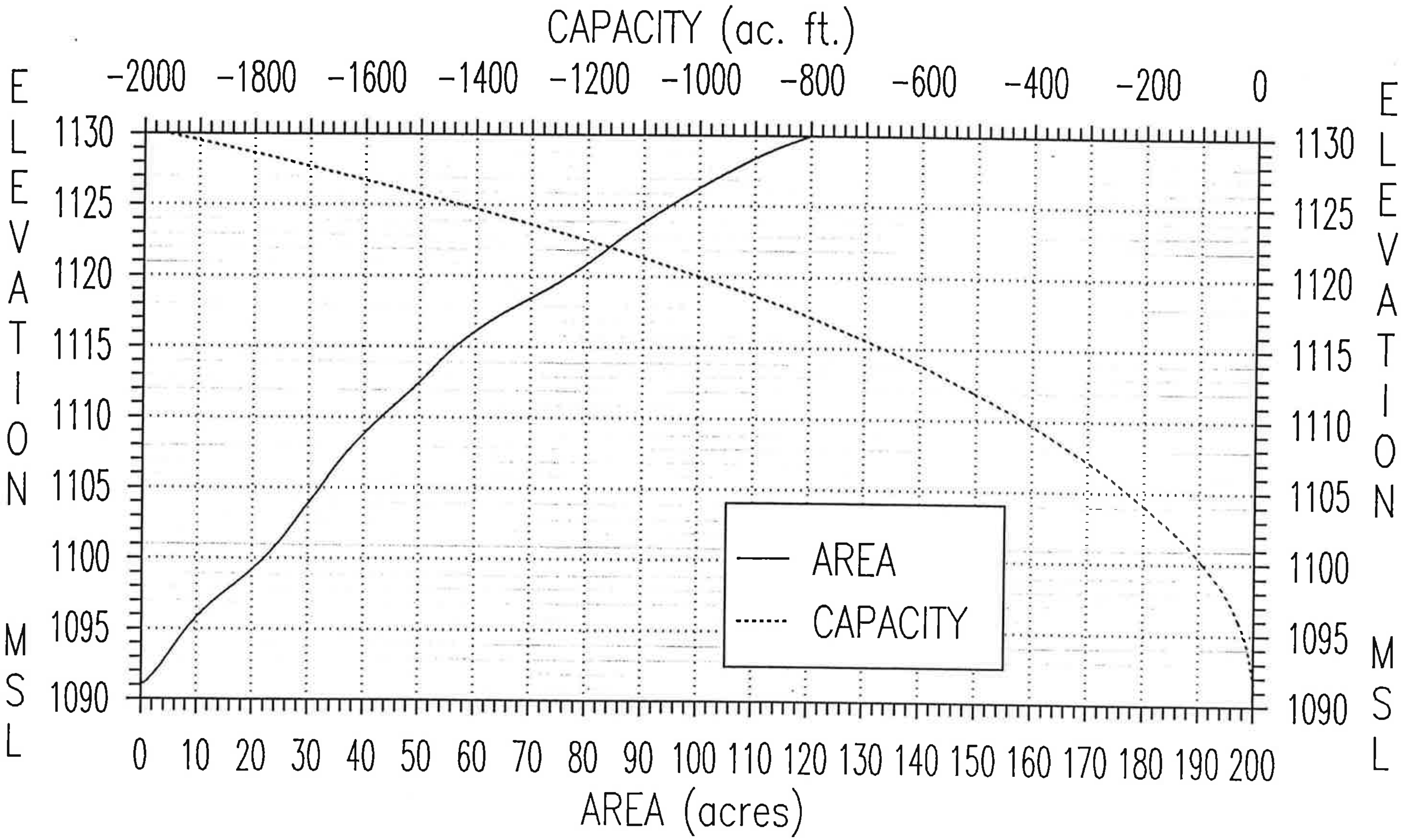


ALTERNATE B

TRENCH OVER TOP OF DAM

DEAD COLT CREEK DAM PROJECT #1671

AREA–CAPACITY CURVES



PROJECT:

COUNTY: RANSOM

LOCATION:

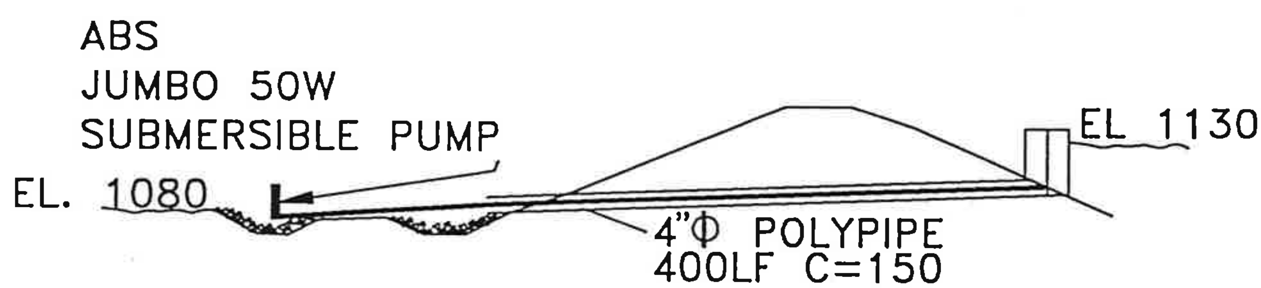
MAP DATE:1985

DATE: 1991 K.F.K.

ELEV. (msl)	DIST (FT)	SQ. AREA (acres)	SUM (acres)	1/2 SUM (acres)	CAPACITY (acft.)	ACCUMULATE CAPACITY (acft.)
1091		0.00				0
	1		2.69	1.35	1.3	
1092		2.69				1
	4		13.16	6.58	26.3	
1096		10.47				28
	4		32.59	16.30	65.2	
1100		22.12				93
	4		52.32	26.16	104.6	
1104		30.20				197
	4		68.28	34.14	136.6	
1108		38.08				334
	4		86.89	43.45	173.8	
1112		48.81				508
	4		108.49	54.25	217.0	
1116		59.68				725
	4		136.38	68.19	272.8	
1120		76.70				998
	4		167.52	83.76	335.0	
1124		90.82				1333
	4		198.76	99.38	397.5	
1128		107.94				1730
	2		227.82	113.91	227.8	
1130		119.88				1958
			119.88	59.94	0.0	

DEAD COLT CREEK DAM
SWC # 1671
DESIGN SEEP WATER PUMPBACK SYSTEM

ALTERNATIVE A: PUMP SEEP WATER THRU SPILLWAY



ASSUME: Q=180GPM=0.40107CFS=0.794118AF/DAY
STATIC HEAD(Hs) = 1130−1080 = 50FT
FRICTION HEAD(Hf) = 1.60FT/100FT x 4 = 6.4
VELOCITY HEAD(Hv) ≅ 0.25FT
PUMP LOSSES(Hp) ≅ ASSUME = 5.35

TOTAL DYNAMIC HEAD(TDH) =
Hs + Hf + Hv + Hp =
50'+6.4'+0.25'+5.35' = 62'

HORSE POWER(HP) = $\frac{Q\gamma_w H}{550}$
Q=CFS=0.401CFS
γ_w = 62.4LB/FT^3
H=TDH=62

HP = $\frac{0.401\ (62.4)\ 62}{550}$ = 2.82HP

ASSUME: EFFICIENCY = 70%
TOTAL = $\frac{2.82\text{HP}}{0.7}$ = 4.03HP
POWER REQUIRED(KW) = 0.746HP
KW = 4.03HP x 0.746 = 3.00KWP

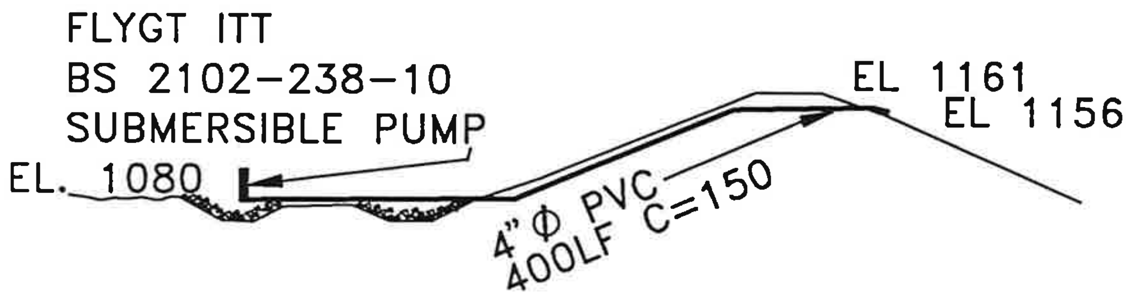
ASSUME: PUMPING 240 DAYS A YEAR
Qt = 0.794118AF/DAY x 240DAYS = 190.588 A.F./YEAR

POWER USED: 3.01 KW x 24HR/DAY x 240DAYS/YEAR =
17,280 KWHRS/YEAR

ASSUME COST = $0.05KWHR =
$0.05 x 17,280KWHR = $864.00/YEAR

DEAD COLT CREEK DAM
SWC # 1671
DESIGN SEEP WATER PUMPBACK SYSTEM

ALTERNATIVE B: PUMP SEEP WATER OVER DAM



ASSUME: Q=170GPM = 0.3787878 = 0.75AF/DAY
STATIC HEAD(Hs) = 1156-1080 = 76FT
FRICTION HEAD(Hf) = 1.548FT/100FT x 4 = 6.2'
VELOCITY HEAD(Hv) ≅ 0.25'
PUMP LOSSES(Hp) ≅ ASSUME = 2.55'

TOTAL DYNAMIC HEAD(TDH) =
Hs + Hf + Hv + Hp =
76.0'+6.2'+0.25'+2.55' = 85'

HORSE POWER(HP) = $\frac{Q\gamma_w H}{550}$
Q=CFS=0.37879CFS
γ_w = 62.4LB/FT^3
H = TDH = 85

HP = $\frac{0.37878782(62.4)\ 85}{550}$ = 3.653HP

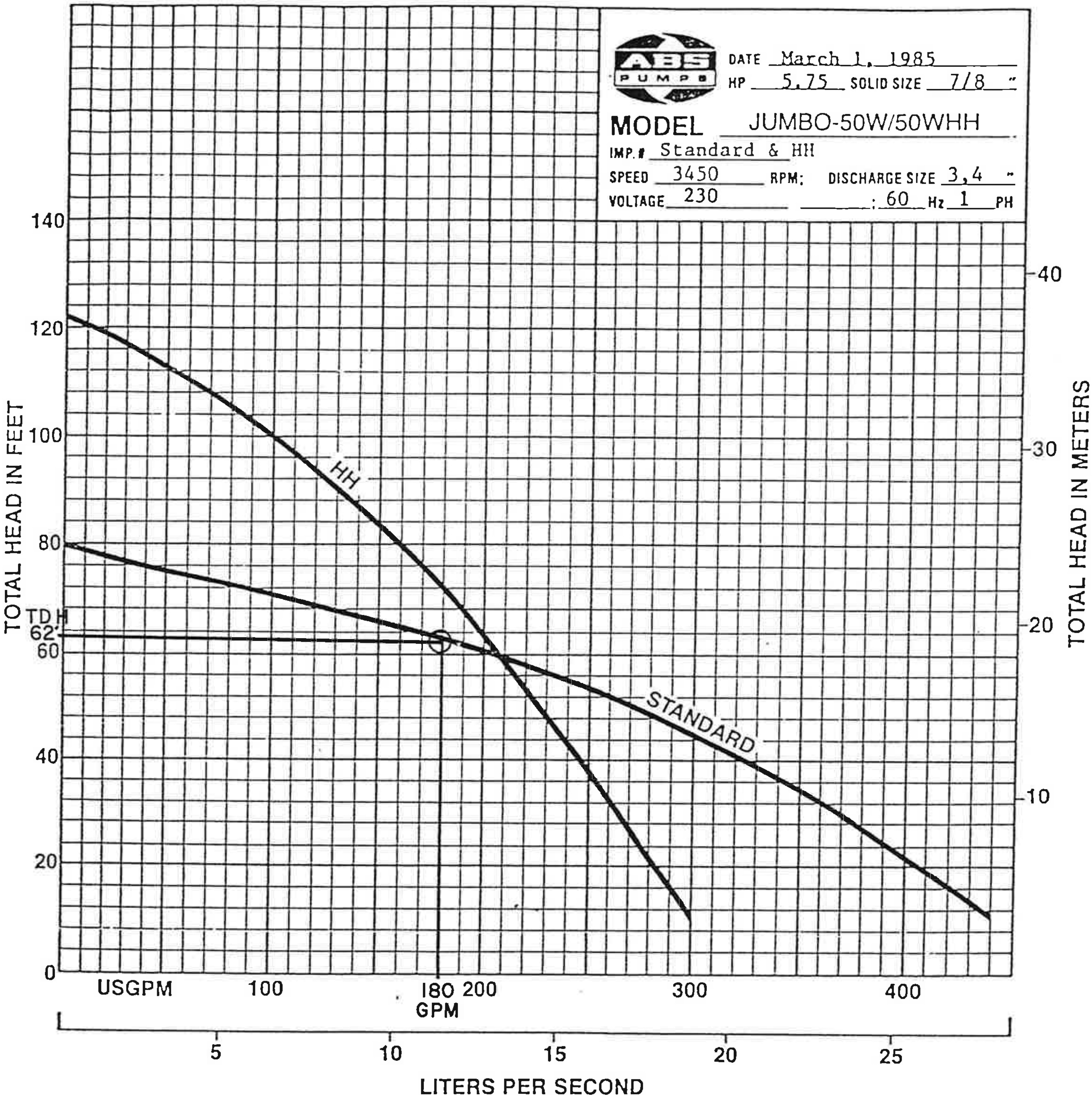
ASSUME: EFFICIENCY = 70%
EFFICENCY = $\frac{3.653HP}{0.7}$ = 5.2 HP

POWER REQUIRED(KW) = 0.746HP
KW = 5.2 HP x 0.746 = 3.893KW

ASSUME: PUMPING 240 DAYS A YEAR
Qt = 0.75AF/DAY x 240DAYS = 180 A.F./YEAR

POWER USED: = 3.893KW x 24HRS/DAY x
240 DAYS/YEAR = 22623.33 KWHR/YEAR

ASSUME COST = $0.05KWHR =
$0.05 x 22423.33KWHR = $1121.17/YEAR



GENERAL DATA

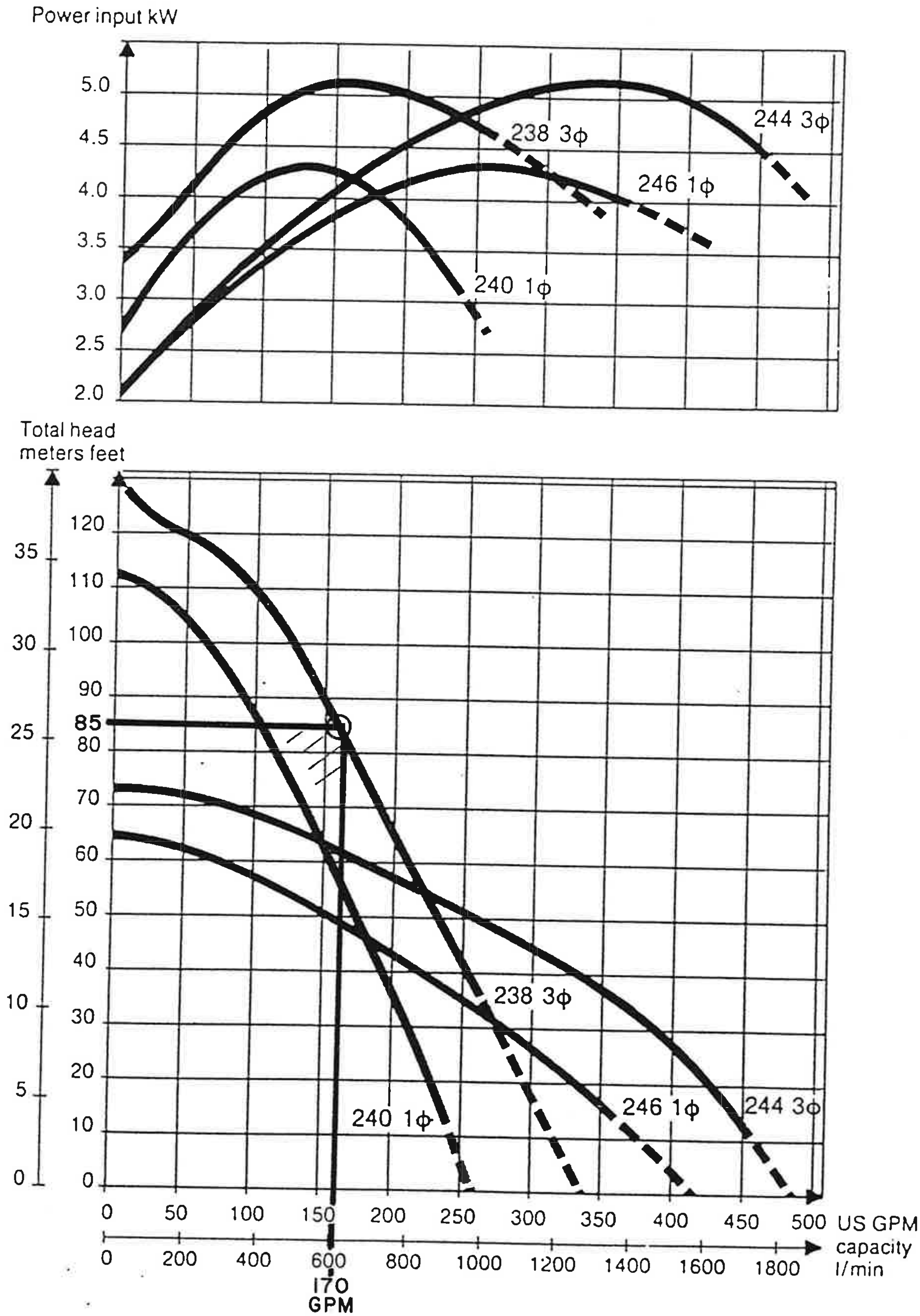
MAXIMUM SUBMERGENCE	65'	CABLE, STANDARD LENGTH	50'
POWER CABLE, TYPE	NSSHOEU or SOW	PUMP WEIGHT - LBS.	135

ELECTRICAL DATA

MAXIMUM STATOR TEMP.	155°C	INSULATION CLASS	F	
MOTOR TYPE	Enclosed Submersible			
MOTOR PROTECTION	Sealminder. Overload/short circuit protection			
VOLTAGE	208	230		
H.P. (KW)	5.75 (4.3)	5.75 (4.3)		
FULL LOAD AMPS	27.6	25		

BS-2102

Impellers 238, 240, 244, 246



ALT. B

SWC Project #1671
August 8, 1991

Dead Colt Creek Dam
Seep Water Pump Back System
Alternative A-1
Cost Estimate

No.	Project	Quantity	Unit	Unit Price	Total
1.	Mobilization		LS	$	$ 2,000
2.	Excavation		LS		1,000
3.	Pump		LS		6,000
4.	4-inch Diameter Poly Pipe	400	LF	10.00	4,000
5.	4-inch Diameter Dip Pipe Fittings		LS		1,000
6.	Pump Support		LS		2,000
7.	Rock Riprap		LS		1,000
8.	Electrical Hookup		LS		2,500
9.	Cleanup and Seeding		LS		500
	Subtotal				$20,000
	Contingencies (15%)				3,000
	Engineering (10%)				2,000
	Contract and Administration (10%)				2,000
	TOTAL				$27,000

SWC Project #1671
August 8, 1991

Dead Colt Creek Dam
Seep Water Pump Back System
Alternative A-2
Cost Estimate

No.	Project	Quantity	Unit	Unit Price	Total
1.	Mobilization		LS	$	$ 2,000
2.	Excavation		LS		1,000
3.	Pump		LS		6,000
4.	4-inch Diameter Dip Pipe	400	LF	18.00	7,200
5.	4-inch Diameter Dip Pipe Fittings		LS		1,000
6.	Pump Support		LS		2,000
7.	Rock Riprap		LS		1,000
8.	Electrical Hookup		LS		2,500
9.	Cleanup and Seeding		LS		500
	Subtotal				$23,200
	Contingencies (15%)				3,200
	Engineering (10%)				2,300
	Contract and Administration (10%)				2,300
	TOTAL				$31,000

SWC Project #1671
July 24, 1991

Dead Colt Creek Dam
Seep Water Pump Back System
Alternative B
Cost Estimate

No.	Project	Quantity	Unit	Unit Price	Total
1.	Mobilization		LS	$	$ 2,000
2.	Excavation		LS		1,000
3.	Pump		LS		6,000
4.	4-inch Diameter PVC Pipe	400	LF	12.50	5,000
5.	4-inch Diameter Dip Pipe		LS		1,000
6.	Pump Support		LS		2,000
7.	Rock Riprap		LS		1,000
8.	Electrical Hookup		LS		2,500
9.	Cleanup and Seeding		LS		500
	Subtotal				$21,000
	Contingencies				3,150
	Engineering				2,125
	Contract and Administration				2,125
	TOTAL				$28,400