A PRELIMINARY EVALUATION OF THE WALHALLA IMPOUNDMENT SWC PROJECT #1769

Prepared by the North Dakota State Water Commission
for the City of Walhalla

January 4, 1983

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North Dakota State Water Commision
State Office Building
900 East Boulevard

PREPARED BY:

Paul D. Urban

PAUL D. URBAN, P.E.
Investigation Engineer

SUBMITTED BY:

David A. Sprynczynatyk

DAVID A. SPRYNCZYNATYK, P.E.
Director of Engineering

APPROVED BY:

Vernon Fahy

VERNON FAHY, P.E.
State Engineer

I. INTRODUCTION

Background

Dawn Enterprises, Inc., is a corporation that is interested in constructing an alcohol fuels plant south of the City of Walhalla. The proposed plant will need a guaranteed supply of water. To accommodate this, the City requested the State Engineer to grant a water permit to use 2,000 acre-feet of water and requested the State Water Commission to conduct an investigation of developing the water supply. At the time it was thought that this water could be stored in a reservoir on the Pembina River. An agreement was drafted and sent to the City in March of 1982 for the investigation of a dam to supply the needed water. It was subsequently signed by the City on August 28, 1982.

Normally in an investigation of this type, surveys are commenced after the agreement is signed. After all the necessary information is gathered, an analysis is made, and a preliminary design is developed. However, due to the uncertainty of the funds for this project the agreement was not signed until late summer. At that time there was still some question as to how much water was needed for the project. Also, by that time, the State Water Commission had other survey commitments and as a result the field survey could not be scheduled until the spring of 1983.

On October 13, 1982, a meeting was held with the City, the developers and the State Water Commission to identify what was desired and what had to be done. The City stated their intent to apply for a Federal grant for this project by January 15, 1983. Because of the short time frame involved, and because of other project commitments, it was decided to do a very preliminary evaluation of the water supply project. This would

allow basic information to be provided to the City in time for their grant application deadline. This report is the result of the preliminary evaluation of the project.

SCOPE

It should be understood that the scope of this report is very preliminary. Since no field information was collected, a worst case condition was assumed for engineering assumptions. Topographic information was obtained from 7½ minute quad maps. United States Department of Agriculture soils maps were used to determine the general soil conditions in the area. Although, this information was readily available, it is of general nature and may not reflect site specific conditions.

The intent of this report is to develop an idea of what is entailed in constructing the reservoir to supply the alcohol fuels plant with water. Information presented here should be adequate for budgeting purposes and the application for federal grant money. When conditions improve this spring, field surveys of the chosen site can be conducted. This new information can be applied to the preliminary design presented here. Any changes in design due to this new information can be made and a more accurate preliminary engineering report will be presented. The preliminary engineering report will provide sufficient information to start final design, if the project is deemed feasible.

II. PROPOSED PROJECT

INTRODUCTION

At the October 13, 1982 meeting with the City, Dawn Enterprises and the State Water Commission, project alternatives were discussed. It was determined that a nine month supply of water would need to be stored to guarantee a supply during dry years. The onstream Pembina River storage idea was dropped since it could not supply enough water for the project without causing flooding. Therefore, it was decided that offstream storage should be considered.

There was some confusion at this meeting as to how much water was needed for the project. A number of conflicting figures were presented as to the plant's projected useage and the City's useage. It was decided to design an impoundment that would provide a useable supply of 800 acre-feet. This was later reduced to 400 acre-feet.

This evaluation considered that the plant would require 400 acre-feet of stored water. In addition, ice losses, based on 3 feet of depth, would be about 180 acre-feet; evaporation, based on 28 inches per year, would be 138 acre-feet; and 82 acre-feet were assumed to be lost to seepage or be in the last foot of depth, which would probably be unrecoverable. The plant useage plus losses totals 800 acre-feet. Therefore, the impoundment would have to hold 800 acre-feet.

Two sites were considered. Site A is located south of where Highway 32 crosses the Pembina River. It is on the east side of the road in Section 29, Township 163 North, Range 56 West. Site B is located on the bluffs east of Site A. This is in the NW¼ of Section 28. Figure 1 shows the location of these areas.

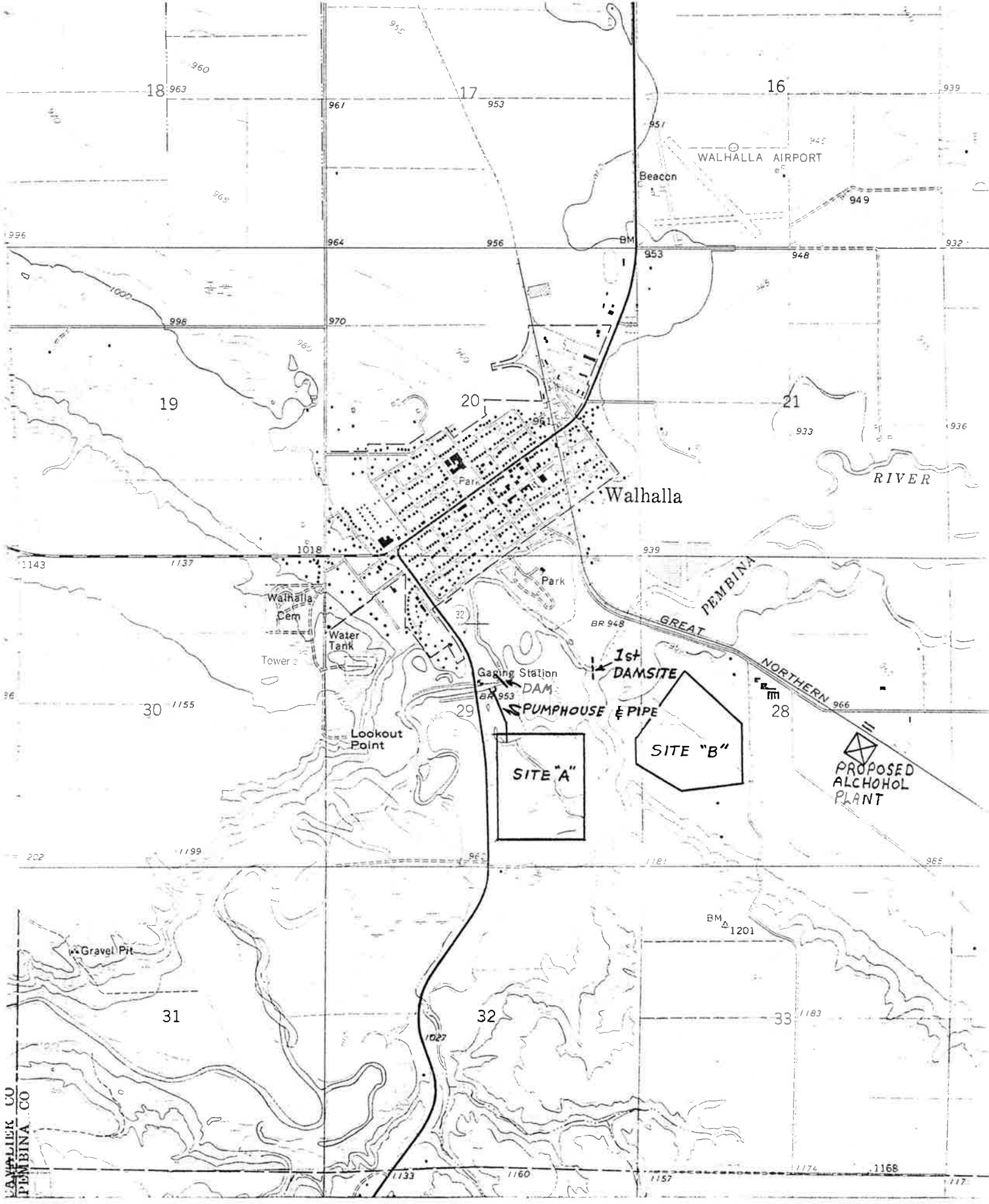


FIGURE 1

Location Map

Site A is located on a nearly level area that has a coulee running through it. This coulee will provide extra storage and decrease the amount of excavation needed. The soils are a Fairdale silty clay which has a moderate permeability. It also has a moderate to high shrink-swell potential. The soil is subject to piping and has a low shear strength.

Site B is located on a sloping area and requires extensive excavation to get the necessary storage. This would result in a high dike on the east end. If the height of the dike is to be kept low, the excess excavated material must be wasted. The soils in this area are a Brantford series, which are sandy and have a rapid permeability. Because of the sandy soil and the greater amount of excavation needed for site B, it was decided to utilize Site A.

The project would consist of three parts: a channel dam to provide a pumping pool, a pipeline and pumps to lift the water, and the impoundment at site A. Figure 1 shows the location of these components.

CHANNEL DAM

In order to provide a pumping pool from which to take water out of the river, a channel dam is proposed. It would be located east of the Highway 32 crossing in Section 29. The dam will have a height of ten feet and be constructed of reinforced concrete. Figure 2 shows the proposed structure.

Originally, the dam for this project was proposed to be farther downstream in the NE¼ of Section 29 (See Figure 1). Because of concern for flooding in the park and possible stability problems with steep banks, it was decided to locate the dam just downstream from Highway 32.

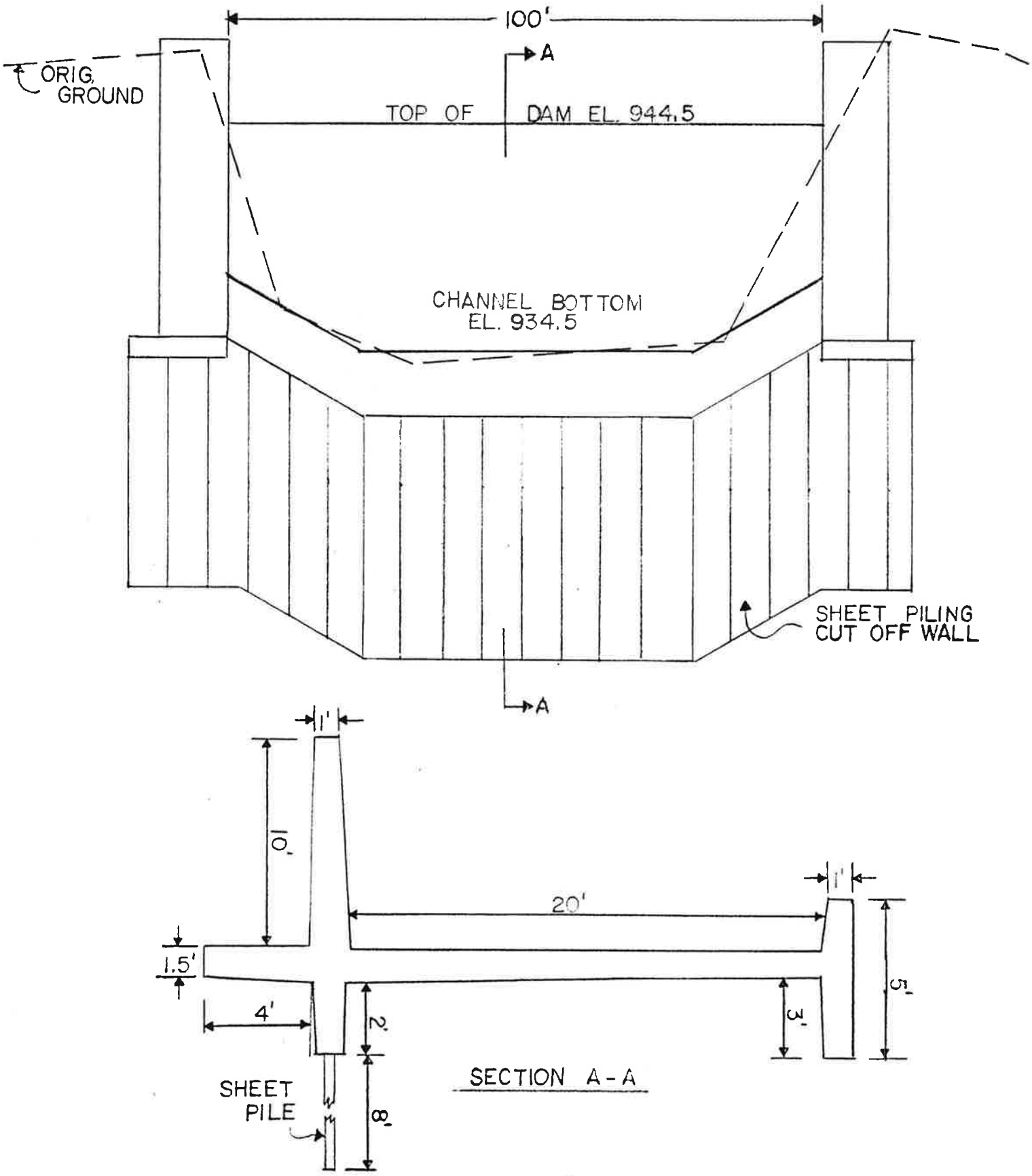


FIG. # 2
CHANNEL DAM
NO SCALE

PUMP AND PIPELINE

The pump will lift water from the reservoir behind the channel dam, through the pipeline and into the impoundment. In dry years, it is estimated that sufficient water will be flowing in the Pembina River for at least three months. Therefore a pump having a capacity of 2,000 gallons per minute is required to pump for 800 acre-feet of water in a time period of three months.

It is proposed to install a vertical, mixed flow pump. This will be submerged in the pumping pool and be enclosed in a pumphouse structure as shown in Figure 3. A 3-phase electric motor capable of producing 20 horsepower at 1,800 R.P.M. will be needed to drive the pump. The pumphouse will be located on the river's edge.

The water will be pumped to the impoundment through a 12-inch diameter pipe. Near the pumphouse ductile iron pipe would be used, with the remainder being P.V.C. pipe.

IMPOUNDMENT

The offstream reservoir must hold a useable supply of water amounting to 400 acre-feet. Accounting for losses, as mentioned earlier, the structure was designed to store 800 acre-feet.

Along the centerline of the dikes, the impoundment measures 1,490 feet (east to west) by 1,815 feet (north to south). The average water depth will be 12 feet and there will be 3 feet of freeboard. This will result in a maximum water surface area of 59.2 acres. The dikes will have top width of 15 feet. Side slopes on the outer side will be 3H:1V while the inner slopes will be 4H:1V. Rock riprap will cover the top 48 feet of the inner slope. This will provide erosion protection.

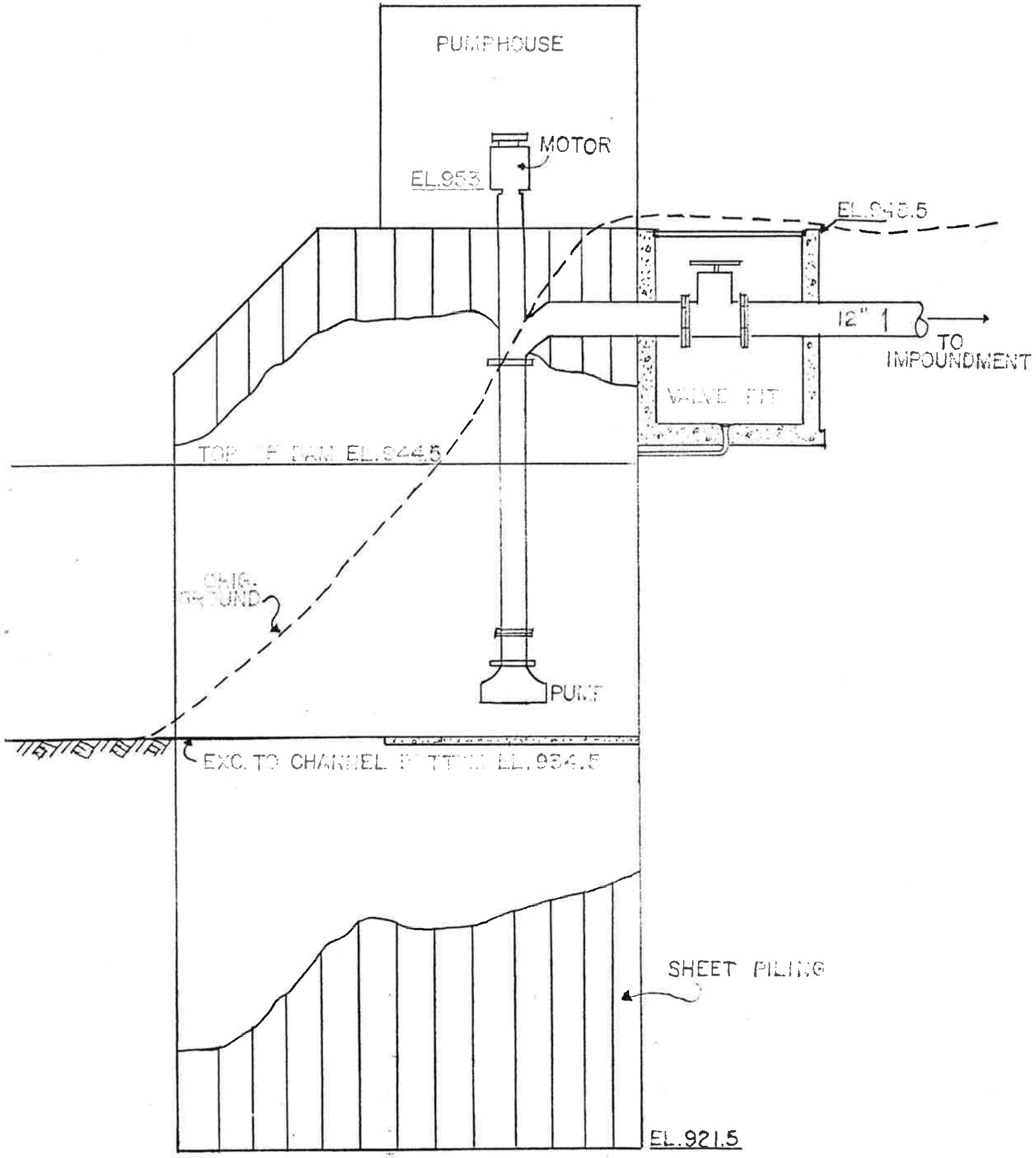


FIG. # 3
PUMPHOUSE EL.
NO SCALE

In order to control seepage, a clay liner will be installed. Since indications are that the material at Site A is the best available, the liner will be constructed by using existing material. This will be done by subcutting two feet below the bottom elevation and backfilling this layer with well compacted material.

Since Site A has a small coulee running through it now, a drainage ditch will have to be built along the east side. This will carry away any runoff coming off the hills to the south and east.

Figure 4 shows a plan of the impoundment. Figure 5 shows two cross-sectional views.

COST ESTIMATE

Cost of the channel dam, including engineering, contract administration and contingencies is about $177,000. The pumphouse and pipeline, likewise, would cost $103,000. With engineering, administration and contingencies, the impoundment would cost $970,000. Therefore, total project costs would be $1,250,000. Table 1 shows the breakdown of these costs.

TABLE 1
Cost Estimate

I. CHANNEL DAM

	Item	Quantity	Unit	Unit Price	Cost
1.	Site Preparation	1	L.S.	2,000	2,000
2.	Excavation	1,100	C.Y.	1.50	1,650
3.	Sheet Piling	940	L.F.	20	18,800
4.	Concrete	335	C.Y.	250	83,750
5.	Reinforcing Steel	50,250	Lbs.	0.50	25,125
6.	Coffer Dam	1	L.S.	5,000	5,000
			Subtotal		$136,325

II. PUMP HOUSE AND PIPE

1.	Stripping, Stockpile & Spread Topsoil	850	S.Y.	0.20	170
2.	Structural Excavation & Backfill	1	L.S.	4,000	4,000
3.	Concrete	25	C.Y.	250	6,250
4.	Reinforcing Steel	4,250	Lbs.	0.50	2,125
5.	Structural Steel	1	L.S.	6,000	6,000
6.	Sheet Piling	900	L.F.	20	18,000
7.	Pump	1	L.S.	12,000	12,000
8.	Pump Installation	1	L.S.	1,000	1,000
9.	Pump House Accessories	1	L.S.	6,000	6,000
10.	8'x10' Building	1	L.S.	5,000	5,000
11.	Electrical Hookup	1	L.S.	3,000	3,000
12.	12" Ductile Iron Pipe	75	L.F.	35	2,625
13.	12" P.V.C. Pipe	700	L.F.	15	10,500
14.	Rock Riprap	110	C.Y.	18	1,980
15.	R.R.R. Filter Material	55	C.Y.	8	440
16.	12" Flap Gate	1	L.S.	300	300
			Subtotal		$ 79,390

III. IMPOUNDMENT STRUCTURE

1.	Excavation (for dikes)	257,300	C.Y.	0.90	231,570
2.	Subcut Excavation (make compacted liner)	185,000	C.Y.	0.90	166,500
3.	Drain Ditch Excavation	11,000	C.Y.	0.90	9,900
4.	Stripping, Stockpile & Spread Topsoil	359,000	S.Y.	0.20	71,800
5.	Seeding	17	Acre	150	2,550
6.	Rock Riprap	11,217	C.Y.	18	201,906
7.	R.R.R. Filter Material	5,609	C.Y.	8	44,872
8.	Fence	7,000	L.F.	2.00	14,000
			Subtotal		$743,098

Total All 3	$958,813
Engineering, Contingencies & Contract Administration (30%)	241,187
TOTAL COST	$1,250,000

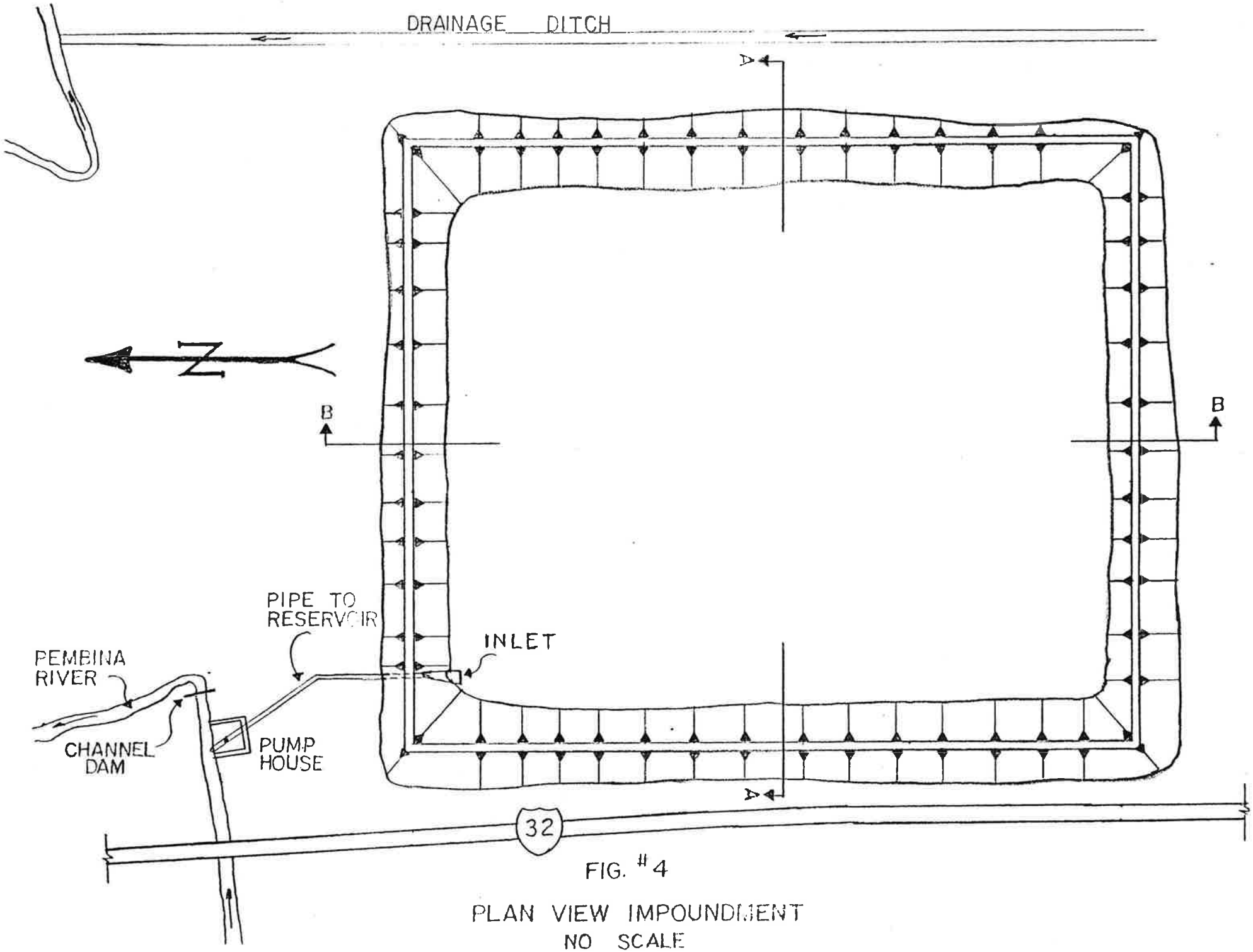
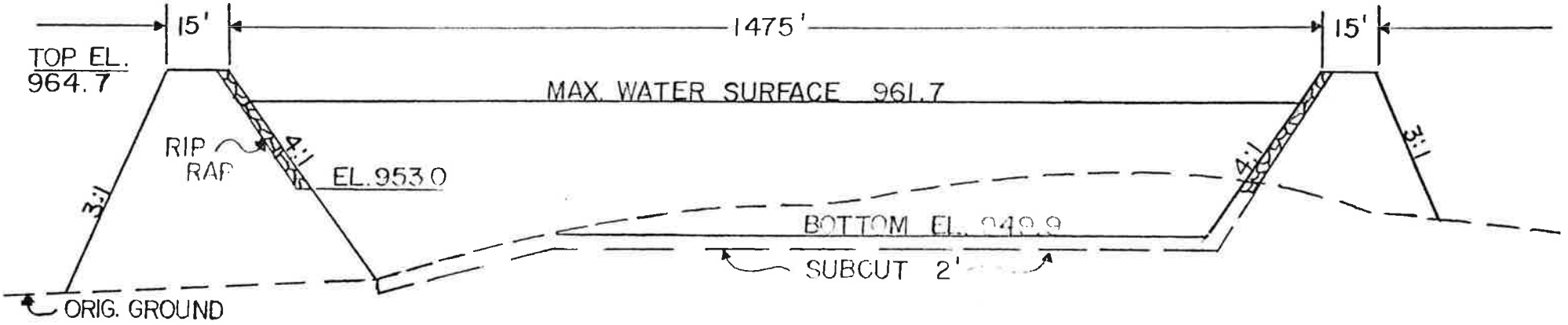
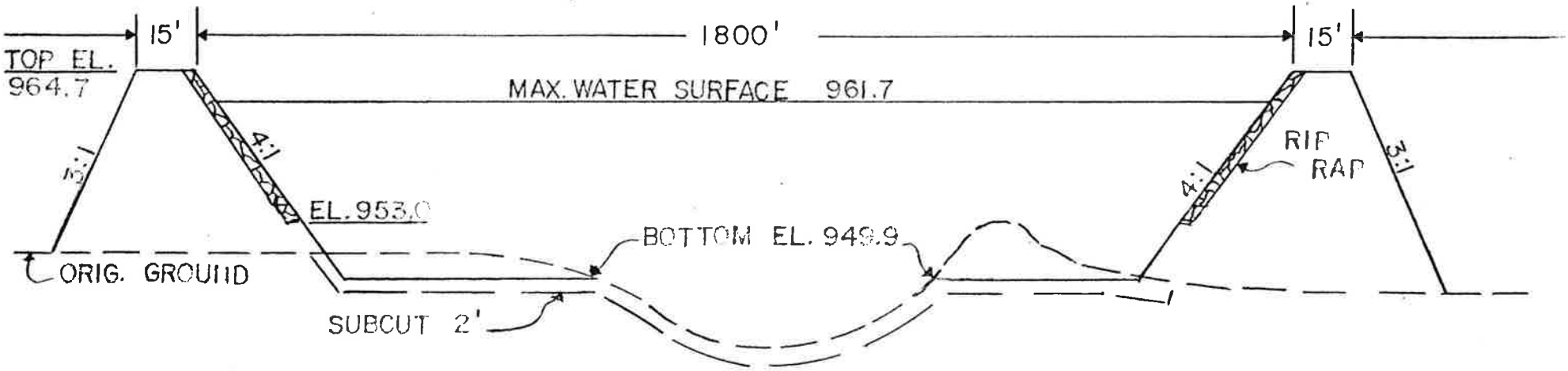


FIG. # 4

PLAN VIEW IMPOUNDMENT
NO SCALE



SECTION A-A
NO SCALE



SECTION B-B
NO SCALE

FIG # 5

SECTION VIEW OF IMPOUNDMENT

III. SUMMARY

Basically the project has three parts. These are:

1.	Channel Dam	$177,000
2.	Pumphouse and pipeline	$103,000
3.	Impoundment structure	$970,000

The figures represent the estimated costs for each part. The total cost is estimated to be $1,250,000.

Preliminary design as presented here was based on assuming a worst case condition. No field surveys or soil surveys were made. Information came from 7½ minute quad maps and soils maps. It is planned to do the necessary field work this spring. After completion, the preliminary design will be developed. This may lower costs by allowing higher dikes resulting in a smaller reservoir area which would decrease evaporation and ice losses.

After revision of the preliminary design a detailed preliminary report will be presented. It will allow the city to decide on proceeding with the project and have enough information to start the final design for construction. Even though changes may occur, it is believed that the costs presented here reflect a reasonable preliminary estimate that can be used for budgeting purposes.