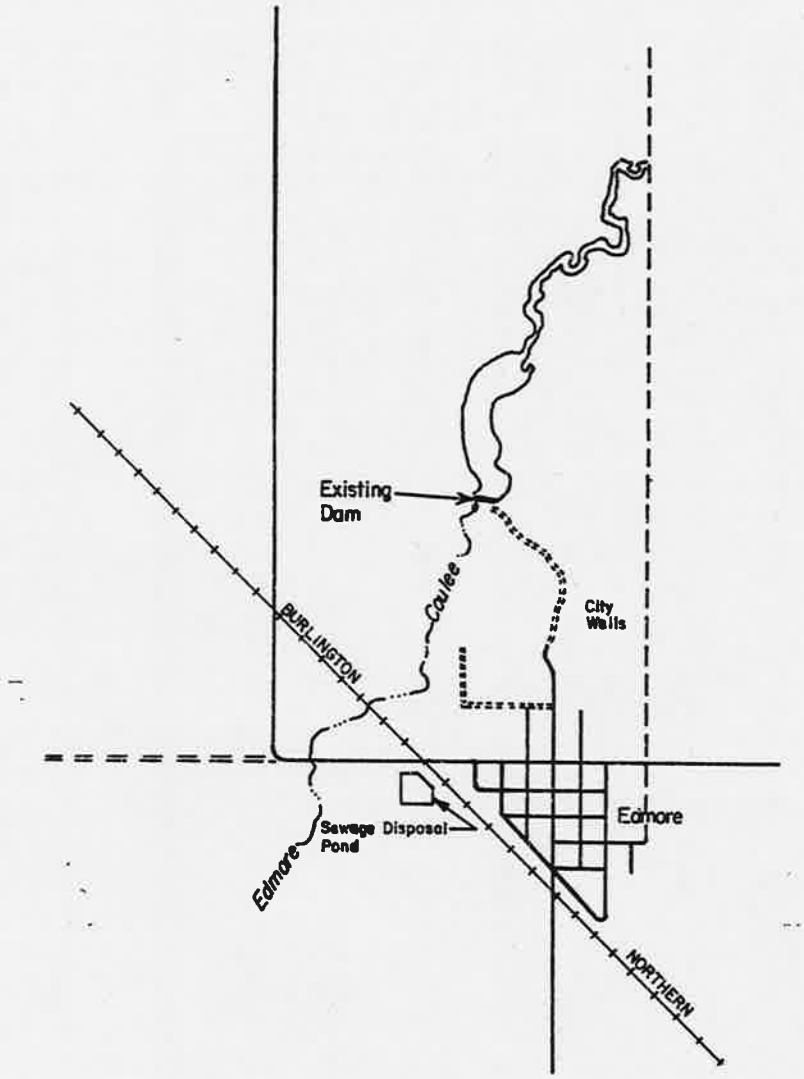
ENGINEERING REPORT
EDMORE DAM
RAMSEY COUNTY, NORTH DAKOTA



NORTH DAKOTA
STATE WATER COMMISSION
APRIL, 1989

NORTH DAKOTA STATE WATER COMMISSION

OFFICE MEMO

MEMO TO: David A. Sprynczynatyk, Director, Engineering Division
FROM: Randall Binegar, MR&I Water Supply Program Coordinator
SUBJECT: SWC Project 237-34 - Edmore Water Supply
DATE: April 17, 1989

On April 13, 1989, a meeting was held in the Edmore Auditorium regarding the water supply problem facing the city of Edmore. The purpose of the meeting was to describe two alternatives for solving the Edmore water supply problem and receive input this office could use to evaluate the two alternatives. Approximately 200 people were in attendance at the meeting which mainly consisted of residents of Edmore. Representatives from KBM Engineering, Langdon Rural Water Users, North Central Planning Council, and the cities of Nekoma, Fairdale, and Hampden were also in attendance.

Representatives from KBM Engineering presented the Langdon Rural Water Supply System alternative, as contained within the Feasibility Report for Phase 2, Langdon Rural Water System, dated March 1989. A few questions from the audience were asked regarding the water quality from the Langdon system and the exact costs of the water to the consumers.

I then presented the results of the engineering report which discusses the raising of the Edmore Dam as an alternative for meeting the water supply needs of Edmore. Upon completion of the presentation, the Edmore representatives made it clear they unanimously oppose the dam raising alternative. The concerns raised regarding the dam raising alternative included: the poor

water quality of the existing water supply and its effect on the odor and taste of the water and the staining of clothing; water within a channel which feeds the reservoir water to the aquifer recharge area freezes during the winter months and the proposed dam raising alternative would not alleviate this problem; the proposed 1.3 feet increase in the reservoir level would not sufficiently provide for the water supply needs of Edmore; due to the low gradient of the Edmore Coulee, the Edmore Dam backs water up a considerable distance along the Edmore Coulee and the raising of the dam would compound this problem. Landowners upstream of the Edmore Dam indicated backwater effects were noticeable 23 miles upstream of the dam. The landowners indicated that $25,000 would be extremely inadequate for land costs considering the affect of the project on the land and previous improvements made to this land.

Edmore's water supply quantity problem is more severe and consistent than earlier believed. Severe water shortages which require rationing have occurred in most years and have not been limited to the two years Edmore was forced to haul water into the community.

The proposed Phase 2 of the Langdon Rural Project would also serve the communities of Hampden and Fairdale. Both these cities water supplies are served through individual wells located within the community. It was learned at the meeting that the wells within the community are inadequate and go dry much of the time. Documentation on the seriousness of the water supply within these

communities was requested and should be forwarded to this office in the near future.

The overwhelming sentiment of the group attending the meeting was to pursue the advancement of the Langdon Rural Water System alternative and heavy opposition was found for the dam raising alternative.

RB:dm

ENGINEERING REPORT

EDMORE DAM

SWC PROJECT #927

North Dakota State Water Commission
900 East Boulevard
Bismarck, ND 58505-0187

Prepared by:

Ronald A. Swanson

Ronald Swanson
Design Engineer

Submitted by:

David A. Sprynczynatyk, P.E.
Director of Engineering

Approved by:

Vernon Fahy

Vernon Fahy, P.E.
State Engineer

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EDMORE DAM
SWC PROJECT #927

PROJECT HISTORY

The city of Edmore obtains its municipal water requirements from a shallow aquifer north of the city. The aquifer was originally recharged by water impounded by a dam which was installed by the Great Northern Railroad. The railroad removed the dam in about 1960, and by 1962, the city was experiencing a severe water shortage.

Groundwater investigations revealed no feasible solution to the city's problem, so a decision was made to replace the dam and resume the recharging of the shallow aquifer.

The earthfill embankment with an emergency spillway and trickle tube outlet was completed in October of 1963. The spring runoff of 1964 occurred before the grass in the emergency spillway was established and severe erosion damage resulted. The emergency spillway was repaired and it was decided that a gated spillway should be installed to prevent frequent use of the emergency spillway.

A concrete flume equipped with a radial gate was placed in the embankment during the fall of 1964. The construction was completed with the placement of the riprap which concluded in November of that year.

PROJECT PURPOSE AND DESCRIPTION

Edmore Dam impounds water for use in recharging the aquifers which satisfy the municipal water requirements of the city of Edmore. A failure of the dam would result in the loss of the city water supply, which would cause appreciable economic losses. For this reason, Edmore Dam is classified in the 2, or significant hazard, category.

Basin Description:

There are 120 square miles of drainage area above Edmore Dam which contribute to runoff. This drainage basin is drained by three major streams: Edmore Coulee, Nekoma Coulee, and East Branch Nekoma Coulee. All three combine above Edmore Dam and have their source in a poorly drained region to the north in southern Cavalier County. The longest stream, Edmore Coulee, has its source at elevation 1575 msl, and a length of 23 miles, giving a slope of 2.8 feet per mile. The above drainage area lies within the Devils Lake Basin.

General Geology:

Edmore Dam is located in the Drift Plains District of the Central Lowlands Physiographic Province. The surfaces deposits are a result of glacial activity and range from 0 to 70 feet in thickness. This material consists of boulder clay (till), sand and gravel, and cobbles. The Pierre Formation of Cretaceous Age underlies the surface deposits. This formation consists of shale

STRUCTURAL AND GEOTECHNICAL EVALUATION

General:

The evaluation of the project is based on the available design and construction data, operating records, conversations with people familiar with the project, and the visual inspection. Review of the available data does not reveal any design conditions or construction methods that would result in an unsafe structure.

Embankment:

Stability analyses have not been performed on the embankment of Edmore Dam, so the margins of safety are unknown. However, the 4H:1V upstream slope and 3H:1V downstream slope applied to the low embankment (13 feet) are considered adequate. This is supported by the lack of slumps, cracks, depressions, or other signs of embankment instability. If such signs should ever appear, the embankment should be reevaluated and its stability should be analyzed.

Eroded areas were found near the entrance of the service spillway and near the left wingwall of its outlet. The area near the entrance should be backfilled and protected by rock riprap. The area on the downstream slope has been backfilled and riprap had been added near the plunge pool. This area should be monitored to determine if these repairs are adequate. The area below the dam should be monitored for boils, flowing water, and other

OBJECTIVES OF STUDY

This report attempts to determine the feasibility of raising the control elevation of Edmore for the purpose of increasing the storage capacity. During the dry year of 1988, there was very little runoff in the drainage basin and the impounded municipal water supply was almost exhausted. The original corrugated metal pipe spillway also failed at this time causing the loss of previously stored water.

These problems have made the existing water supply appear to be inadequate to provide for the community's needs. This study, along with others, considering the possibility of attachment to certain pipeline sources, will evaluate ways in which a more dependable water supply may be attained.

Associated Problems:

There are certain problems that must be considered along with any potential benefits in the review of the dam raise alternative. These include the fact that additional land would be flooded, the possibility that the embankment may be more susceptible to failure due to an increased hydraulic pressure, and the limited spillway capacity available. Also, the raised pool would have a greater surface resulting in an evaporation replenishment at a greater rate which would negate part of the apparent gain.

surveys would be needed to fully determine the impacts of this raise and more accurately determine the land and protective dike costs.

Preliminary Cost Estimate

Edmore Dam Improvements
SWC Project #927

1.	Mobilization and Demobilization - LS	$ 2,000.00
2.	Travel - LS	1,000.00
3.	Steel Fabrication and Welding - LS	1,000.00
4.	Strip, Stockpile and Spread Topsoil - LS	2,000.00
5.	Earthfill, Raise Dam and Emergency Spillway 1,000 CY @ $5.00	5,000.00
6.	Rock Riprap Filter Material - 50 CY @ $20.00	1,000.00
7.	Rock Riprap - 100 CY @ $25.00	2,500.00
8.	Seeding - LS	500.00
	Subtotal	$15,000.00
	Plus 33.3% Contingencies, Engineering and Contract Administration	5,000.00
	Land (Estimated)	25,000.00
	Protective Dikes	5,000.00
	TOTAL	$50,000.00

Flood-Routing:

Hydrologic studies were made for the drainage basin and storms of the proper magnitude were determined for this class of dam. The ratings of the relevant storms were the 25-year event, the 100-year event, and a 0.3 Maximum Probable Flood. These storms were then flood-routed through the existing reservoir and through the proposed modified condition, in both cases with the control gate open. The results of the routing are as follows:

Yield Analysis - Existing Dam

Starting Elevation		Area (Acres)	Storage (Acre-feet)
	1516.2	57.5	130
Annual Veep.	-2.4		
End Elev.	1513.8	22.7	35

Yield Analysis - Raised Dam

Starting Elevation		Area (Acres)	Storage (Acre-feet)
	1517.4	80.0	220
Annual Evap.	-2.4		
End Elev.	1515.0	38.0	72

The annual yield of 1200 acre-feet was not included because the storage of the reservoir is small when compared with the runoff, indicating that the reservoir will fill with a 80 percent chance spring runoff.

Water Quality:

The North Dakota State Department of Health has reviewed the monitoring data for the city of Edmore's drinking water supply for all contaminants regulated by the Safe Drinking Water Act (SDWA), as spelled out in their letter of February 28, 1989. At this time, the system is in full compliance with the SDWA. In addition, the city of Edmore's drinking water supply is also in compliance with all secondary drinking water regulations (non-enforceable) except manganese. Secondary standard violations are not enforceable by the EPA at this time. Routine

Annual Cost

Operation Costs:

(Per City Water Commissioner)	Per Year	$ 3,200

Maintenance and Repair Costs:

		1988 Value
1975 - Dam Repairs	$ 6,749.64	$13,771
1980 - Dam Rework	16,152.44	22,520
1988 - Dam Rework	10,776.00	10,776
1988 - Well Work	13,000.00	13,000
		$60,067

Average Maintenance and Repair Costs Per Year Since Original Dam Construction in 1963 — $ 2,403

Debt Service Payment:

(Total Project Cost) x (25%) = Loan Amount
$50,000 x (.25) = $12,500 = Loan Amount
$12,500 x .080132 (7.5%, 30 years) = $ 1,001

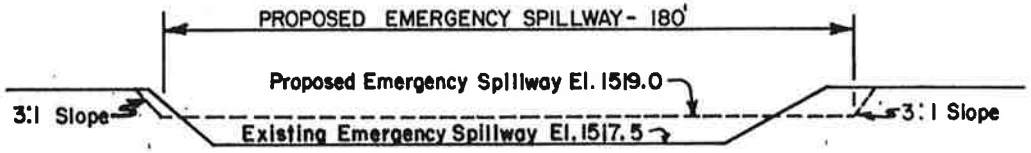
Replacement Fund (Contingencies):

10 Percent of Annual Cost
(.10) x 1001 = $ 100

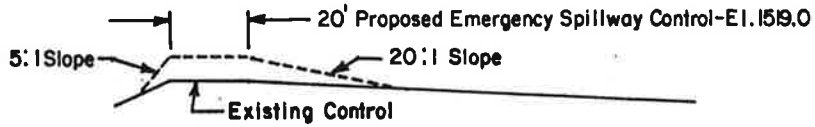
TOTAL ANNUAL COST **$ 6,704**

tive indicates that it would be worth further consideration and comparison with the other alternatives.

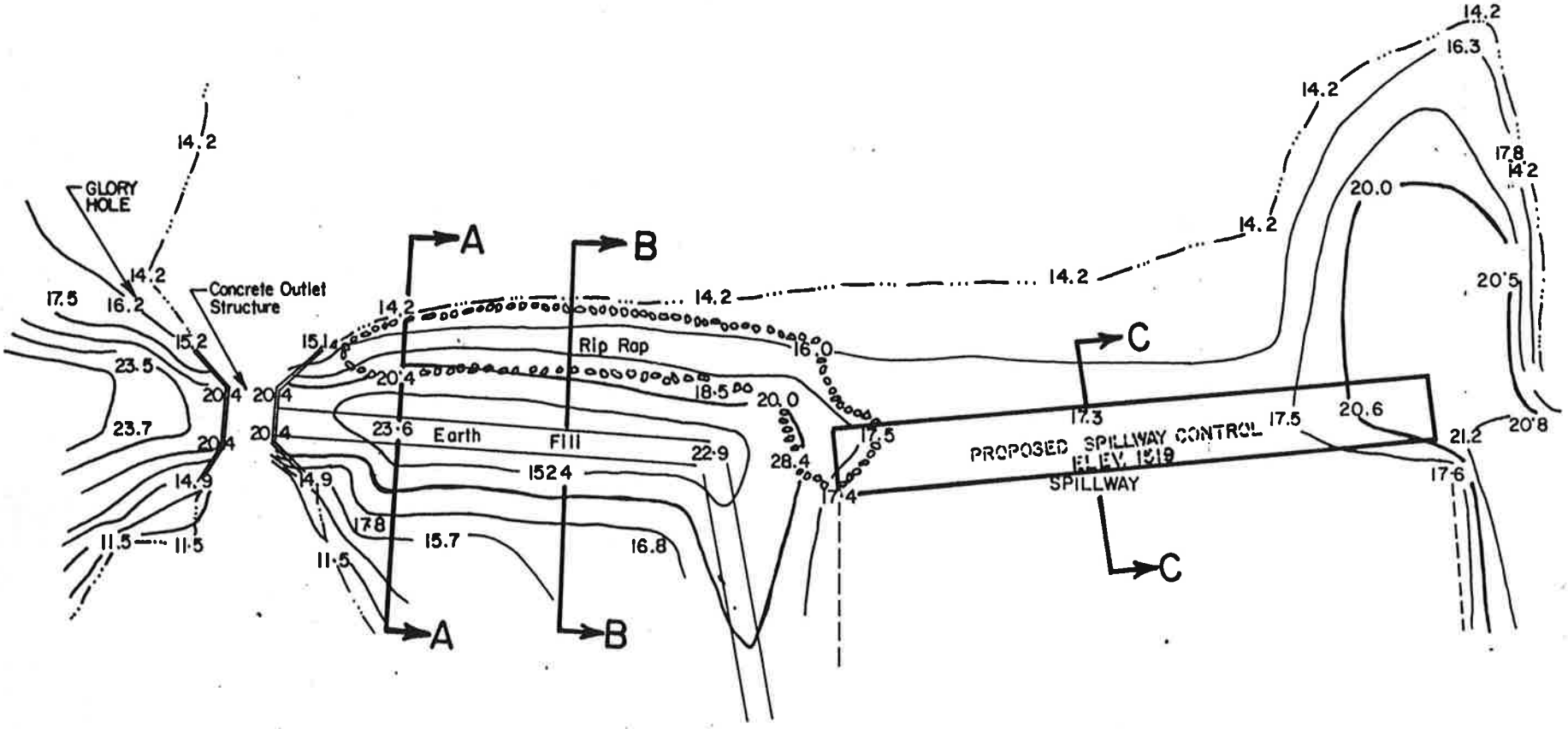
APPENDICES

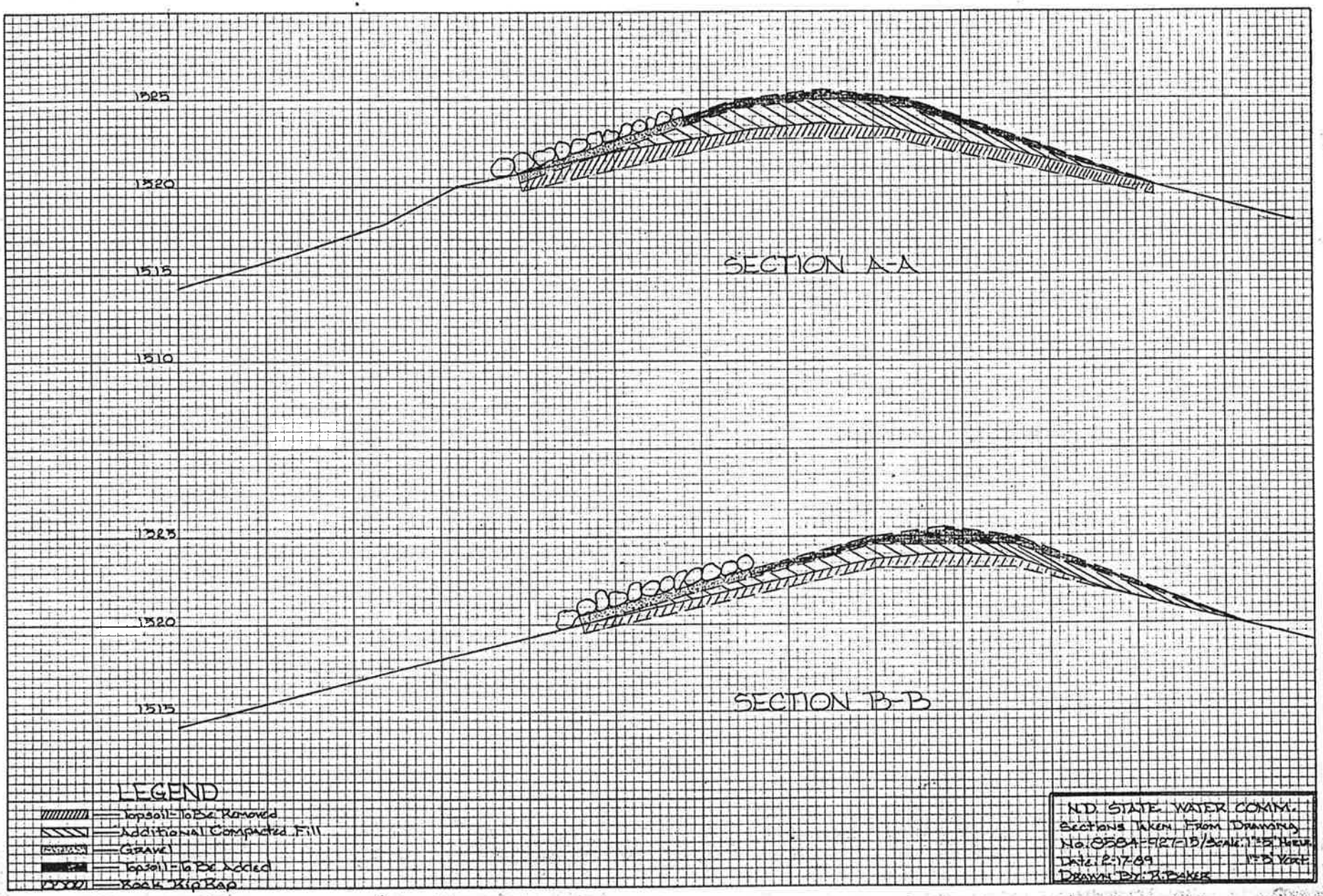


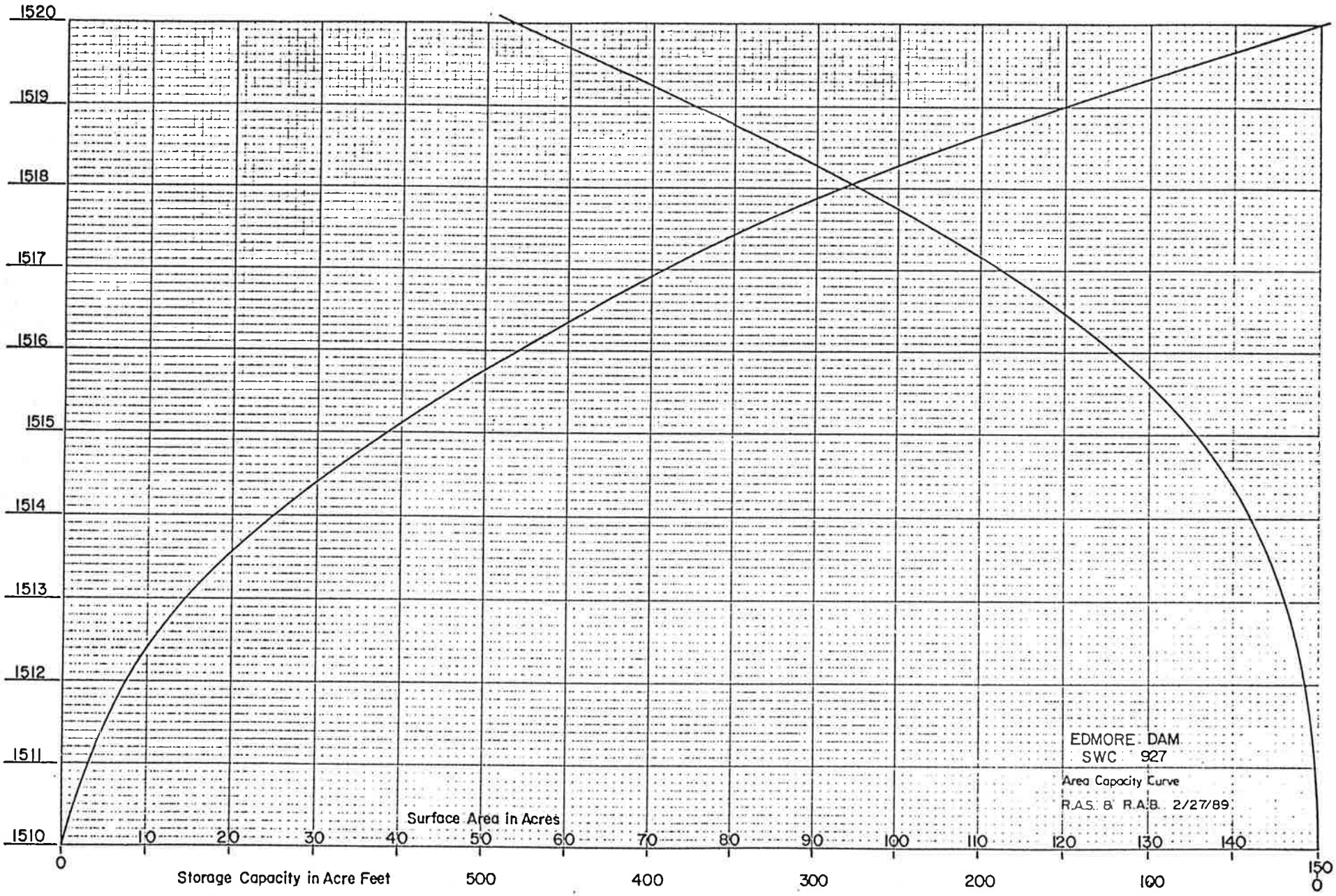
CENTERLINE PROFILE



SECTION C-C




1525
1520
1515
1510
SECTION A-A
1523
1520
1515
SECTION B-B
LEGEND
Topsoil-To Be Removed
Additional Compacted Fill
Gravel
Topsoil-To Be Added
Rock Rip Rap
N.D. STATE WATER COMM.
Sections Taken From Drawing
No. 0504-987-B/Scale: 1"=5' Horiz.
Date: 2-17-89 1"=5' Vert.
Drawn By: R. Baker


1520
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EDMORE DAM
SWC 927
Area Capacity Curve
R.A.S. & R.A.B. 2/27/89
Surface Area in Acres
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Storage Capacity in Acre Feet
500
400
300
200
100
0

NORTH DAKOTA
STATE DEPARTMENT OF HEALTH
AND CONSOLIDATED LABORATORIES
State Capitol
Bismarck, North Dakota 58505

ENVIRONMENTAL HEALTH SECTION

1200 Missouri Avenue
P.O. Box 5520
Bismarck, North Dakota 58502-5520

February 28, 1989

Dave Sprynczatyk, P.E.
Director, Engineering Division
North Dakota State Water Commission
900 East Boulevard
Bismarck, ND 58505-0187

RE: SWC Project No. 927 - Edmore Dam

Dear Mr. Sprynczatyk:

This letter will confirm the receipt of your letter dated February 17, 1989, regarding the acceptability of the current drinking water supply utilized by the city of Edmore.

I have reviewed the monitoring data for the city of Edmore's drinking water supply for all contaminants regulated by the Safe Drinking Water Act (SDWA). At this time, the system is in full compliance with the SDWA. In addition, the city of Edmore's drinking water supply is also in compliance with all secondary drinking water regulations (non-enforceable) except manganese. Routine samples collected in 1987 showed a manganese level of 0.22 milligrams per liter (the recommended level is 0.05 milligrams per liter). Although not yet finalized, please note that pending EPA drinking water regulations may further impact public water systems utilizing surface water or surface water-influenced sources.

I appreciate the opportunity to provide comments. Please contact me at 224-4598 if you desire any further information.

Sincerely,

D. Wayne Kern

D. Wayne Kern, Environmental Engineer
Drinking Water Program Administrator
Water Supply & Pollution Control

DWK:krh