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SUPERIOR SPRING PROJECT

Prepared by

Wyoming Water Development Commission

December, 1988

Table of Contents

I. Project Description 1

II. Methodology 1

III. Study Findings:

Water Quality 1

Water Quantity 6

Storage 7

IV. Recommendations 7

Figures

Figure 1: Surficial Geology 2

Figure 2: Project Location Map 3

Figure 3: Mesaverde Formation Water Quality 4

Tables

Table 1: Water Quality Analysis 5

Project Description

The Town of Superior is located in southwestern Wyoming along the northern end of the geologic structure known as the Rock Springs Uplift. The surficial geology is characterized by numerous faults in the Mesaverde formation, which is composed of the Almond, Erickson, and Rock Springs members. (Figure 1)

Superior has recently commenced operation of a new town water system which is supplied from groundwater. The Town's request, under this application, is to study the feasibility of utilizing a nearby spring for irrigation of Town facilities. (Figure 2)

The Mayor of Superior requested that WWDC determine the feasibility of using the spring, located in the SE 1/4 of Section 28, T21N, R102W, for irrigation of the Town's parks. The project might consist of a small impoundment and pumping and conveyance facilities.

Methodology

WWDC staff visited the site on two occasions to perform reconnaissance investigations and conduct water quality and quantity measurements. This included a field survey of potential geologic features that might be conduits for recharge to the study area, and a cursory examination of other potential water sources.

A literature review was performed to assist in definition of the spring source, and water quality parameters were modeled using the computer program WATEVAL. Water quality data from several other Mesaverde formation sources were examined and compared to the spring source. As is shown in the graphical output from WATEVAL (Figure 3) the water quality from the spring is quite similar in nature to other Mesaverde waters. This reinforces the notion that the Mesaverde Formation is the source of the spring.

An analysis of the spring water quality relative to its potential uses was performed, and its suitability for irrigation of various crop types was determined.

Study Findings:

Water Quality

WWDC collected water samples from the spring and performed an analysis of the suitability of the spring for irrigation with the following results. (Table 1)

Total Dissolved Solids Concentration

Conductance is a measure of the collective concentration of dissolved constituents in water. Higher values indicate a higher concentration of total dissolved solids and poorer

Figure 1: Surficial Geology

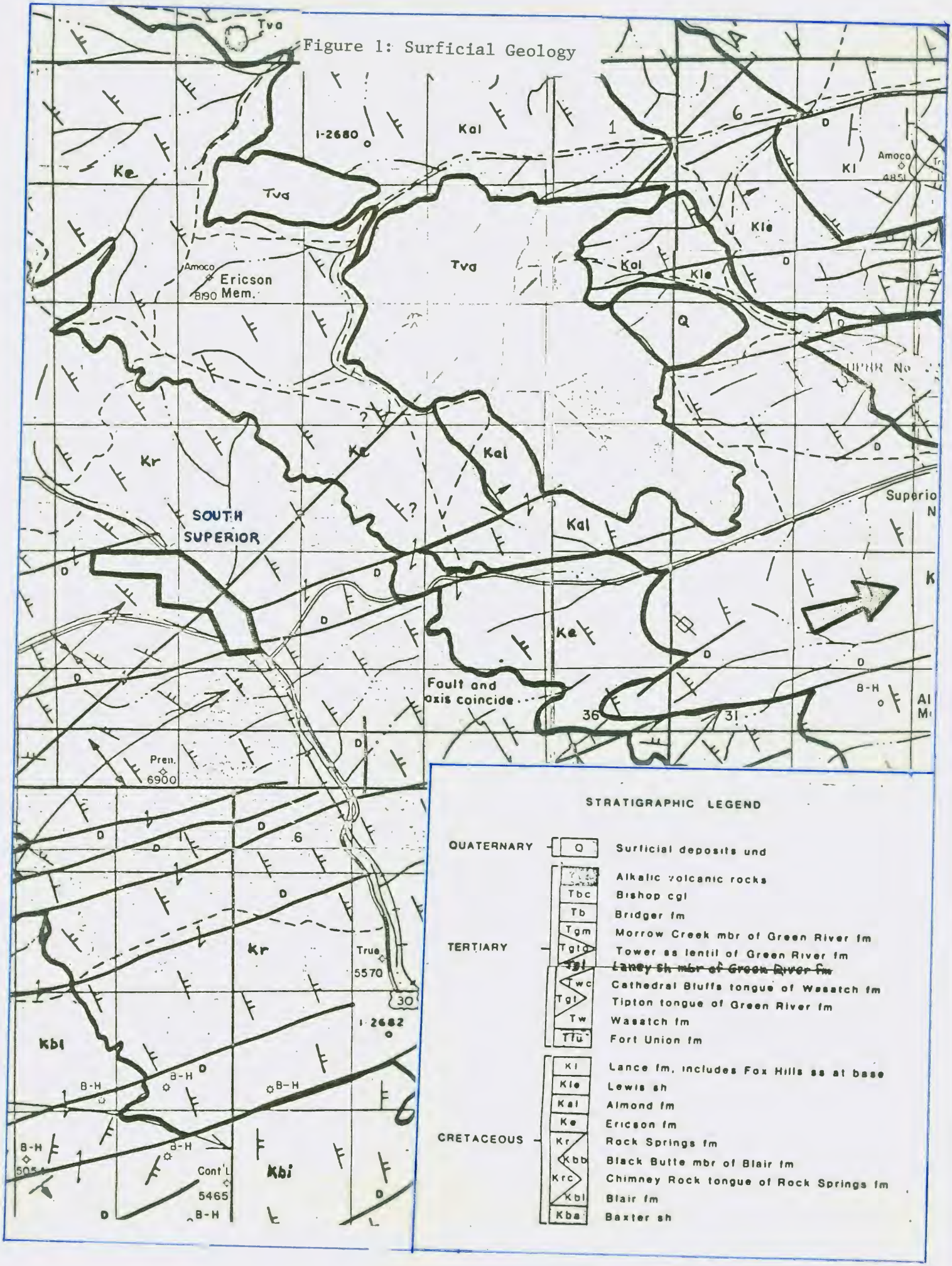

Figure 2: Project Location Map

Approximate Scale: 1 inch = 488 feet

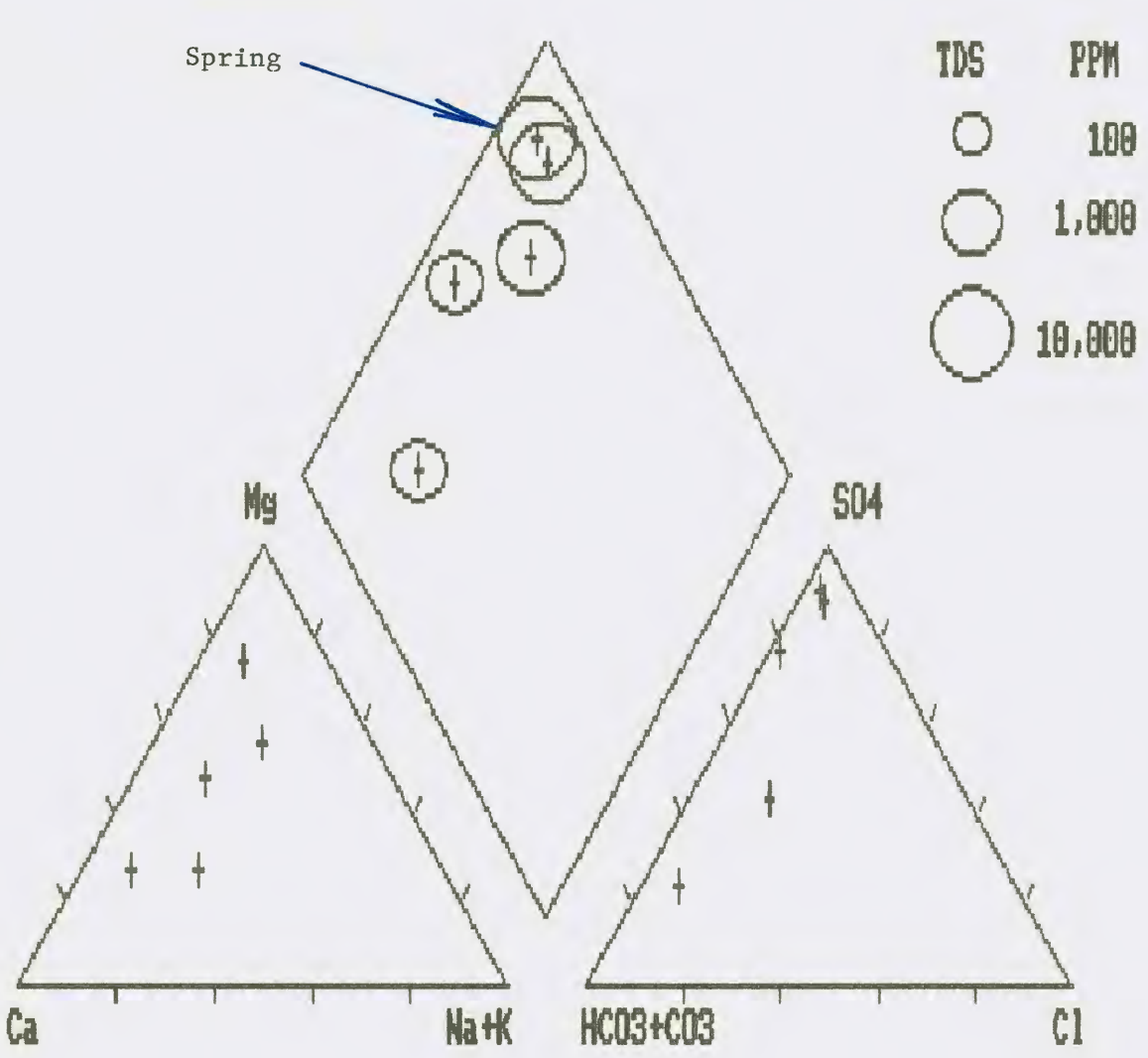

Figure 3: Mesaverde Fm Water Quality

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WDA-222
3-83

No. 88-10412

Table 1: Water Quality Laboratory Results

OFFICIAL LABORATORY REPORT

Sample of _____ Brand _____

Date Sample was Collected _____ Date Received by Laboratory June 22, 1988

Other Identification Water Development Commission, Herschler Bldg, Cheyenne, WY 82002

Jon Wade: Superior WQ Analysis

Purchased From _____ Address _____

Retailer _____ Address _____

Wholesaler _____ Address _____

Manufacturer _____ Address _____

Analysis Requested Irrigation

Sample Collected By _____ Collection Report No. _____

ANALYSIS	meq/l	mg/l		meq/l	mg/l
Calcium	16.47	330	Carbonate	0.00	0.0
Magnesium	68.30	830	Bicarbonate	6.82	420
Sodium	7.39	170	Sulfate	87.04	4200
Potassium	1.05	41	Chloride	3.10	110
			Nitrates as NO_3	0.01	0.1
Total Cations	93.21		Total Anions	96.97	
Boron		2.1	pH (units)		8.16
Conductance (umho/cm)		5810	ROE		6260
Total alkalinity as $CaCO_3$		340			

I hereby certify that the above sample was analyzed by myself or my assistant.

_____, Director
Division of State Laboratories

State Bacteriologist

Date August 9, 1988

Henry D. Thomas
State Chemist

ADMINISTRATIVE REMARKS

Commissioner of Agriculture

water quality.

The conductance of the sample is 5810 umhos, which classifies the spring as extremely saline and not suitable for irrigation without leaching.

Sodium

The Sodium Adsorption Ratio (SAR) for the sample is 1.14. This places the sample in class C4-S1, which classifies it as not suitable for irrigation unless the soil is permeable, well drained, leach water is available, and the water is applied to very salt tolerant crops.

This indicates that salts will be deposited in the soils irrigated with this supply unless excess water is applied to leach the salts down through the soil horizons and thereby prevent a concentration in the root zone.

Boron

The boron level in the sample was 2.1 mg/l which indicates the water should be applied only to "boron tolerant" crops.

Leaching Requirement

Given the chemical nature of the spring water and assuming approximately 24 inches of water would be needed by the parks during the irrigation season, the leaching requirement would be approximately 20 inches per season.

This means that approximately 44 inches of water should be applied, given the chemical nature of the spring water, to prevent buildup of salts in the soil. The leaching requirement assumes that the soil is sufficiently permeable and well drained to allow irrigation water to infiltrate freely downward and out of the soil horizons. Otherwise the soil will become increasingly saline and less productive.

Water Quantity

Flow measurements taken at the spring in June indicated a yield of approximately 2 gpm. There had been no rainfall for some time prior to the measurement, therefore the measured flows are assumed to emanate entirely from the spring. Assuming the 2 gpm yield is constant and would not be diminished by the head imposed on it by the reservoir pool, and assuming the proposed impoundment would be empty at the end of the irrigation season, the impoundment could accumulate approximately 500,000 gallons (1.53 acre-feet) of spring flow by the start of the next irrigation season (May - Oct). The spring could yield approximately 1,000,000 gallons (3.07 acre-feet) per year.

The total area to be irrigated from the spring is estimated at approximately 2 acres. It has been established earlier in

this report that the total irrigation demand would be approximately 44 inches per season, therefore the total irrigation requirement will be approximately 7.3 acre-feet per season. The spring alone is capable of supplying less than half that amount.

Storage

The Horsethief Creek channel is approximately 40 feet wide and 10 feet deep in the study area, and is cut in the Rock Springs Formation. This formation is composed of interbedded sandstone, shale, coal, and clay, and is quite friable. This material is probably competent enough to support a very small dam, however it is likely that considerable interflow would occur around the abutments of the proposed dam unless preventative measures were taken.

A 10 foot high dam constructed across Horsethief Creek just below the spring would back water approximately 550 feet upstream, and would store approximately 2.5 acre-feet of water (Figure 2). This indicates that even if an adequate supply of water was available from the spring or other sources, the channel in the vicinity of the spring will not accommodate construction of a reservoir with suitable capacity.

Recommendations

Due to the poor water quality of the spring and the lack of a suitable reservoir site in the study area it does not appear that the proposed spring development will meet the expectations of the Town, therefore it is not recommended that this proposal be pursued any further.

It appears that the Town's alternatives are to continue irrigating with their municipal supply, or construct a properly located and designed well to meet their watering needs. The Town should carefully examine the costs to construct and operate an irrigation well and conveyance system, if that is their preference, and compare those figures with the pumping and treatment costs that could be avoided by eliminating the irrigation demand on their existing municipal system.