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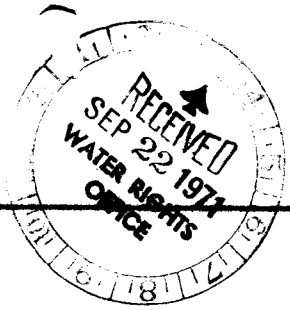
UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

112 Federal Building, Provo, Utah 84601



SUBJECT: ENG - Preliminary Investigation - Upper & Lower Marion Irrigation Company Streambank Erosion

DATE: Sept. 21, 1971

TO: Lyle Reynolds
District Conservationist
Coalville, Utah

Attached is a copy of the preliminary investigation report for the above company and job. You should plan to review this with the irrigation company officials. Neil Murray can assist you, if needed.

This requires an application from the irrigation companies to the State Engineer. If this application, showing their intent, has not been made, you need to encourage them to do so.

The State Engineer will most likely desire to meet with company officials and us, at the site, to review the PIR.

Ralph H. Felker

Ralph H. Felker
Area Conservationist

cc: A. W. Hamelstrom
Hubert Lambert
Neil Murray

PRELIMINARY INVESTIGATION REPORT
of
STREAM BANK EROSION
for
THE UPPER AND LOWER MARION IRRIGATION COMPANIES
Oakley, Utah

By: Neil R. Murray September 16, 1971

Summary

The investigation of this stream bank erosion problem on the Weber River was completed August 2. The investigation revealed progressive erosion occurring to the south stream bank just above the Upper and Lower Marion Irrigation Companies' diversion structure. In time, the river could wash around the south end of the diversion.

Due to the nature of this stream, it was the opinion of those investigating the erosion problem that armor plating the eroding area would be a better solution. Three alternatives are suggested to provide this protection. They are:

1. Lining the bank with very large (ten or more) loose rock riprap. This alternative would cost between $9,000.00 and $12,000.00. Its annual cost would be about $1,000.00. A benefit of $10.00 for every dollar spent could result.

2. Lining the bank with wire baskets filled with small diameter rock. This alternative would cost between $9,500.00 and $12,000.00. Its annual cost would be about $1,200.00. A benefit of $8.33 for every dollar spent could result.

3. Lining the bank with steel cribbing. This alternative would cost between $35,000.00 and $40,000.00. Its annual cost would be about $2,100.00. A benefit of $4.80 for every dollar spent could result.

Investigation

The investigation, among other items, included a review of the flow record of the Weber River near Oakley, a preliminary topographic survey of the problem area, and a survey of the damages. A topographic map and an aerial photograph of the area is attached.

According to the flow records obtained by the USGS, the maximum flow in the Weber River near Oakley occurred in 1984 and amounted to 4,010 cfs (cubic feet per second). Other high water years and amounts are as follows: 1951 - 2,100 cfs, 1942 - 2,040 cfs, 1953 - 2,110 cfs, and 1954 - 1,100 cfs. These and the other flow records on file were plotted on probability paper. The probability of some of the more important flow events being repeated are tabulated below.

Chance - %	Event - cfs
50	1,900
10	2,900
4	3,300
2	3,600
1	3,800
0.1	4,400

The preliminary survey shows the active eroding areas to be about 250 feet in length. The most active part being about 140 feet above the diversion. At this point the bank is 22 feet high. There is also evidence of erosion occurring at the south abutment of the diversion. Over a five month period, about 10 feet of bank have been washed away. Most of this occurred during spring runoff. It is conceivable that in time the river could wash around the south abutment of the diversion. The soil is river alluvium. Present erosion is contributing to the pollution of this river.

The river through this area has a slope of 0.0065 ft/ft (feet per foot). Its channel width varies from about 35 feet to 60 feet. Velocities of over 8 ft/sec (feet per second) can be expected at flood stage.

As is typical of erosion problems at a curve, the stream has deposited a large gravel bar next to the north bank. The stream banks to the south and east vary from 8 to 25 feet above the stream bed, while those on the north remain rather constant at 3 to 4 feet. Any flood flow exceeding 1,000 cfs will overflow the north and west bank.

The north bank and the area back of it have not been damaged by past floods. This is due to the wide area in which the water has to spread and the fact that the area is heavily vegetated.

Alternatives

Due to the nature of the stream, it was the opinion of those conducting the investigation that the south and east river banks be armor plated with some suitable nonerosive material. To do this, three alternatives were considered and are presented below.

Alternative I

This alternative would consist of:

1. Removing the gravel bar and using it as needed to fill the eroded areas.

2. Placing about 250 feet of very large (ton or more) loose rock riprap on the south and east river banks.

3. Adding a concrete wall about 20 feet long and 4 feet high to the canal outlet structure and east abutment of the diversion.

The large rock for this alternative is not available at the site. The material may have to be trucked to the site for distances up to 15 miles. The initial cost of this alternative would be between $9,000.00 and $12,000.00.

Alternative II

This alternative would be the same as alternative I, except that the loose rock riprap would be replaced with rock filled wire bins. The rock used to fill the bins would be of small diameter (3 to 12 inches). The major amount of rocks required to fill the bins can be obtained at the site. That amount required, over and above what is available at the site, will have to be hauled in from distances of 5 miles or less. If this alternative is employed, a protection of large loose rock will have to be provided at the channel bottom where rolling rocks may damage the wire bins. The initial cost of this alternative would between $9,500.00 and $12,000.00.

Alternative III

This alternative would consist of:

1. Excavating for and placing steel cribbing along the south and east bank.

2. Excavating the gravel bar from the river.

3. Back filling the cribbing.

4. Installing the concrete walls mentioned in alternative I.

The initial cost of this alternative would be between $35,000.00 and $40,000.00.

Environmental Impact

In a day when there is more and more interest and concern being shown toward effects of construction work on our environment, a decision to employ an alternative should not be made without considering its environmental impact. A discussion of the three alternatives from this standpoint follows.

The bulk of the material to be used in the first two alternatives occurs naturally in nature. While the galvanized steel cribbing is man made. To some, the use of rock may be more esthetically pleasing than steel. All material suggested, however, is foreign to the earth bank that is to be protected and may, as a result, be a distraction. It is, however, the opinion of the author that regardless of the material used, if well done, the project should be attractive to anyone.

Benefits

The benefits to be derived from this project are mostly in the preventive category. The monetary advantages are estimates of damages that could occur should the river wash around the diversion abutment. These are shown below in the table form.

Item No.	Item	Estimated Damage Cost
1	Land adjacent to the river	$ 5,000.00
2	Diversion	100,000.00
3	Canal	30,000.00
4	Crops	30,000.00
5	Land below diversion	10,000.00
	Total	$175,000.00

Benefit-Cost Ratios

Using the above estimated costs and benefits, the benefit-cost ratios were computed and are shown below in table form. All alternatives and benefits are compared on an annual cost basis. The annual interest rate used in comparing these alternatives was 5%. The estimated life of each alternative is:

1. Alternative I - 40 years.
2. Alternative II - 30 years.
3. Alternative III - 75 years.

	Benefits	Cost	
Alternative I	$10,000.00	First Cost (Annual)	$ 700.00
		Maintenance	300.00
			$1,000.00

Benefit-Cost Ratio = 10 to 1

Alternative II	$10,000.00	First Cost (Annual)	$ 800.00
		Maintenance	400.00
			$1,200.00

Benefit-Cost Ratio = 8.33 to 1

Alternative III	$10,000	First Cost (Annual	$2,100.00
		Maintenance	.00
			$2,100.00

Benefit-Cost Ratio = 4.8 to 1

FIGURES FACING NORTH

(B-13) 2-1

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TOPOGRAPHIC MAP
UPPER AND LOWER MARION
IRRIGATION COMPANIES DIVERSION

SCALE 1" = 30'
CONTOUR INTERVAL = 1 FOOT