MINUTES OF

ARKANSAS RIVER COMPACT ADMINISTRATION

SPECIAL MEETING

July 9, 1963

Court House

Lamar, Colorado

Attendance:

For Colorado:

L. R. Kuiper, Denver
Hacket Smartt, Lamar
David Jenkins, Las Animas

For Kansas:

Logan N. Green, Garden City, Vice-Chairman
Carl E. Bentrup, Deerfield
R. V. Smrha, Topeka

For the United States:

F. M. Bell, Denver, Chairman

Others Attending:

F. C. Snyder	Div. Engineer - Div. #2	Pueblo, Colo.
J. W. Odell	U. S. G. S.	Denver, Colo.
Ross W. Moor	U. S. G. S.	Lamar, Colo.
Dean M. Zander	Corps of Engineers	Albuquerque, N. M.
R. J. McGrath	Water Comm. #66 & #67	Lamar, Colo.
Harry C. Nevius	Amity Canal Co.	Lamar, Colo.
Wm. Pattie	Fort Lyon Canal Co.	Las Animas, Colo.
W. R. Randle	City of Lamar Water Department	Lamar, Colo.
Arthur C. Gordon	Fort Lyon Canal Co.	Lamar, Colo.
Guy M. Vincent	Kans. State Div. of Water Resources	Garden City, Kans.
Robert H. Buchhagen	Corps of Engineers	John Martin Dam
George H. Russell	City Engineer	Lamar, Colo.
E. A. Thaxton		Las Animas, Colo.
C. V. Mills	Daily News	Lamar, Colo.
Dan Bogart	Colo. Game & Fish	Lamar, Colo.
Sisto Guidotti	Amity Canal Co.	Bristol, Colo.
Ralph Adkins	Colo. Fuel & Iron Corp.	Pueblo, Colo.
Robert G. Rogers	City of Lamar	Lamar, Colo.
James E. Wagner	Fort Lyon Canal Co.	Lamar, Colo.

Others Attending: (Continued)

J. A. McGlothlin	Catlin Canal Co.	La Junta, Colo.
Frank Milenski	Catlin Canal Co.	La Junta, Colo.
Everette Marshall	Catlin Canal Co.	La Junta, Colo.
Roy Eckles	Game & Fish Comm.	Lamar, Colo.
Chester Cozine	Model Land & Irrig. Co.	Model, Colo.
Wm. Howland	Amity Canal Co.	Holly, Colo.
Fred L. Boydston, Jr.	Colorado Water Conservation Board	Denver, Colo.

Chairman Bell called the meeting to order at 9:30 A. M. and noted that there were several items of business on the agenda, but that he would proceed with them in the regular order of business. He asked for any corrections or additions to the minutes of the special meeting held March 26, 1963. Corrections were suggested and agreed to on pages 5 and 6. The Chairman, hearing no objections, declared the minutes approved as corrected.

Mr. Bell said that the Chairman had no written report to make, but he had received a report of the Corps of Engineers on the City of Las Animas Flood Control Project and had transmitted it to the Chairman of the Engineering Committee. He also had received an inquiry from the Chairman of the Conference of Interstate Agencies wanting general information on the Compact Administration. Mr. Bell said he had answered the inquiry.

The Chairman asked for the Secretary's Report, and Mr. Smartt gave the following:

SECRETARY'S REPORT

from

3/26/63 to 7/9/63

The Secretary distributed the Annual Reports to the Canal Boards below the reservoir, sent 25 copies to Mr. Barnhart, Secretary of the Arkansas Valley Ditch Association at Pueblo, Colorado, Fort Lyon Canal Co. at Las Animas were furnished with 25 copies; also some were mailed to others upon request.

The releases from the reservoir were ordered on April 1st and the gage at The Lamar Station was read by the Secretary and Mr. Guy Vincent was furnished the report on this daily.

On April 8th a Telephonic Meeting was called for the purpose of finding the reservoir empty. It was declared to become empty on April 12th.

Mr. Whitten, State Engineer, was notified by telephone. Also Mr. F. C. Snyder was contacted by telephone. Mr. Whitten was later given written notice, with a copy being sent to Mr. F. C. Snyder, Division Engineer at Pueblo.

Bills are paid to date and a Treasurer's Report prepared for this meeting.

Respectfully submitted,

Hacket Smartt,
Secretary-Treasurer A.R.C.A.

Mr. Bell said if there were no objections the Secretary's Report would be accepted.

Chairman Bell then asked Mr. Smartt to give the Treasurer's Report, which he did as follows:

TREASURER'S REPORT

to June 30, 1963

		Balance on hand March 26, 1963	$5,815.29
Date	Voucher Number	Payee and Purpose	Amount
3/28/63	365	Peerless Printing Company Printing 14th Annual Report	$ 625.00
4/ 2/63	366	Mt. States Telephone Co.	$ 12.65
4/ 2/63	367	Hacket Smartt, Sec.-Treas. Qtr. ending March 31, 1963	$ 289.13
4/ 2/63	368	Treasurer of the United States 1st qtr. 1963 Social Security	$ 21.75
5/ 5/63	369	Mt. States Telephone Co. April Telephone service	$ 20.20
6/30/63	370	U. S. Geological Survey 3rd qtr. Cooperative Agreement	$ 450.00
6/30/63	371	Hacket Smartt, Sec.-Treas. April, May & June Salary includes $12 mileage and $12 reading gage	$ 313.13
6/30/63	372	Second qtr. Social Security	$ 21.75
6/30/63	373	Mt. States Telephone Co. May & June telephone bill	$ 23.75
		Total Disbursements this period	$1,777.36
		Balance on hand - 7/9/63	$4,037.93

Mr. Bell said that the Treasurer's Report would be received unless he heard objections. No objections were heard.

Mr. Green was asked to report for the Administrative and Legal Committee, and he said the Committee had nothing to report.

Mr. Smrha was asked to report for the Engineering Committee. He said that the Engineering Committee had completed the study on the effect of stock ponds in the Arkansas River Basin, and he would like to present it to the Administration. Mr. Kuiper moved and Mr. Smartt seconded the motion to accept the report. The motion was passed and the report is included as Appendix A to these minutes.

Mr. Smrha continued his report by saying that on May 17, 1963 the Chairman of the Administration had transmitted to him a copy of the Corps of Engineers proposed flood control project for Las Animas. He asked Mr. Kuiper to read the report of the Engineering Committee on this proposed project. Mr. Kuiper reported as follows:

Engineering Committee

Arkansas River Compact Administration

July 9, 1963

Report on Flood Control Project for
Las Animas, Colorado

An Interim Report on Review Survey for Flood Control, Arkansas River and Tributaries, Las Animas, Colorado and Vicinity has been prepared by the U. S. Corps of Engineers, and has been reviewed by the Engineering Committee of the Arkansas River Compact Administration.

Of three proposed plans submitted in the report, Plan C is the most comprehensive and affords the greatest total benefits of flood damage reduction, increased land utilization, and recreation facilities, but also requires the greatest expenditure of funds. The 1963 estimated cost is $1,872,000 of which the Federal Government will bear $1,759,000 and non-Federal or local costs are $113,000. The Arkansas River Conservancy District, the contracting agency, has agreed to all terms of construction, operation and maintenance prescribed by the Corps of Engineers.

The flood protection area consists of a strip of land adjacent to and parallel to the Arkansas River approximately nine miles long and about 2½ miles wide at Las Animas, Colorado. The area contains about 6,880 acres -- 740 acres urban and 6,140 acres of farm land. The project plan provides for 9.6 miles of levee, about 12 feet high on the south side of the river. About two-thirds of the levee will be west of Las Animas and about one-third east of town. The latter location provides a back water flood protection from the Purgatoire River mouth which is less than a half mile distant. A 13 foot levee one mile in length on the north side of the Arkansas River opposite Las Animas provides protection for State Highway #94 and U. S. Highway #50. In conjunction with the levee system, flexible type bank protection is provided where necessary. Plans call for an interior drainage system including a drainage ditch, two ponding areas covering approximately 80 acres, outlet structures to the river, and outlet drains and pumping facilities for the lagoon area of the existing sewage disposal plant. Inlet structures are provided for two irrigation canals which traverse the flood control area.

The Arkansas Valley Branch Line of the A. T. & S. F. Railroad west of town is to be raised nine feet in grade, and the railroad bridge over the river northeast of town is to be altered to pass the design flood. The Colorado State Highway Department will construct a new bridge on U. S. Highway #50 north of town. Plans for the two bridges meet all requirements to pass a design flood of 140,000 c.f.s. The channel between the two bridges will be entirely stripped of all vegetation and obstructions. Channel straightening is provided at other river stations. A specified borrow area for levee fill material will produce a lake some 2,200 feet long of about 22 acres in extent to be used as a fishing lake and recreation area. This area is city owned and water for the pond would be maintained by an existing irrigation ditch from which the city has a water right.

It is the opinion of the Engineering Committee that this flood protection project will have no effect on the useable flows of the Arkansas River, and replacement water for evaporation losses from the small fish pond which is to be constructed will come from ditch rights which are presently being used in irrigation.

Therefor, the Engineering Committee recommends that the attached letter be approved for dispatch to the U. S. Corps of Engineers.

Respectfully submitted by the Engineering Committee

/s/ R. V. Smrha
R. V. Smrha, Chairman

/s/ L. R. Kuiper
L. R. Kuiper

July 9, 1963

Colonel John F. Arfman
District Engineer
U. S. Army Corps of Engineers
Albuquerque District
517 Gold Avenue
Federal Building
Albuquerque, New Mexico

Dear Colonel Arfman:

The Arkansas River Compact Administration has reviewed the Interim Report on Review Survey for Flood Control, Arkansas River and Tributaries, Las Animas, Colorado and Vicinity.

It is the opinion of the Compact Administration that the proposed project will not be injurious to the operation of John Martin Reservoir, nor will it materially deplete or adversely affect the usable quantity and availability for use of the waters of the Arkansas River to water users in Colorado Water District 67 and Kansas.

Very truly yours,

Hacket Smartt,
Secretary

Chairman Bell said that he had transmitted the proposed project report to the Engineering Committee directly in the hope that action on the report could be taken at this meeting. He, therefor, requested approval of the Administration for his action. Mr. Kuiper's motion, seconded by Mr. Smartt, to approve the action of the Chairman in forwarding the Las Animas Flood Control report directly to the Engineering Committee was passed by vote of the states. Mr. Smrha then moved for approval of the report of the Engineering Committee, including the letter to the Corps of Engineers, on the Las Animas Flood Control Project. Mr. Bentrup seconded the motion and it was duly passed by vote of the states. Mr. Smrha said that concluded the report of the Engineering Committee. In the discussion of clearing of the channel of the Arkansas for the Flood Control Project at Las Animas, Mr. Kuiper related that studies have shown that salt cedar growth has increased greatly in the Arkansas river and estimates have been made of the excessive consumptive use of water of these phreatophytes over usable grasses. He said he hopes to be able to make recommendations in the future for solution of the problem.

Mr. Bentrup gave the report of the Operations Committee as follows:

OPERATION'S COMMITTEE REPORT

to July 9, 1963

The gates at The John Martin Reservoir were opened on April 1st, with a discharge of 1,000 c.f.s. being requested. Kansas called for 400 c.f.s. and Colorado called for 600 c.f.s. These requests were continued until the reservoir was empty at 12 p.m. on April 12, 1963, at which time the gates were ordered open for river flow and have remained open to date.

Water in storage on April 1st - - - - - - - - - 21,950 Ac. Ft.

" " " " July 9th - - - - - - - - - None

Respectfully submitted,

/s/ Carl E. Bentrup
Carl E. Bentrup, Chairman.

Hacket Smartt, Member.

Mr. Bell said that unless there were some objections, the report of the Operations Committee would be accepted.

Mr. Bentrup asked to be excused from the rest of the meeting because of other commitments, and noted that a quorum would still be present to carry on the business. Mr. Bell thanked Mr. Bentrup for coming to the meeting.

Mr. Smartt presented the minutes of the telephonic meeting and confirmation letter to the Colorado State Engineer as follows:

SPECIAL TELEPHONIC MEETING

April 8, 1963

A Special Telephonic meeting was held on April 8th, 1963, as provided in Article IV, Section 3 B of the By-laws of the Administration, for the purpose of declaring the reservoir empty. As a result of this meeting, the reservoir was declared to become empty on April 12th, 1963.

The State Engineer of Colorado was notified that commencing on this date, unless a change of conditions justify, cancellation or modification of this notice, he is required, under terms of the compact, to administer the rights of water users in Colorado in the manner and for a period of time as set forth in Article V F of the compact. A copy of this notice was also sent to Mr. F. C. Snyder, Division Engineer at Pueblo.

The reservoir was empty 12 p.m., April 12, 1963.

Members contacted were:

For Kansas - Mr. Green and Mr. Bentrup.
For Colorado - Mr. Smartt and Mr. Jenkins.

Hacket Smartt,
Secretary A.R.C.A.

April 8, 1963

Mr. J. E. Whitten
State Engineer for Colorado
State Office Building
Denver 3, Colorado

Dear Mr. Whitten:

This will confirm my telephone conversation with your office on this date through the Colorado Water Conservation Board concerning action taken by the Administration this date declaring that if nothing unforeseen happens to modify or change the situation the John Martin Reservoir will be empty on April 12, 1963, and priority administration should commence and decreed rights of water users in Colorado would be administered by the State Engineer of Colorado.

Respectfully yours,

Hacket Smartt,
Secretary A.R.C.A.

cc: F. C. Snyder
Pueblo, Colorado

Mr. Bell said that the minutes of the April 8, 1963 telephonic meeting will stand approved, as written, since no objections were heard.

Mr. Kuiper read a proposal from the City of Lamar for construction of a dam and reservoir on Clay Creek. The proposal is attached as Appendix B. In the discussion which followed, both Mr. Smartt and Mr. Jenkins voiced their opinion that when floods occurred on Clay Creek there are usually floods on most of the other dry creeks in the area. Mr. Kuiper gave his opinion that the proposed reservoir would not diminish the usable flows of the Arkansas river, and suggested that at this time the Administration could only approve the proposal in principle, reserving final approval for such time as final plans are submitted. Mr. Smrha said any approval should come only after the Engineering Committee has studied the proposal. He therefor moved and Mr. Kuiper seconded that the Administration accept the proposal of the City of Lamar and refer it to the Engineering Committee for study and recommendations. The motion passed by vote of the states. When Mr. Russell was asked about the urgency of constructing the project, he replied that Lamar water consumption was now at about 4,000,000 gallons per day and he considered the situation to be very urgent. Mr. Kuiper then suggested that the Engineering Committee advise the City of Lamar as soon as possible of the sense of the report to be made to the Administration so that Lamar could proceed with plans. Mr. Smrha agreed that this could be done.

Mr. Jenkins brought up the subject of ditches diverting without decreed rights. He related an instance where he knew of a man in La Junta diverting from Smith Canyon who admitted he had no decree on the stream. He said he realized the State Engineer did not have sufficient men to administer the rights, and asked when the Compact Administration was going to look into rights of those making diversions. It was his opinion that the Administration should hire an engineer to work on checking the decrees and report to the Administration all information on the illegal use of water. Mr. Kuiper said he thought that such action would be beyond the scope of the duties of the Administration and he would not like to consider hiring an engineer until he could have an opinion from the Attorney General. Chairman Bell read Article VI, A, 1 of the Compact, and in the discussion which followed, Mr. Smrha remarked that unless such policing would result in water being stored in John Martin Reservoir, Kansas would not be interested in the problem, and he was sure the Kansas legislature would not provide any money for such policing as is suggested. Mr. Kuiper also said that the Colorado legislature would probably not appropriate money to the Administration for this, but that the State Engineer would stand a much better chance of getting an appropriation. Mr. Snyder was asked how much water was being used illegally and he said the amount was very small and that there are really very few cases of stealing of water.

Mr. Odell was asked to report on the cost of automatic recording gages on the Arkansas and Purgatoire near Las Animas, and read the following report:

Radio Equipment for Arkansas Basin

A rough estimate of the cost of installing radio equipment at the gaging stations on the Arkansas River at Las Animas and Purgatoire River near Las Animas was obtained from Motorola Communications and Electronics Inc., Denver, Colorado, on July 5, 1963.

The estimate was $13,500.

Includes:

Transmitters at Las Animas (2 stations)

Relay station at John Martin Dam

Receiver at Lamar with Printout on tape. Regular broadcast at 1 hour intervals.

If the relay is not needed at the Dam, the cost would be $11,000 to $12,000.

Additional printout at Dam + $1,600.
Interrogation from Lamar or the Dam + $1,700.

The Company has a contract with the Air Force for furnishing this type of equipment. The contract may be utilized by other Federal Agencies. They also have a lease-purchase plan under the contract which permits lease of the equipment with option to purchase later.

This would be about $210 per month rental plus about $75 per month maintenance.

If the rent-purchase plan is used, there will be an interest charge of approximately 2.1% per month on the value of the equipment.

J. W. Odell
7/8/63

A lengthy discussion followed during which Mr. Odell, in answer to a question, estimated the annual operating costs, exclusive of normal operating costs, would probably be about $200 which would be mostly for batteries. Mr. Kuiper said studies have been made of water savings which could have been accomplished by leaving the gate openings in John Martin Reservoir set at 1,000 c.f.s. and possible 850 c.f.s. when the reservoir was dry. He said it appeared that with better control about 5,000 acre feet additional could be stored in most years. He thought the $13,500 cost of these gages would, therefor, be a good investment.

The budget was then taken under consideration, and after lengthy discussion, the following budget was presented by Chairman Bell:

ARKANSAS RIVER COMPACT ADMINISTRATION

PROPOSED BUDGET

1964 - 1965

Personal Services		$6,825.00
Secretary Salary	$1,200.00	
Social Security	$ 50.00	
Gage Reports	$1,800.00	
Professional Services (Audit of Accounts)	$ 75.00	
Cooperative gage replacement and rehabilitation	$3,700.00	
Capital Outlay		$ 300.00
Maintenance and Operation		$1,675.00
Bond, Treasurer	$ 25.00	
Printing	$ 600.00	
Official Publications	$ 100.00	
Travel Expense - Secretary and Employees	$ 150.00	
Typing and Mailing	$ 200.00	
Investigation and Inspection	$ 150.00	
Telephone and Telegraph	$ 300.00	
Office Supplies	$ 150.00	
Total Proposed Budget, 1964-1965		$8,800.00
Estimated Carry-over as of June 30, 1964		$1,580.00
Total to be appropriated by Colorado and Kansas		$7,220.00

In accordance with Article VIII E (I), the amount of such budget payable by the State of Colorado is sixty percent thereof, or $4,332.00, and the amount payable by the State of Kansas is forty percent thereof, or $2,888.00.

The budget was adopted, as presented, by vote of the states on a motion by Mr. Kuiper and seconded by Mr. Smrha.

Mr. Kuiper said he wanted to present information on two items of interest to the Administration: (1) the operating principles on the Trinidad Project are about to be finalized, and he anticipates that a meeting of the Administration will be held to consider them, and a meeting of the AVDA will also be held for that purpose; and (2) a permanent pool in John Martin Reservoir is again being considered and studied.

Mr. Adkins referred to an error in the report of the Operation Committee dated May 8, 1962 and appended to the September 21, 1962 minutes and requested that the report be corrected. A motion was passed that the fourth paragraph from the bottom on Page iii of the Operation Committee report, referred to, be corrected. Mr. Smartt made the motion which was seconded by Mr. Smrha. The paragraph, as corrected, is as follows:

"Brief inspections were made at two points at which water was being returned to the river. ~~They were the return flow from the Colorado Fuel and Iron Company's operation.~~ ONE WAS SALT CREEK. ~~This formerly had a measuring device that was later discontinued when it was found that the return was at almost constant flow.~~"

Mr. Smartt said he would order 500 sheets of new stationery, but that he had sufficient envelopes.

Mr. Smrha reminded all the members that a draft of the Annual Report should be prepared by a committee of some kind right after October 31st.

Mr. Smartt also reminded the members it would be necessary for him to get gage reading on the Purgatoire and Arkansas near Lamar at the time of closing the gates November first.

The meeting adjourned at 12:10 P. M.

APPENDIX A

A REPORT ON STOCK PONDS IN THE ARKANSAS RIVER BASIN AND AN ESTIMATE OF THEIR PROBABLE EFFECT UPON THE FLOWS OF THE ARKANSAS RIVER

Prepared By

The Engineering Committee
of the
Arkansas River Compact Administration

The Arkansas River Compact Administration has become concerned with the possible effect of stock ponds, in Colorado, upon the administration of the Arkansas River as provided for in the Arkansas River Compact. In view of the fact that the Colorado Water Conservation Board had previously embarked upon such a study, the Colorado member of the Engineering Committee of the Arkansas River Compact Administration was instructed to report the findings of the above mentioned study to the Compact Administration. The following report is in conformity with such instructions.

The procedure followed in conducting this study was:

(1) To examine the records of the State Engineer of the State of Colorado and from these records to tabulate the location by section, township, and range, as contained in the filing, the date filed, the name of the owner and the water course upon which the stock pond was constructed. The capacity as reported in the filing was also tabulated. The tabulations thus acquired were arranged according to water district.

(2) The stock ponds tabulated in (1) above were then plotted upon a large scale map of the Arkansas River Basin.

(3) In certain selected areas decrees of record were plotted to delineate the relationship between the location of stock ponds and the location of headgate structures for the subject decrees.

(4) Certain selected areas were studied by various methods and correlated with weather records to attempt to determine the effects upon the specific water courses.

(5) Two field trips were made into selected areas to examine and photograph stock ponds in those areas.

The results of these procedures are described in greater details by the following.

The distribution of stock ponds, by water district, are shown in the following tabulation which sets forth the number of ponds, the total capacity, and the average capacity for each water district within the Arkansas River Basin:

Water District	No. of Ponds	Capacity (Acre-Feet)	Average Capacity (Acre-Feet)
10	121	560	4.6
11	2	12	6.0
12	119	218	1.8
13	13	29.6	2.2
14	300	1,352.4	4.5
15	76	148.2	1.9
16	89	222.9	2.5

Water District	No. of Ponds	Capacity (Acre-Feet)	Average Capacity (Acre-Feet)
17	299	1,024.4	3.4
18	123	237.1	1.9
19	859	2,110.8	2.4
66	179	378.6	2.1
67	597	1,906.9	3.1
Total for the Basin	2,777	8,200.9	2.9

The first method used for detailed study was to choose an area for which weather station records of precipitation are available and which is located adjacent to, or near, a river gaging station at which records of flow are also available. The first area chosen was on the Purgatoire River at Trinidad, where there is located a stream gaging station and a weather station with adequate stream flow and precipitation records. The period of study chosen was from 1945 to 1960. For study purposes it was assumed that all of the stock ponds in the watershed of the Purgatoire River upstream from the Trinidad gage would be filled in the first major storm (more than 1.25 inches of precipitation) occurring during the months of May and June. This assumption, of course, would presume that a major storm occurring during either of these months was of watershed-wide significance. An examination of the stream flow records did not indicate that this was always the case. As a matter of fact it appeared that this was probably the case in approximately 50 percent of the years.

From the stream flow records it appears that in seven years

of the sixteen studied, the storms recorded by the Trinidad weather station were probably watershed-wide. The total capacity of the stock ponds located upstream from the Trinidad gaging station, in the Purgatoire River Basin, is 518 acre-feet. If we are to assume that all of the stock ponds were filled during the first major spring storm which is probably watershed-wide, the theoretical effect upon the flood flows passing the Trinidad gage would be in the magnitude of 1.69 percent. This is undoubtedly the highest possible percentage effect the stock ponds could have upon the flows at the Trinidad gage. This percentage does not take into account the channel losses that would occur if this water were not impounded by the stock ponds. The channel characteristics downstream from the stock ponds are generally broad with very few, well defined threads of channel. Vegetation similar to the surrounding area comes down to and across the channel bottom. A study of these channel areas downstream from the stock ponds indicates that water of sufficient magnitude to cut well defined channels has not historically flowed down these channels. It is obvious, therefore, that infiltration into the soils of the channel would be quite high and that the net yield at the lower reaches would probably not be significant. A detailed study of the infiltration over the extensive area involved is not feasible at this time. It is the concensus of the staff of the Colorado Water Conservation Board that the effect of these stock ponds at the Trinidad

gage would be considerably less than the 1.69 percent average indicated in the procedure outlined above and it is questionable that the effect would be measurable at the gage.

A study similar to the Purgatoire River at Trinidad was made for the Apishapa River near Aguilar. The period studied was from 1940 to 1950. The precipitation stations used were those at Walsenburg and Trinidad and the river gage was the gage on the Apishapa River near Aguilar. It was found that of the ten years' studied, from an examination of river flows, that in only four of the years was the precipitation apparently watershed-wide. Assuming again that all of the stock ponds, aggregating 237 acre-feet of capacity, were filled in this storm, the average effect on the gage at Aguilar would have been 3.19 percent. An examination of the location of these stock ponds indicates that they are even further removed from the stream than were those used in the Purgatoire River studies. Therefore it is likely that the infiltration effect downstream from these ponds would be even greater than would be the case in the Purgatoire River Basin. It is the opinion of the staff of the Colorado Water Conservation Board that it is unlikely that the existence of these stock ponds significantly affects the flows of the Apishapa River near Aguilar.

Several double-mass diagrams were prepared to see if this approach would demonstrate a significant effect on river flows.

In each case no signicant effect was observed. One double-mass diagram is included as an exhibit of this report in order to illustrate what a typical mass diagram will show. This double-mass diagram plots Fountain Creek at Pueblo against the Arkansas River near Pueblo. The period used was from 1941 to and including 1959. It is interesting to note that there is a significant change in slope between the years 1948 and 1956. This change in slope is not due to the construction of stock ponds since the total capacity of the stock ponds constructed upstream from the Fountain Creek at Pueblo gage amounted to only 58 acre-feet. Some phenomena other than stock ponds caused this significant change in relationship. Although the period of record from 1956 forward is not sufficiently long to indicate a firm trend, it is interesting to note that a "line of best fit" applied to this period parallels the line "line of best fit" applied to the period 1941 to 1948.

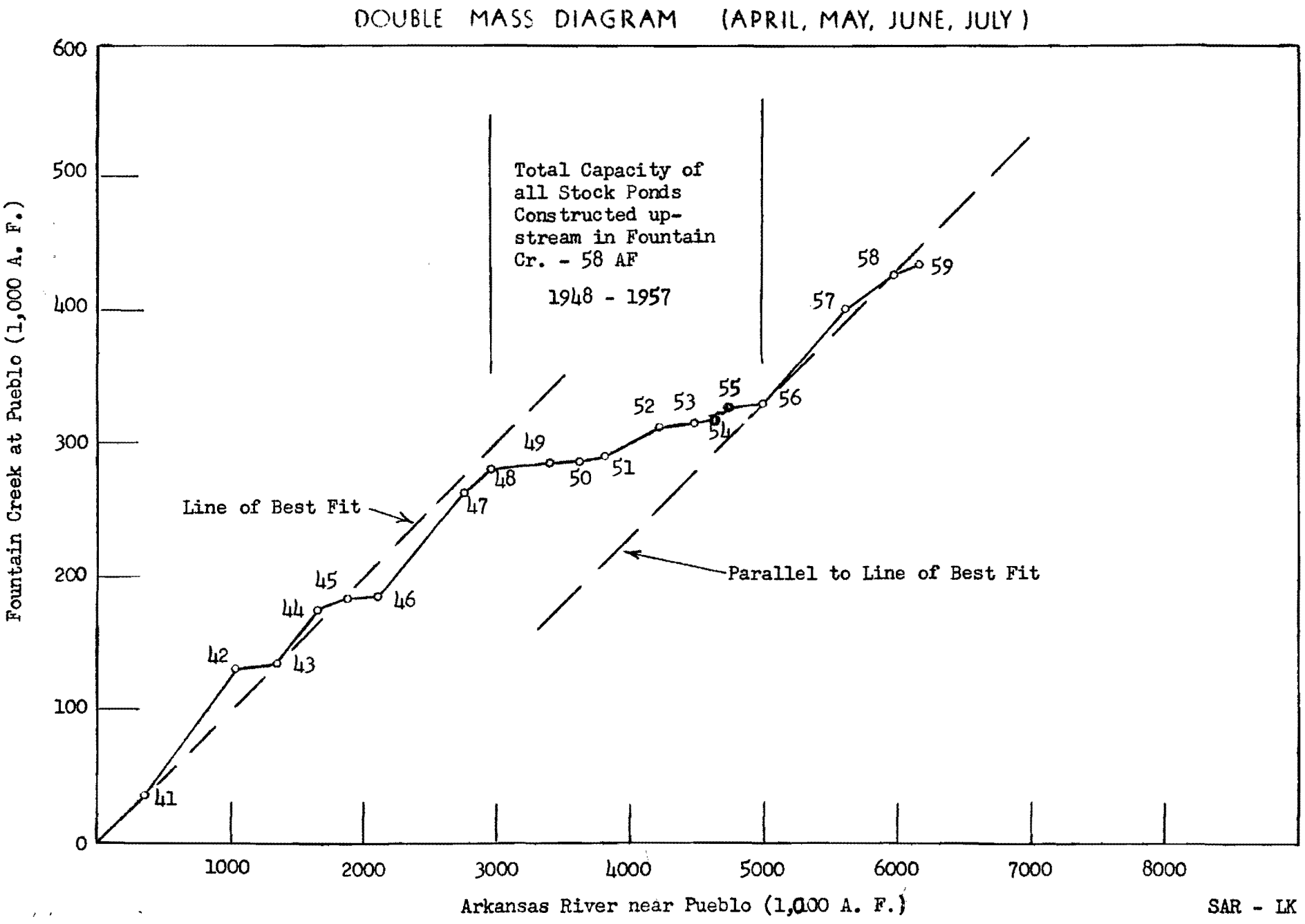
Two field trips were made into the area during the month of July to study and photograph certain stock ponds. S. A. Rizvi, Assistant Hydraulic Engineer for the Colorado Water Conservation Board, Mr. Wallace A. Doe, Consulting Engineer from Ordway, Colorado, and Bob Mariano, Water Commissioner for Water District No. 19, made this field trip. One day was used to study the area northwest of Trinidad in the vicinity of Forbes, Hastings, Berwin, and Ludlow. A second day covered a larger area northwest of Trinidad

in the Apishapa Basin in the general vicinity of Sarcilo, Gulnare, Aguilar, Tyrone and Elmora. This was in rough mountainous country and the Dry Valley area. Generally on this trip it was found that most stock ponds were empty. The exceptions were those ponds which had been built below natural springs in which cases the ponds were full. These were small springs and it is extremely questionable whether the water lost by evaporation from the surface at these higher altitudes would be significant. The area in the Apishapa Basin consists of a more rugged topography than is general in the lower reaches of the basin. In this particular area there is some erosion due to the steepness of the slopes. It was found that a large number of the ponds in this area were more for the purpose of controlling erosion than they were for storing stock waters.

A further field trip was taken in the area east of Trinidad in the vicinity of Trinchera and Elmora. In this area again several of the stock ponds were used for erosion control rather than for storage for stock watering purposes. It was the concensus of the field party that in this area substantial amounts of water would not reach the local streams either with or without stock ponds. In the opinion of the field party most of the water would be lost as seepage in the channel and by evaporation. This appears to be an area of local storm so that no particular storm would effect any significant number of stock ponds. The character of the

land where most of the stock ponds are located is flat, rolling country with very few clear, deep depressions. The ponds are located quite some distance from any main stream or channel. It was the opinion of the Water Commissioner member of this field party that the existence of the stock ponds probably has very little, if any, direct effect on flows of the main stream.

LRK:lk
Attachment
4/8/63


DOUBLE MASS DIAGRAM (APRIL, MAY, JUNE, JULY)
Total Capacity of all Stock Ponds Constructed upstream in Fountain Cr. - 58 AF
1948 - 1957
Line of Best Fit
Parallel to Line of Best Fit
Fountain Creek at Pueblo (1,000 A. F.)
Arkansas River near Pueblo (1,000 A. F.)
SAR - LK
0
100
200
300
400
500
600
1000
2000
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APPENDIX B

CITY OF LAMAR, COLORADO

July 9, 1963

The City of Lamar, wishing to obtain the approval of the Arkansas River Compact Administration, submits the following description and analysis of a proposed reservoir project.

Lamar proposes to construct a dam and reservoir on Clay Creek about five miles southeast of the city for recharge of the municipal water well field from which the city derives the majority of its water supply. The Colorado Game and Fish Department has agreed to assist Lamar in constructing the project and in return will stock the reservoir for fishing. The city will maintain the water level in the reservoir by surface flows of Clay Creek when they are available and at other times by pumping from the municipal wells, "- - - if said water is available and if the furnishing of same would not be detrimental to the domestic supply of the city."

At present the city of Lamar has a population of about 8,500, and uses approximately 1,500 acre feet of water annually, most of which is returned to the Arkansas River thru the city sanitary sewer system. The Lamar Municipal Light and Power Plant uses water for cooling requirements which is obtained by pumping from a sump and ten wells. After small condensation losses, it is estimated that about 5,500 acre feet annually is discharged into a storm sewer to the Arkansas River from the power plant. The city now owns 4.5 c.f.s. surface water rights on Clay Creek and derives a part of its municipal water from this source by pipeline from about twelve miles south of town. The surface rights are: 1.6 c.f.s., priority number 48 dated April 20, 1915; and 2.9 c.f.s., priority number 84, dated October 12, 1939. The remainder of the municipal water supply, as well as all future supplies, will be obtained from wells near the proposed dam on Clay Creek.

Designs for the proposed dam are incomplete, but the outlet works will be designed to pass flows to senior water rights downstream within the channel capacity. The dam is expected to be thirty-five feet high and will have a capacity of about 1,800 acre feet with a surface area of about 195 acres. It is estimated that net evaporation from a full reservoir this size will be about 500 acre feet annually. The evaporation losses would be replaced either by water from the city well system or by surface runoff.

Surface runoff of Clay Creek is only intermittant and very few measurements are available on it. Table 1, attached hereto, is a tabulation of streamflows at times when Clay Creek flows were measured for the years 1957, 1959, 1960, 1961 and 1962. These measurements were, in turn, used to obtain a correlation with Caddoa Creek flows. In the four year period 1942-1945 Caddoa Creek near Caddoa was gaged, and from this record an estimate of the Clay Creek flows for the same years were made. Below are tabulated the annual recorded and estimated flows of Clay Creek near Lamar for nine years:

CLAY CREEK NEAR LAMAR

Water Year	Acre Feet
1942	988 E
1943	330 E
1944	956 E
1945	1,362 E
-	-
1957	6,400
1958	No Record
1959	1,250
1960	1,250
1961	800
1962	4,700
9 Year Average	2,000

Note: E = estimated.

From the records and estimates it appears that probably there would be sufficient surface flows each year to take care of the net evaporation losses. However, since these surface flows are so very erratic, as a matter of practical operation to

maintain a pool for fishing and recreation, it will probably be necessary to replace most of the evaporation losses each year with water pumped from the city well system.

To summarize the results of the effect of this reservoir:

(1) Net evaporation losses by the reservoir will be about 500 acre feet annually.

(2) Surface runoff is probably available to replace evaporation losses most years.

(3) From the meager records available, it appears that when storms are general throughout the area, large flows on Clay Creek reach the Stateline virtually undiminished, while smaller flows of Clay Creek from spotty storms appears to be diminished by seepage into the groundwater storage or by diversions.

(4) Ditches in Colorado below the mouth of Clay Creek do not depend greatly on Clay Creek flows for irrigation requirements.

(5) Lamar returns more water to the river each year through the sanitary and power plant systems than would be used by the proposed reservoir.

Respectfully submitted,

/s/ George H. Russell
George H. Russell
City Engineer
Lamar, Colorado

TABLE I

UNIT = C.F.S.

1957

	May 10	May 16	July 25	Aug. 1	Aug. 11	Aug. 18	Oct. 8
Caddoa Cr.	-	3,000	200 (a)	-	-	-	125
Mud Cr.	-	4,000	150 (a)	-	-	-	500
Dry Cr.	-	200	3,000	100	-	25	-
Willow Cr.	-	50	300	500	-	-	-
Clay Cr.	50	2,000	500	150	100	400	650
Big Sandy Cr.	-	25	1,500	-	35	-	-
Wolf Cr.	100 (b)	1,000	-	-	250	-	300 (a)
Buffalo Cr.	100 (a)	75	-	-	200	-	-
Granada Cr.	-	1,000	-	-	-	-	-
Wild Horse Cr.	-	500	-	-	-	-	-
Two Buttes Cr.	200 (a)	3,000	-	250 (c)	-	-	-
Cheyenne Cr.	-	-	-	-	-	-	-
Ark. R. below J. M.	727	438	366	430	740	880	495
" " at Lamar	-	-	-	-	-	-	-
" " at Stateline	111	5,100	663	714	1,780	646	1,170 (a)
" " at Garden City	11	3,290 (b)	45 (b)	30 (b)	58 (b)	12 (b)	8 (b)
Kansas Demand	0 (1)	0	500	500	750	500	350
Colo. Div. below Clay Creek	49	43	123	116	129	87	53

(a) one day later.

(b) two days later.

(c) previous day.

(1) John Martin Reservoir empty.

TABLE I

UNIT = C.F.S.

1959

	May 22	June 9	Sept. 25
Caddoa Cr.	-	-	200 (a)
Mud Cr.	-	-	600
Dry Cr.	-	-	200
Willow Cr.	-	-	200
Clay Cr.	100	25	500
Big Sandy Cr.	-	-	-
Wolf Cr.	50	-	200
Buffalo Cr.	-	-	400
Granada Cr.	-	-	200
Wild Horse Cr.	40	-	-
Two Buttes Cr.	-	-	800
Cheyenne Cr.	60	-	200
Ark. R. below J. M.	490	505	337
" " at Lamar	269	64	715
" " at Stateline	604	131	2,270
" " at Garden City	69 (a)	31 (a)	638 (b)
Kansas Demand	0	0	0 (1)
Colo. Div. below Clay Creek	144	113	119

(a) one day later.

(b) two days later.

(c) previous day.

(1) John Martin Reservoir empty.

TABLE I

UNIT = C.F.S.

1960

	June 9	June 10
Caddoa Cr.	-	-
Mud Cr.	-	500 (b)
Dry Cr.	-	-
Willow Cr.	-	-
Clay Cr.	600	25
Big Sandy Cr.	-	-
Wolf Cr.	200	300
Buffalo Cr.	-	-
Granada Cr.	50	50
Wild Horse Cr.	-	-
Two Buttes Cr.	-	-
Cheyenne Cr.	-	-
Ark. R. below J. M.	284	350
" " at Lamar	8	8
" " at Stateline	242	418
" " at Garden City	220 (a)	292 (a)
Kansas Demand	0 (1)	0 (1)
Colo. Div. below Clay Creek	88	86

(a) one day later.

(b) two days later.

(c) previous day.

(1) John Martin Reservoir empty.

TABLE I

UNIT = C.F.S.

1961

	June 4	June 5	June 6
Caddoa Cr.	500 (c)	150 (c)	50 (c)
Mud Cr.	175 (c)	-	500 (a)
Dry Cr.	-	100	400 (a)
Willow Cr.	-	-	-
Clay Cr.	200	150	50
Big Sandy Cr.	200	150	50
Wolf Cr.	-	-	-
Buffalo Cr.	-	-	-
Granada Cr.	-	-	-
Wild Horse Cr.	-	-	-
Two Buttes Cr.	-	-	-
Cheyenne Cr.	-	-	-
Ark. R. below J. M.	6	4	4
" " at Lamar	370	107	64
" " at Stateline	2,650	887	638
" " at Garden City	595 (a)	1,090 (a)	863 (a)
Kansas Demand	0	0	0
Colo. Div. below Clay Creek	4	90	63

(a) one day later.

(b) two days later.

(c) previous day.

(1) John Martin Reservoir empty.

TABLE I

UNIT = C.F.S.

1962

	May 18	May 19	June 1	July 3	July 4	Sept. 1
Caddoa Cr.	-	-	-	-	-	-
Mud Cr.	-	-	-	-	-	-
Dry Cr.	-	-	-	-	-	-
Willow Cr.	-	-	-	-	-	-
Clay Cr.	1,000	500	200	400	200	50
Big Sandy Cr.	550	-	-	-	-	-
Wolf Cr.	50 (c)	300 (c)	-	-	-	-
Buffalo Cr.	-	-	-	-	-	-
Granada Cr.	-	-	-	-	-	-
Wild Horse Cr.	300	-	-	-	-	-
Two Buttes Cr.	750 (c)	1,000 (c)	-	-	-	-
Cheyenne Cr.	2,300	1,500	-	-	-	-
Ark. R. below J. M.	711	161	368	550	490	45
" " at Lamar	770	25	11	30	252	5
" " at Stateline	2,710	1,330	288	148	112	33
" " at Garden City	446 (b)	317 (b)	69 (b)	25 (b)	23 (b)	4 (b)
Kansas Demand	0	0	0 (1)	0 (1)	0 (1)	0 (1)
Colo. Div. below Clay Creek	93	96	63	88	85	37

(a) one day later.

(b) two days later.

(c) previous day.

(1) John Martin Reservoir empty.