ANALYSIS OF CLIMATOLOGICAL DATA

FOR THE

SPRING CLOUD-SEEDING PERIOD OVER NORTH CENTRAL COLORADO

By

Sol D. Resnick
Civil Engineering Section
Colorado Agricultural Experiment Station
Fort Collins, Colorado

prepared for
Northern Colorado Natural Resources Association
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through
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T A B L E O F C O N T E N T S

FOREWORD

The analysis of climatological data described in this report was made for the period March 1, 1951 to June 1, 1951, during the cloud-seeding operations by the Water Resources Development Corporation of Denver, Colorado, covering a target area roughly defined as the valleys of the Cache la Poudre, Big Thompson, and St. Vrain Rivers east of the Continental Divide. The study was authorized by a contract between the Colorado Agricultural Research Foundation of Colorado A & M College, through the Civil Engineering Section of the Experiment Station, and the Northern Colorado Natural Resources Association.

Mr. William D. Farr, President, NCNRA, and Mr. Donald W. Farnham, Acting Secretary, NCNRA, were in consultation with Colorado A & M College staff members and made valuable suggestions during the course of the study.

The Section Chiefs of the U. S. Weather Bureau and Mr. Homer J. Stockwell, Irrigation Engineer, Soil Conservation Service, USDA, were very cooperative in making available climatological data.

Prof. Andrew G. Clark, Head, Mathematics Department, Colorado A & M College, advised on the statistical analysis of the climatological data.

College staff engineers who contributed to the studies were Prof. Maxwell Parshall, who assisted in the assembly and analysis of the climatological data; Mr. Irving S. Dunn, who advised on the meteorological aspects of the analysis and reviewed the report; Mr. James R. Barton, who assisted in the analysis of the snowfall data; Mr. Chong-Hung Zee, who assisted in the analysis of the precipitation data; and Mr. Victor Grimm, who assisted in the assembly of the data for the report.

Dr. D. F. Peterson, Jr., Chief of the Civil Engineering Section, assisted in analysis of the results and preparation of the report. Dean T. H. Evans, Chairman of the Engineering Division of the Station and Dean of Engineering, advised on direction of the work and assisted in analysis of results and preparation of the report. Prof. Sol D. Resnick was leader of the project. As such he had major responsibility for organization and technical direction of the work, analysis of results, and preparation of the report.

Cost of the study was borne by both parties to the contract. The College contributed the time of its personnel, which in Prof. Resnick's case was two-thirds time for four and one-half months. The NCNRA paid the costs of student assistants, travel, communication, extra rain gages, and report preparation.

SYNOPSIS

Presented in this report is an analysis of the climatological data for the period March 1, 1951 to June 1, 1951, during the cloud-seeding operations over north central Colorado.

The results of the various methods of analysis are as follows: the March, April, and May, 1951, mean depth of precipitation on the target area was 4.36 inches as compared to a forty-year normal of 5.40 inches and the probability study revealed that the 4.36 inches which fell during the three month period on the target area has been equaled or exceeded 69 percent of the time or approximately every two years out of three. Secular series studies for the period of March, April, and May indicate a significant upward trend in precipitation and the presence of a possible wet cycle.

The mean depth of precipitation on the control area for the month of March, 1951, was found to be 62 percent of the normal mean depth of precipitation on the control area for the month of March, whereas the mean depth of precipitation on the target area for the month of March, 1951, was found to be 52 percent of the normal mean depth of precipitation on the target area for the month of March.

The mean depth of snow-water content increase on the target area for the period of March and April, 1951, was 4.9 inches as compared to a thirteen-year normal of 3.1 inches. However, the above normal water content increase for the period of March and April, 1951, was apparently the result of the below normal monthly temperatures, which reduced the snow melt, for the same period.

The mean depth of snow-water content increase on the control area for the period of March and April, 1951, was 147 percent of the thirteen-year normal; whereas, the mean depth of water content increase on the target area for the same period was 158 percent of the thirteen-year normal.

A study of the precipitation in the western United States for the period of March, April, and May, 1951, showed that in general the Pacific coastal states, the eastern Rocky Mountain states, and the southwestern states were below normal in precipitation; whereas, the western Rocky Mountain states, the plains states, and the mid-western states were above normal in precipitation.

The analysis in which the isopercential theory was used to determine the changes in patterns and amounts of rainfall due to cloud seeding was not completed because of limited funds. An abbreviated approach based on the above theory was tried, but the results were not satisfactory.

The results indicate that there was no apparent increase in precipitation resulting from cloud seeding during the period March 1, 1951, to June 1, 1951, over north central Colorado.

There is also no proof that possibly good results cannot be brought about by artificial cloud seeding. Extensive field experimentation over a period of years, under conditions that permit scientifically adequate observation, may be required to establish the degree of success which cloud-seeding operations may be expected to achieve.

The report by the American Institute of Aerological Research, Denver, Colorado, on cloud-seeding operations in northern Colorado during the period March 1, 1951 to June 15, 1951, contained the following conclusions:

"1. In the period March 1, 1951 to June 15, 1951 generator operations for the benefit of northern Colorado totaled 1013 hours and 17 minutes.

2. Weather conditions for cloud seeding operations were generally poor with only one good seeding interval in each of the months of May and June.

3. Precipitation over the project averaged slightly below normal during the period of operations.

4. It is probable that seeding operations produced an increase in precipitation of between zero and 5 percent over what would have fallen naturally."

CHAPTER I

INTRODUCTION

The evaluation of cloud-seeding results is known to be extremely difficult, and perhaps even impossible because of the tremendous variation and extremes of natural weather phenomena. The analysis of precipitation records which is presented herein was undertaken with a full realization of the possibility that for the short period considered nothing significant might be detected. The change resulting from seeding operations can be detected only if of unasual statistical significance when compared by approved scientific methods to past precipitation records. Lack of any significant changes for even a season, on the other hand, indicates that there is no real evidence for the success of the operation.

Colorado A & M College decided to enter into this study for the NCNRA because it wished to assist in seeking answers to the many questions raised about artificial cloud seeding. It was an opportunity to assist the public, which it serves, and at least determine some of the problems involved in evaluation of this new development. The staff hoped also that some definite recommendations could be made which might assist in evaluations of future operations and in improvement of the type of contract used.

The Problem

The study undertaken is concerned with analyzing the attempts to increase precipitation, improve precipitation patterns, and reduce the weather extremes of violent downpour and excessive erosion and destruction. The target area is outlined accurately on the map attached as Fig. 1. It can be defined roughly as the valleys of the St. Vrain, Big Thompson, and Cache la Poudre Rivers east of the Continental Divide and north to the Wyoming border.. The period covered by this study was for March, April, and May of 1951.

CHAPTER II

METHODS OF ANALYSIS

The methods used in the analysis of the attempts to increase precipitation and improve precipitation patterns were developed during the progress of the study.

One method of evaluation considered was that of using scientific forecasts of what would happen if artificial nuclei had not been introduced. After a pilot attempt to correlate commercial and governmental forecasts with actual occurrences was made this method was abandoned as too unreliable or indefinite to enable the investigators to detect significant changes if they occurred.

The attempts to increase the total precipitation were therefore analyzed by the following methods: statistically studying precipitation on the target area and a control area; comparing snow pack on the target area and a control area; and studying the rainfall patterns over the entire western United States.

Precipitation on Target Area

The statistical study of precipitation on the target area consisted of computing the mean depth of precipitation on the target area for each year from 1911 through 1951, using the Thiessen polygon method, for the months of March, April, May, and the summation of the three months. The artificial nucleation operations for the target area lend themselves in general to an investigation of the cumulative effects on monthly precipitation which may be produced by sustained cloud seeding. A plot was drawn for each of the periods, consisting of mean depth of precipitation on the target area versus years, forty-year normal mean depth of precipitation on the target area, and forty- and fifteen-year secular series. A moving ten-year secular series for the three month period was also computed and plotted. The above time series studies were made to denote trends in total monthly and seasonal precipitation. Probability curves were then plotted and the frequency of occurrence of the precipitation which occurred during the seeding period was computed.

Precipitation on Target Area Versus Control Area

Comparing precipitation on the target area and control area, see Fig. 1, consisted of computing the normal mean depth of precipitation on the target and control areas by the isohyetal method for the month of March and the mean depth of precipitation on the areas for March, 1951. The ratios of March, 1951, precipitation to normal March precipitation for target and control areas were compared.

Seeding operations were undertaken in the control area during the month of April, 1951, and hence this method of analysis was possible only for the month of March. The control area was chosen on the basis of correlation studies between stations in the target and control areas.

Snowfall on Target Area

The effect of seeding on the snow pack in the target area was studied statistically by computing the mean depth of water content change of the snow on the target area, using an arithmetical mean, for the months of March and April, and summation of the two months for each year from 1938 through 1951. Snow-survey information was not available for the month of May. A plot was drawn for each period consisting of mean depth of water content change versus years and the thirteen-year normal mean depth of water content change. Snow-pack records are based on monthly snow surveys made through April of each year by the Soil Conservation Service and, hence, the amount of snow melt, which depends to a great extent on temperature, between surveys, affects the snow-pack values obtained almost as much as the snowfall itself during the interval. Therefore a study was made showing the relationship of water content change and temperature for the months of March and April, and the summation of the two months for each year from 1938 through 1951.

Snowfall on Target Area Versus Control Area

Comparing snow pack on the target area and control area, see Fig. 1, consisted of comparing mean depths of water content change for the periods of March, April, and the summation of the two months for each year from 1938 through 1951.

Precipitation on Western United States

Another method of analysis used consisted of finding normals for March, April, May, and the summation of the three months for stations with precipitation records of forty-five to fifty-five years chosen in the United States west of the Mississippi River. The rainfall of March, April, May, 1951, and the summation of the three months was computed as a percent of the normal and points of equal percentages above and below normal were connected. The resulting patterns show how the seeded area compares with other sections of western United States in terms of normal precipitation. Correlation studies were made between stations in seeded and non-seeded areas.

Precipitation Patterns

One of the advantages of cloud seeding is said to be that it causes the rainfall to be more evenly distributed

over the area. In order to investigate this possible effect, the rainfall patterns on the target area and immediately east of the target area in eastern Colorado, western Nebraska and Kansas were studied, using the Corps of Engineers isopercential theory. This theory is based on the observed fact that in basins which have pronounced orographic effects, the rainfall depths of various stations for a particular storm tend to be uniform percentage of a normal for the storm type regardless of the magnitude of the rainfall, the altitude of the station, or the position of the station with relation to "rain shadows". Isopercential patterns consisting of lines connecting points of equal percentage are drawn for type storms which occurred during the seeding period and compared with the patterns of storms of the same type occurring prior to the seeding period. Within type groups of past storm statistical methods of comparison are used. One method, concerning the target area only, consisted of computing the standard deviations of the precipitation recorded at stations on the target area from the mean depth of precipitation on the area as a percent of the mean depth and also in ablsolute values for similar type storms which occurred during and prior to the seeding period. Probability curves were then plotted for each case and the frequency of occurrence of the standard deviations which occurred during the seeding period were computed.

This method was also used for determining any change in rainfall distribution resulting from cloud seeding for the period of March, April, and May, 1951, as compared with the same period for each year from 1911 through 1950.

CHAPTER III

RESULTS OF ANALYSIS

The results of analysis of the climatological data for the period March 1, 1951 to June 1, 1951, during the cloud-seeding operations over north central Colorado are presented in the following discussion.

Precipitation on the Target Area

In the statistical study of the mean depth of precipitation on the target area the following results were obtained. In each case the month or group of months was compared to the forty-year normal for that month or group, and the probability of that occurrence being equaled or exceeded was calculated from the charts so plotted. See Figs. 2-9, inclusive, and Tables 1-13, inclusive.

Month or Group	40-year Normal	Mean depth 1951	Percent of time Equaled or Exceeded	Approximate Years Equaled or Exceeded
March	1.05	0.49	72%	3 out of 4
April	1.98	1.39	58%	3 out of 5
May	2.37	2.47	40%	2 out of 5
Mar-May incl.	5.40	4.36	69%	2 out of 3

The tabulation shows, for example, that during March, 1951, 0.49 inches of rain fell, whereas the normal mean depth of precipitation on the target area for March over the past 40 years has been 1.05 inches. It further shows that in approximately three out of every four years the March rainfall has exceeded that of March, 1951. Considering the whole March-April-May period, the 1951 depth of 4.36 inches is less than the 40-year normal of 5.40 inches. In two out of every three years the natural rainfall has exceeded that for the 1951 cloud-seeding period. The rainfall for May, 1951, slightly exceeded the normal, however two years out of five are naturally wetter than May, 1951.

The forty- and fifteen-year secular series studies of mean depth of precipitation on the target area revealed that the March, April, and May trends are relatively insignificant, see Figs. 2, 4 and 6; whereas, for the summation of the three months, the forty-year trend is 0.0111 inches per year upward and the fifteen-year trend is 0.0611 inches per year upward. Both of these trends can be considered significant, see Fig. 8 and Tables 14 and 15. The moving ten-year secular series study for the summation of the three months, see Fig. 10 and Table 16, revealed a possible cyclic trend, which indicates the presence of a series of wet Spring periods, and a significant overall upward trend of 0.0134 inches per year.

Precipitation on Target Area Versus Control Area

The mean depth of precipitation on the control area for the month of March, 1951, was found to be 62 percent of the normal mean depth of precipitation on the control area for the month of March; whereas, the mean depth of precipitation on the target area for the month of March, 1951, was found to be 52 percent of the normal mean depth of precipitation on the target area for the month of March, see Figs. 11 and 12 and Tables 17 and 18. Fig. 13 is an example of a correlation study between a precipitation station in the target area and a station in the control area.

Snowfall on Target Area

In the statistical study of the mean depth of snowfall on the target area the following results were obtained. The March, 1951, mean depth of water content change on the target area was +3.8 inches as compared to a thirteen-year normal of +3.1 inches, see Fig. 14 and Table 19. The April, 1951, mean depth of water content change on the target area was +1.1 inches as compared to a thirteen-year normal of 0.0 inches, see Fig. 15 and Table 19. Lastly, the summation of March and April, 1951, mean depth of water content change on the target area was +4.9 inches as compared to a thirteen-year normal of +3.1 inches, see Fig. 16 and Table 19. However, the greater than normal water content changes for March and April, 1951, apparently result from less than normal monthly temperatures, see Figs. 17 and 18, for the same periods. Note that the months which have below normal temperatures are also the months of high water content increases.

Snowfall on Target Area Versus Control Area

The mean depth of snow-water content change on the control area for the period of March and April, 1951, was 147 percent of the thirteen-year normal; whereas, the mean depth of water content change on the target area for the same period was 158 percent of the thirteen-year normal. A good correlation with regard to snow pack exists between the control area selected and the target area, see Figs. 14, 15 and 16. Abnormally high snow-pack increase on both the target and control area is attributed to subnormal temperatures which reduced the melt during the March-May, 1951, period.

Precipitation on Western United States

Fig. 19 reveals, in terms of percent variation from normal precipitation, how the seeded target area as well as other seeded areas compare with unseeded areas in western United States. Figures similar to Fig. 19 for the individual months of March, April, and May, 1951, revealed that one heavy general storm, which fell in the latter part of May on the target area and on a large area immediately east of the target area, was responsible for increasing the precipitation

for the period of March, April, and May, 1951, to near normal and above normal for many precipitation stations in eastern Colorado and western Kansas and Nebraska.

Correlation studies between stations in the seeded areas and unseeded areas to the east, see Fig. 20, show that the stations in the seeded areas received less precipitation during March, April and May, 1951 than would normally be indicated on the basis of the correlation.

Precipitation Patterns

A visual comparison of the isohyetal patterns on the target area for March, 1951, and the normal March, see Figs. 11 and 12, revealed no significant improvement in the rainfall pattern for March, 1951, due to cloud seeding.

The analysis in which the isopercential theory was used to determine the changes in patterns and amounts of rainfall due to cloud seeding was not completed because of limited funds. After drawing isohyetals for eight similar storms, each of which was caused by a synoptic situation which resulted in a circulation from the east over the target area, an abbreviated approach also based on the isopercential theory was used. This shorter method of analysis consisted of using precipitation stations on several east-west lines from western Kansas to the continental divide and drawing profiles of precipitation depths, see Figs. 21 and 22, for the above type of storms, which occurred prior to and during the cloud-seeding period. The profiles of precipitation depths for storms occurring prior to the seeding period did not show any consistency and hence could not be used for comparison with profiles for storms occurring during the seeding period. The abbreviated method, therefore, is apparently not suitable for determining changes in patterns and amounts of rainfall due to cloud seeding.

CHAPTER IV

CONCLUSIONS

The results of the analysis of the climatological data led to the conclusion that there was no apparent increase in precipitation as a result of cloud seeding over north central Colorado for the period of March 1, 1951, to June 1, 1951.

The above conclusion is supported by the following results of the analysis:

1. The mean depth of precipitation on the target area during the seeding period was less than normal and has been equaled or exceeded naturally every two years out of three for the past forty years.

2. The precipitation on the areas to the east and west of the seeded area was above normal during the cloud-seeding period. A conclusion that the natural precipitation on the target area would have been significantly less than that which actually fell is held to be unlikely.

3. The mean depth of precipitation, as a percent of normal, on the control area for March, 1951, was approximately equal to the mean depth of precipitation, as a percent of normal, on the target area for March, 1951. This does not indicate any increase in precipitation on the target area due to cloud seeding. The approximation of equality was used, although the control area was ten percent higher than the target area, because a difference of this magnitude observed for only one period is not considered significant, either as to the degree or the cause.

4. The mean depth of snow-water content increase, as a percent of normal, on the control area for the period of March and April, 1951, was approximately equal to the mean depth of snow-water content increase, as a percent of normal, on the target area for the same period. This does not indicate any significant increase in snow pack in the target area due to cloud seeding. Again, the approximation of equality was used, although the target area was eleven percent higher than the control area, because such a small difference was not considered significant in view of the short period considered. If such a difference were maintained consistently over a long period of years under similar temperature conditions, then the question would arise as to the cause. The mean depths of snow-water content increase on both the control and target area were above normal for the period of March and April, 1951, but the greater than normal increase for both areas was due, in part at least, to the below normal monthly temperatures and resulting decreased snow melt for the same period.

In spite of its limited use in the above analysis the isopercential theory appears to be a promising method of determining changes in rainfall patterns and amounts due to cloud seeding in basins which have pronounced orographic effects. Even the abbreviated method if refined further by using an average of precipitation depths for several precipitation stations on the same elevation on approximately a north-south line instead of using only precipitation depths for single stations on the east-west line as in this analysis, may prove to be a valuable elevation method.

The report by the American Institute of Aerological Research, Denver, Colorado, on cloud-seeding operations in northern Coloradu during the period, March 1, 1951 to June 15, 1951, contained the following conclusions:

"1. In the period March 1, 1951 to June 15, 1951 generator operations for the benefit of northern Colorado totaled 1013 hours and 17 minutes.

2. Weather conditions for cloud seeding operations were generally poor with only one good seeding interval in each of the months of May and June.

3. Precipitation over the project averaged slightly below normal during the period of operations.

4. It is probable that seeding operations produced an increase in precipitation of between zero and 5 percent over what would have fallen naturally."

CHAPTER V

GENERAL OBSERVATIONS

As a result of the experience gained by this analysis of a cloud-seeding experiment, the following general observations have been made. While the first observation has bearing on the specific project studied the remainder might pertain to any project.

1. Note that the WRDC'S forecasts for March, April, and then May, 1951, predicted above normal precipitation for this area. The U. S. Weather Bureau forecasts were also of the same nature. The statistical trend lines shown in the report indicate the possibility of a wet cycle. All of these factors reinforce the need for more research in the field of artificial nucleation to explain the dry spring period under seeding.

2. The discoveries, experiments, and conclusions of many prominent scientists strongly support the opinion that the science of increasing precipitation may have great possibilities. There is, however, no agreement at all at the present time among outstanding meteorologists that economically significant changes can be brought about. The Civil Engineering Section Staff firmly believes that much more experimentation on a field scale of practical size should be carried out for several years in order to determine the pertinent facts and to apply those facts to intelligent practical use. Evaluation should be done by an impartial scientific agency. The staff is convinced, further, that this work must be accomplished on a strictly scientific basis with the primary objective of obtaining the necessary basic information. This means adequate control areas in the vicinity of target areas, close cooperation between operator and evaluator, and adequate staff to do the job.

3. A possibility of obtaining comparison between natural and artificial results might be to pick days at random on which there would be no seeding, as against days when seeding would be tried.

4. To promote mutually beneficial research cooperation between the operator and the evaluating agency (as a representative of the purchaser), a staff member of the latter should observe and consult with the operators frequently during the contract period.

5. While more seasons of research will undoubtedly lead to better methods of evaluation and analysis, the methods used in this report are believed to be as good as any now available and that they are sufficiently sensitive to indicate any significant changes which may occur. When

the study is of a longer duration, the methods would be even more sensitive. If significant changes are detected then the question will arise as to how much may be attributed to artificial means. A distinct improvement in analyzing cause and effect that definitely needs to be brought about for future evaluations is to require the operator to notify the purchaser of details of his operations on the day they take place. This will assist in evaluation studies as well as in checking on the operator's estimate of a seeding opportunity. It does not appear unreasonable to request operators to "call their shots" as a means of further strengthening an evaluation.

6. The purchasers would be spending money wisely to cooperatively provide adequate staffs to evaluate one or more projects. During the developmental years in the science of artificial nucleation, when all efforts are unproven and subject to great controversy, it would appear economically desirable to be certain that the results would not have occurred naturally.

7. There is need for a more elaborate study, which would include tracking storms to learn in detail what they did during their complete movement. This will serve the purpose, among other things, of determining just where the moisture falls and whether or not precipitation in one area robs any other area along the storm path.

8. A fairer type of contract for the purchaser, during the unknown and uncertain stages in the development of this science, would include a performance requirement. Examples of this type of contract are the ones drawn up for the Tri-County operation in Oregon and the San Luis Valley operation in Colorado.

9. Other independent evaluation studies have been made by the Oregon State College Agricultural Experiment Station in collaboration with the U. S. Soil Conservation Service. The reports in general state that there was no conclusive evidence of changes in precipitation as a result of cloud seeding.

Table 1

Precipitation Data

Precip. Station - Fort Collins State-Colo. Long. 105°05' Lat. 40°35'

Date: From 1911 through 1951 Total 41 years

Year	Month			Thiessen Area Factor	Area factor x Month Precip.			
	March	April	May		March	April	May	Sum of 3 mos.
1951	0.35	1.39	2.59		7.601	30.187	56.247	94.035
50	0.36	2.00	3.91		7.818	43.434	84.913	136.165
49	1.96	1.53	2.94		42.565	33.227	63.848	139.640
48	0.68	0.67	2.16		14.768	14.550	46.909	76.227
47	0.95	1.41	3.62		20.631	30.621	78.616	129.867
46	0.78	0.43	2.68		16.939	9.338	58.202	84.479
45	0.42	3.02	1.88		9.121	65.585	40.828	115.534
44	2.01	4.10	1.98		43.651	89.039	42.999	175.689
43	0.71	1.45	5.95		15.419	31.489	129.216	176.124
42	0.30	5.50	2.26		6.515	119.444	49.080	175.039
41	1.16	3.49	2.01		25.192	75.792	43.651	144.635
40	0.72	1.39	1.83	21.717	15.636	30.187	39.742	85.565
39	1.60	1.42	1.56		34.747	30.838	33.879	99.464
38	1.28	2.47	2.70		27.798	53.641	58.636	140.075
37	1.48	2.23	1.48		32.141	48.429	32.141	112.711
36	0.71	1.16	1.10		15.419	25.192	23.889	64.500
35	0.21	1.24	6.71		4.561	26.929	145.721	177.211
34	0.71	1.41	1.92		15.419	30.621	41.697	87.737
33	0.60	1.91	4.56		13.030	41.479	99.030	153.539
32	1.09	0.88	2.14		23.672	19.111	46.474	89.257
31	0.41	1.07	2.55		8.904	23.237	55.378	87.519
30	0.70	0.56	4.08		15.202	12.162	88.605	115.969
29	1.78	2.37	1.08		38.656	51.469	23.454	113.579

Table 1 (Continued)

Precipitation Data

Precip. Station - Fort Collins State-Colo. Long. 105°05' Lat. 40°35'

Date: From 1911 through 1951 Total 41 years

Year	Month			Thiessen Area Factor	Area factor x Month Precip.			
	March	April	May		March	April	May	Sum of 3 mos.
1928	1.38	0.98	3.35		29.969	21.282	72.752	124.003
27	1.87	2.69	0.91		40.611	58.419	19.762	118.792
26	1.54	2.99	1.76		33.444	64.934	38.222	136.600
25	0.58	0.10	1.13		12.596	2.172	25.626	40.394
24	1.83	0.93	3.90		39.742	20.197	84.696	144.635
23	2.74	2.18	4.46		59.505	47.343	96.858	203.706
22	0.36	2.80	0.87		7.818	60.808	18.894	87.520
21	0.13	1.71	1.97		2.823	37.136	42.782	82.741
20	0.14	3.60	1.95	21.717	3.040	78.181	42.348	123.569
19	1.65	0.93	0.45		35.833	20.197	9.773	65.803
18	0.14	3.72	2.95		3.040	80.787	64.065	147.892
17	0.99	1.22	5.82		21.499	26.495	126.393	174.387
16	0.31	0.86	3.85		6.732	18.677	83.610	109.019
15	1.73	4.01	3.78		37.570	87.085	82.090	206.745
14	0.87	3.23	2.73		18.894	70.146	59.287	148.327
13	0.20	1.49	2.09		4.343	32.358	45.389	82.090
12	1.79	0.90	3.36*		38.873	19.545	72.969	131.387
11	0.05	1.89	0.72		1.086	41.045	15.636	57.767

* Data obtained from correlation studies.

Table 2

Precipitation Data

Precip. Station - Longmont (2) State-Colo. Long. 105°04' Lat. 40°10'

Date: From [illegible] 1951 Total [illegible] Years

Year	Month			Thiessen Area Factor	Area factor x Month Precip.			
	March	April	May		March	April	May	Sum of 3 mos.
1951	0.62	1.15	2.00		4.964	9.207	16.012	30.183
50	0.17	1.61	2.30		1.361	12.889	18.414	32.664
49	1.65	1.30	3.05		13.210	10.408	24.418	48.036
48	0.41	1.32	1.51		3.282	10.568	12.089	25.939
47	0.95	1.31	3.66		7.606	10.488	29.302	47.396
46	0.35	0.72	2.08		2.802	5.764	16.652	25.218
45	0.25	2.36	3.90		2.002	18.894	31.223	52.119
44	1.20	3.53	1.47		9.607	28.261	11.769	49.637
43	0.59	1.15	3.91		4.724	9.207	31.303	45.234
42	0.37	4.09	2.09		2.962	32.744	16.733	52.439
41	0.78	3.54	1.30	8.006	6.245	28.341	10.408	44.994
40	1.33	1.36	2.84		10.648	10.888	22.737	44.273
39	1.07	1.27	1.06		8.566	10.168	8.486	27.220
38	0.97	2.98	2.87		7.766	23.858	22.977	54.601
37	0.60	0.80	1.47		4.804	6.405	11.769	22.978
36	0.74	0.76	1.58		5.924	6.085	12.649	24.658
35	0.13	2.52	5.63		1.041	20.175	45.074	66.290
34	0.85	1.12	1.93		6.805	8.967	15.452	31.224
33	0.46	2.30	3.31		3.683	18.414	26.499	48.596
32	0.65	1.04	1.08		5.204	8.326	8.646	22.176
31	0.45	1.04	2.27		3.603	8.326	18.174	30.103
30	0.41	0.90	3.06		3.285	7.205	24.498	34.988
29	1.79	1.58	1.40		14.331	12.650	11.208	38.189

Table 2 (Continued)

Precipitation Data

Precip. Station - Longmont (2) State-Colo. Long. 105°04' Lat. 40°10'

Date: From 1911 through 1951 Total 41 Years

Year	Month			Thiessen Area Factor	Area factor x Month Precip.			
	March	April	May		March	April	May	Sum of 3 mos.
1928	1.16	1.03	2.75		9.287	8.246	22.017	39.550
27	1.17	2.05	1.36		9.367	16.412	10.888	36.667
26	1.13	2.06	2.85		9.047	16.492	22.817	48.356
25	0.33	0.04	1.46		2.642	0.320	11.689	14.651
24	1.19	1.03	3.38		9.527	8.246	27.060	44.833
23	1.25	1.21	3.05		10.008	9.687	24.418	44.113
22	0.43	1.66	0.16		3.443	13.290	1.281	18.014
21	0.24	3.78	2.12	8.006	1.921	30.263	16.973	49.157
20	0.27	5.20	0.78		2.162	41.631	6.245	50.038
19	0.38	1.27	1.10		3.042	10.168	8.807	22.017
18	0.73	3.06	2.02		5.844	24.498	16.172	46.514
17	1.23	1.36	4.66		9.847	10.888	37.308	58.043
16	0.44	1.31	3.02		3.523	10.488	24.178	38.189
15	1.16	4.20	2.97		9.287	33.625	23.778	66.690
14	1.18	2.78	3.46		9.447	22.257	27.701	59.405
13	0.46	1.50	1.60*		3.683	12.009	12.809	28.501
12	1.40	1.26	3.05		11.208	10.089	24.418	45.714
11	0.21	1.50	1.00		1.681	12.009	8.006	21.696

* Data obtained from correlation studies.

Table 3

Precipitation Data

Precip. Station - Greeley State-Colo. Long. 104°41' Lat. 40°26'

Date: from 1911 through 1951 Total 41 years

Year	Month March	Month April	Month May	Thiessen Area Factor	Area Factor x Month Precip. March	April	May	Sum of 3 mos.
1951	0.42	1.29	3.43		6.326	19.429	51.659	77.414
50	0.25	1.89	2.32		3.765	28.465	34.942	67.172
49	1.39	1.01	2.97		20.934	15.212	44.731	80.877
48	0.81	0.38	1.13		12.199	5.723	17.019	34.941
47	0.79	1.32	2.78		11.898	19.880	41.870	73.648
46	0.88	0.77	2.05		13.254	11.600	30.875	55.729
45	0.21	3.07	3.50		3.163	46.237	52.714	102.114
44	1.56	4.32	1.66		23.495	65.064	25.001	113.560
43	0.45	1.56	4.45		6.778	23.495	67.021	97.294
42	0.31	3.19	2.92		4.669	48.044	43.978	96.691
41	1.05	3.04	1.87	15.061	15.814	45.785	28.164	89.783
40	1.00	1.22	1.51		15.061	18.374	22.742	56.177
39	1.17	0.56	1.23		17.621	8.434	18.525	44.580
38	0.55	1.89	2.84		8.284	28.465	42.774	79.523
37	1.04	1.40	1.21		15.663	21.085	18.224	54.972
36	0.59	0.85	2.92		8.886	12.802	43.978	65.666
35	0.29	0.92	5.79		4.368	13.856	87.203	105.427
34	0.49	0.96	1.35		7.380	14.459	20.332	42.171
33	0.12	1.53	3.56		1.807	23.043	53.617	78.467
32	0.83	0.52	1.47		12.501	7.832	22.140	42.473
31	0.55	0.63	1.38		8.284	9.488	20.784	38.556
30	0.33	0.47	2.41		4.970	7.079	36.297	48.346
29	1.42	3.01	0.75		21.387	45.334	11.296	78.017

Table 3 (Continued)

Precipitation Data

Precip. Station - Greeley State-Colo. Long. 104°41' Lat. 40°26'

Date: From 1911 through 1951 Total 41 years

Year	Month March	Month April	Month May	Thiessen Area Factor	Area Factor x Month Precip. March	April	May	Sum of 3 mos.
1928	0.83	0.87	2.87		8.133	13.103	43.225	64.461
27	1.75	2.34	0.88		26.357	35.243	13.254	74.854
26	0.37	1.03	0.97		5.573	15.513	14.609	35.695
25	0.26	0.06	1.01		3.916	0.904	15.212	20.032
24	1.45	0.84	2.59		21.838	12.651	39.008	73.497
23	2.12	0.82	2.14		31.929	12.350	32.231	76.510
22	0.15	1.73	1.25		2.259	26.056	18.826	47.141
21	0.27	1.32	2.83		4.066	19.881	42.623	66.570
20	0.03	4.43	1.42	15.061	0.452	66.720	21.387	88.559
19	0.14	0.75	0.67		2.109	11.296	10.091	23.496
18	0.10	0.76	1.62		1.506	11.446	24.399	37.351
17	0.40	0.94*	5.00*		6.024	14.157	75.305	95.486
16	0.34	0.27	3.28*		5.121	4.066	49.400	58.587
15	1.34*	3.87	2.45		20.182	58.286	36.899	115.367
14	0.61	1.34	2.92		9.187	20.182	43.978	73.347
13	0.45	1.34	3.16		6.777	20.182	47.593	74.552
12	1.64	1.61	2.86		24.700	24.248	43.074	92.022
11	0.01	0.83	1.31		0.151	12.501	19.730	32.382

* Data obtained from correlation studies.

Table 4

Precipitation Data

Precip. Station - Waterdale State - Colo. Long. 105°12' Lat. 40°25'

Date: From 1911 through 1951 Total 41 years

Year	Month March	Month April	Month May	Thiessen Area Factor	Area Factor x Month Precip. March	Area Factor x Month Precip. April	Area Factor x Month Precip. May	Sum of 3 mos.
1951	0.61	1.53	2.36		4.496	11.278	17.396	33.170
50	0.31	2.18	3.40		2.285	16.068	25.061	43.414
49	2.04	1.33	3.28		15.037	9.803	24.177	49.017
48	1.52	1.91	2.51		11.204	14.079	18.501	43.784
47	1.08	2.03	3.11		7.961	14.963	22.924	45.848
46	0.64	0.78	2.79		4.717	5.749	20.565	31.031
45	0.29	3.75	2.66		2.138	27.641	19.607	49.386
44	3.27	4.89	0.71		24.103	36.044	5.233	65.380
43	0.84	1.24	5.53		6.192	9.140	40.762	56.094
42	0.26	4.59	2.02		1.916	33.833	14.889	50.638
41	1.83	3.83	1.35	7.371	13.490	28.231	9.951	51.672
40	1.18	1.72	1.83		8.698	12.678	13.490	34.866
39	1.55	1.58	1.31		11.425	11.646	9.656	32.727
38	1.96	2.85	3.35		14.447	21.007	24.693	60.147
37	1.38	1.26	1.37		10.172	9.287	10.098	29.557
36	1.27	1.32	1.30		9.361	9.730	9.582	28.673
35	0.26	1.49	7.56		1.916	10.983	55.725	68.624
34	0.90	1.46	2.29		6.634	10.762	16.879	34.275
33	0.78	3.72	2.81		5.749	27.420	20.713	53.882
32	0.92	0.86	2.36		6.781	6.339	17.396	30.516
31	0.44	1.52	2.38		3.243	11.204	17.543	31.990
30	0.95	1.03	4.20		7.002	7.592	30.958	45.552
29	1.84	1.77	0.90		13.563	13.047	6.634	33.244

Table 4 (continued)

Precipitation Data

Precip. Station - Waterdale State - Colo. Long. 105°12' Lat. 40°25'

Date: from 1911 through 1951 Total 41 years

Year	Month March	April	May	Thiessen Area Factor	Area Factor x Month Precip. March	April	May	Sum of 3 mos.
1928	2.05	0.65	4.12		15.111	4.791	30.369	50.271
27	1.74	2.46	1.26		12.826	18.133	9.287	40.246
26	1.47	3.82	2.13		10.835	28.157	15.700	54.692
25	0.29	0.10	1.49		2.138	0.737	10.983	13.858
24	1.61	1.06	4.48		11.867	7.813	33.022	52.702
23	1.87	2.10	4.30		13.784	15.479	31.695	60.958
22	0.47*	2.64	1.61		3.464	19.459	11.867	34.790
21	0.27*	2.93	2.06		1.990	21.597	15.184	38.771
20	0.29*	2.59	1.81	7.371	2.138	19.091	13.342	34.571
19	1.72*	1.16*	0.95		12.678	8.550	7.002	28.230
18	0.29*	3.07	2.48		2.138	22.629	18.280	43.047
17	2.08	1.94	6.37		15.332	14.299	46.953	76.584
16	0.59	1.27	1.87		4.349	9.361	13.784	27.494
15	1.80*	4.32*	3.83*		13.268	31.843	28.231	73.342
14	0.57	3.11	2.50		4.201	22.924	18.428	45.553
13	0.62	1.80*	2.66		4.570	13.268	19.607	37.445
12	1.61	1.12*	3.40*		11.867	8.256	25.061	45.184
11	0.26	2.13	0.76		1.916	15.700	5.602	23.218

*Data obtained from correlation studies.

Table 5

Precipitation Data

Precip. Station - Estes Park State-Colo. Long. 105°31' Lat. 40°23'

Date: From 1911 through 1951 Total 41 years

Year	Month March	Month April	Month May	Thiessen Area Factor	Area Factor x Month Precip. March	April	May	Sum of 3 mos.
1951	0.45	0.94	2.15		7.439	15.539	35.542	58.520
50	0.28	1.58	2.19		4.629	26.119	36.203	66.951
49	3.10*	1.54	2.64		51.246	25.458	43.642	120.346
48	1.52	1.08	1.12		25.127	17.853	18.514	61.494
47	1.18	2.07	3.49		19.507	34.219	57.693	111.419
46	1.46	1.59	4.32		24.135	26.284	71.414	121.833
45	0.75	4.35	2.10		12.398	71.910	34.715	119.023
44	2.20	4.90	1.70		36.368	81.002	28.103	145.473
43	1.30	1.80	2.80		21.490	29.756	46.287	97.533
42	0.76	5.43	1.42		12.564	89.763	23.474	125.801
41	2.03	2.91	0.68	16.531	33.558	48.105	11.241	92.904
40	1.99	1.25	2.20		32.897	20.664	36.368	89.929
39	0.87	0.89	1.85		14.382	14.713	30.582	59.677
38	1.80	2.28	2.43		29.756	37.691	40.170	107.617
37	1.01	2.74	1.65		16.696	45.295	27.276	89.267
36	1.28	1.16	0.74		21.160	19.176	12.233	52.569
35	T	2.62	4.49		0	43.311	74.224	117.515
34	0.41	1.57	2.11		6.778	25.954	34.880	67.612
33	0.15	3.30	0.87		2.479	54.552	14.382	71.413
32	1.22	1.31	0.72		20.168	21.656	11.902	53.726
31	0.69	2.00	2.50		11.406	33.062	41.328	85.796
30	0.90	0.08	0.26		14.878	1.322	4.298	20.498
29	0.83	0.32*	1.95*		13.721	5.290	32.235	51.246

Table 5 (continued)

Precipitation Data

Precip. Station - Estes Park State-Colo. Long. 105°31' Lat. 40°23'

Date: From 1911 through 1951 Total 41 years

Year	March	April	May	Thiessen Area Factor	Area Factor x Month Precip. March	April	May	Sum of 3 mos.
1928	1.90	2.09	3.56		31.409	34.549	58.850	124.808
27	1.74	3.43	0.66		28.764	56.701	10.910	96.375
26	2.81	4.92	1.46		46.452	81.333	24.135	151.920
25	0.95	0.22	0.95		15.704	3.637	15.704	35.045
24	2.66	1.81	4.92		43.972	29.921	81.333	155.226
23	3.57	1.83	3.28		59.016	30.252	54.222	143.490
22	1.19	2.80	0.99		19.672	46.287	16.366	82.325
21	1.26	5.72	0.67		20.829	94.557	11.076	126.462
20	0.37	3.59	1.21		6.116	59.346	20.003	85.465
19	1.71	1.46	1.12	16.531	28.268	24.135	18.515	70.918
18	1.06	2.91	2.18		17.105	48.105	36.038	101.666
17	2.00	2.29	5.68		33.062	37.856	93.896	164.814
16	0.75	1.65	2.96		12.398	27.276	48.932	88.606
15	2.12	4.88	2.77		35.046	80.671	45.791	161.508
14	0.98	1.98	2.37		16.200	32.731	39.178	88.109
13	0.26	2.52	1.73		4.298	41.658	28.599	74.555
12	2.89	1.82	2.84		47.775	30.086	46.948	124.809
11	0.85	2.28	0.25		14.051	37.691	4.133	55.875

* Data obtained from correlation studies

Table 6

Precipitation Data

Precip. Station - Longs Peak State-Colo. Long. 105°34' Lat. 40°17'

Date: From 1911 through 1951 Total 41 Years

Year	Month			Thiessen Area Factor	Area factor x Month Precip.			
	March	April	May		March	April	May	Sum of 3 mos.
1951	0.50*	1.26*	2.60*		3.130	7.886	16.273	27.289
50	0.30*	2.00*	2.67*		1.878	12.518	16.712	31.108
49	4.20*	1.95*	3.15*		26.288	12.205	19.716	58.209
48	1.51	1.31	1.18		9.451	8.199	7.386	25.036
47	2.56*	2.62*	4.00*		16.023	16.399	25.036	57.458
46	1.95*	2.00*	4.92*		12.205	12.518	30.794	55.517
45	1.00*	5.35*	2.55*		6.259	33.486	15.960	55.705
44	3.07	4.93	2.66		19.215	30.857	16.649	66.721
43	1.98	1.84	3.91		12.393	11.517	24.473	48.383
42	1.34	8.17	1.56		8.387	51.136	9.764	69.287
41	2.45	4.11	2.04		15.335	25.724	12.768	53.827
40	2.63	1.70	3.22	6.259	16.461	10.640	20.154	47.255
39	1.75	1.42	2.28		10.953	8.888	14.271	34.112
38	3.55	3.26	3.58		22.219	20.404	22.407	65.030
37	1.34	3.25	2.27		8.387	20.342	14.208	42.937
36	1.63	1.82	1.64		10.202	11.391	10.265	31.858
35	0.75	4.20	4.29		4.694	26.288	26.851	57.833
34	1.04	2.38	2.09		6.509	14.896	13.081	34.486
33	0.97	5.91	3.46		6.071	36.991	21.656	64.718
32	2.09	1.85	0.88		13.081	11.579	5.508	30.168
31	3.20	2.50	3.50		20.029	15.648	21.907	57.584
30	0.73	0.28	1.45		4.569	1.753	9.076	15.398
29	2.18	0.46	2.41		13.645	2.879	15.084	31.608

Table 6 (Continued)

Precipitation Data

Precip. Station - Longs Peak State-Colo. Long. 105°34' Lat. 40°17'

Date: From 1911 through 1951 Total 41 Years

Year	Month			Thiessen Area Factor	Area factor x Month Precip.			
	March	April	May		March	April	May	Sum of 3 mos.
1928	2.02	2.20	5.15		12.643	13.770	32.234	58.647
27	1.16	2.65	1.12		7.260	16.586	7.010	30.856
26	2.59	2.49	1.73		16.211	15.585	10.828	42.624
25	0.39	T	1.83		2.441	0.000	11.454	13.895
24	5.25	2.12	6.09		32.860	13.269	38.117	84.246
23	4.84	2.06	3.32		30.294	12.894	20.780	63.968
22	1.59	2.84	1.88		9.952	17.776	11.767	39.495
21	2.18	6.99	1.07*		13.645	43.750	6.697	64.092
20	0.52	7.85	T		3.255	49.133	0.000	52.388
19	2.46	2.63	1.53*	6.259	15.397	16.461	9.576	41.434
18	0.74	2.65	0.93		4.632	16.586	5.821	27.039
17	2.60	1.84	3.29		16.273	11.517	20.592	48.382
16	2.49	3.40	2.84		15.585	21.281	17.776	54.642
15	4.06	4.78	2.97		25.412	29.918	18.589	73.919
14	1.45	3.85	0.90		9.076	24.097	5.633	38.806
13	0.72	3.15*	0.80		4.506	19.716	5.007	29.229
12	3.35	3.04	4.40		20.968	19.027	27.540	67.535
11	1.20	3.18	0.73		7.511	19.904	4.569	31.984

* Data obtained from correlation studies.

Table 7

Precipitation Data

Precip. Station - Fort Lupton State-Colo. Long. 104°43' Lat. 40°05'

Date: From 1911 through 1951 Total 41 Years

Year	Month			Thiessen Area Factor	Area factor x Month Precip.			
	March	April	May		March	April	May	Sum of 3 mos.
1951	0.52	1.20	0.97		1.591	3.672	2.968	8.231
50	0.31	2.31	2.00*		0.949	7.069	6.120	14.138
49	1.92	1.81	7.46		5.875	5.539	22.828	34.242
48	0.67	1.65	0.92		2.050	5.049	2.815	9.914
47	0.24	1.28	3.00		0.734	3.917	9.180	13.831
46	0.40	1.27	4.73		1.224	3.886	14.474	19.584
45	0.11	2.86	1.64		0.337	8.752	5.018	14.107
44	1.44	3.81	1.80		4.406	11.659	5.508	21.573
43	0.68	1.76	3.45		2.081	5.386	10.557	18.024
42	0.19	3.91	1.34		0.581	11.965	4.100	16.646
41	0.53	2.90	3.08	3.060	1.622	8.874	9.425	19.921
40	1.72	1.14	2.01		5.263	3.488	6.151	14.902
39	0.50	1.27	1.25		1.530	3.886	3.825	9.241
38	0.51	2.33	4.17		1.561	7.130	12.760	21.451
37	0.51	0.66	1.61		1.561	2.020	4.927	8.508
36	0.69	0.56	1.78		2.111	1.714	5.447	9.272
35	0.22	2.32	7.13		0.673	7.099	21.818	29.590
34	0.58	0.70	2.11		1.775	2.142	6.457	10.374
33	0.33	2.96	2.71		1.010	9.058	8.293	18.361
32	0.36	0.95	1.15		1.102	2.907	3.519	7.528
31	0.50	1.62	1.91		1.530	4.957	5.845	12.332
30	0.25	1.10	2.32		0.765	3.366	7.099	11.230
29	0.99	0.06	2.15		3.029	0.184	6.579	9.792

Table 7 (Continued)

Precipitation Data

Precip. Station - Fort Lupton State-Colo. Long. 104°43' Lat. 40°05'

Date: From 1911 through 1951 Total 41 Years

Year	Month			Thiessen Area Factor	Area factor x Month Precip.			
	March	April	May		March	April	May	Sum of 3 mos.
1928	0.79	0.70	2.50		2.417	2.142	7.650	12.209
27	0.91	1.12	0.99		2.785	3.427	3.029	9.241
26	0.57	1.23	2.47		1.744	3.764	7.558	13.066
25	0.29	0.12	1.21		0.887	0.367	3.703	4.957
24	0.93	0.48	2.83		2.846	1.469	8.660	12.975
23	0.85	0.79	2.72		2.601	2.417	8.323	13.341
22	0.15	1.87	0.47		0.459	5.722	1.438	7.619
21	0.27	2.50	1.80	3.060	0.826	7.650	5.508	13.984
20	0.11	1.75	1.88		0.337	5.355	5.753	11.445
19	0.34	1.66	1.10		1.040	5.080	3.366	9.486
18	1.14	1.29	2.56		3.488	3.947	7.834	15.269
17	0.94	0.89	3.22		2.876	2.723	9.853	15.452
16	0.16	1.01	2.42		0.490	3.091	7.405	10.986
15	0.74	4.58	1.83		2.264	14.015	5.600	21.879
14	0.72	1.89	2.49		2.203	5.783	7.619	15.605
13	0.24	1.09	2.72		0.734	3.335	8.323	12.392
12	1.05*	1.33	3.71		3.213	4.070	11.353	18.636
11	0.21*	1.24*	1.00*		0.643	3.794	3.060	7.497

* Data obtained from correlation studies.

Table 8

Precipitation Data

recip. Station - Grover State-Colo. Long. 104°25' Lat. 40°52'

ate: From 1911 through 1951 Total 41 Years

Year	Month			Thiessen Area Factor	Area factor x Month Precip			
	March	April	May		March	April	May	Sum of 3 mos.
1951	T	1.64	2.79		0.000	11.762	20.010	31.772
50	0.10	0.60	2.06		0.717	4.303	14.774	19.794
49	1.87	0.72	4.67		13.412	5.164	33.493	52.069
48	0.56	0.12	3.09		4.016	0.861	22.161	27.038
47	0.98	0.73	3.47		7.029	5.236	24.887	37.152
46	0.35	0.24	2.89		2.510	1.721	20.727	24.958
45	0.77	3.65	2.55		5.522	26.178	18.289	49.989
44	1.42	2.00	1.99		10.184	14.344	14.272	38.800
43	0.54	1.43	5.76		3.873	10.256	41.311	55.440
42	0.36	2.75	2.57		2.582	19.723	18.432	40.737
41	1.17	3.19	0.96		8.391	22.879	6.885	38.155
40	0.62	0.60	0.88	7.172	4.447	4.303	6.311	15.061
39	1.18	0.51	0.30		8.463	3.658	2.152	14.273
38	0.42	1.21	2.48		3.012	8.678	17.787	29.477
37	0.55	0.02	2.11		3.945	0.143	15.133	19.221
36	0.04	0.65	2.94		0.287	4.662	21.086	26.035
35	0.01	1.01	5.05		0.000	7.244	36.219	43.463
34	0.13	0.30	0.28		0.932	2.152	2.008	5.092
33	0.05	0.70	3.26		0.359	5.020	23.381	28.760
32	0.78	0.60	1.22		5.594	4.303	8.750	18.647
31	0.63	0.40	2.46		4.518	2.869	17.643	25.030
30	0.85	2.37	4.06		6.096	16.998	29.118	52.212
29	0.15	3.62	0.83		1.076	25.963	5.953	32.992

Table 8 (Continued)

Precipitation Data

Precip. Station - Grover State-Colo. Long. 104°25' Lat. 40°52'

Date: From 1911 through 1951 Total 41 Years

Year	Month			Thiessen Area Factor	Area factor x Month Precip.			
	March	April	May		March	April	May	Sum of 3 mos.
1928	0.13	0.03	3.08		0.932	0.215	22.089	23.236
27	0.65	0.80	0.25		4.662	5.738	1.793	12.193
26	0.18	0.71	1.98		1.291	5.092	14.200	20.583
25	0.15	1.00	1.17		1.076	7.172	8.391	16.639
24	0.95	0.63	0.75		6.813	4.513	5.379	16.705
23	0.77	0.20	1.84		5.522	1.434	13.196	20.152
22	0.08*	1.27	1.95		0.574	9.108	13.985	23.667
21	0.70	1.38	2.37	7.172	5.020	9.897	16.998	31.915
20	0.65	2.84	0.75		4.662	20.368	5.379	30.409
19	0.55	1.35	0.35		3.945	9.682	2.510	16.137
18	0.05	3.35	1.46		0.359	24.026	10.471	34.856
17	1.45	1.70	4.30		10.399	12.192	30.840	53.431
16	0.18	0.82	3.95		1.291	5.881	28.329	35.501
15	2.48	3.43	4.34		17.787	24.600	31.126	73.513
14	0.90	2.62	1.26		6.455	18.791	9.037	34.283
13	0.85	0.75	2.92		6.096	5.379	20.942	32.417
12	1.82	1.14*	1.73		13.053	8.176	12.408	33.637
11	0.04	0.57*	0.98*		0.287	4.088	7.029	11.404

*Data obtained from correlation studies.

Table 9

Precipitation Data

Precip. Station - Boulder State-Colo. Long. 105°17' Lat. 40°00'

Date: From 1911 through 1951 Total 41 Years

Year	Month			Thiessen Area Factor	Area factor x Month Precip.			
	March	April	May		March	April	May	Sum of 3 mos.
1951	2.40	2.73	1.93		7.774	8.842	6.251	22.867
50	0.41	2.95	3.49		1.328	9.555	11.304	22.187
49	2.54	2.17	3.69		8.227	7.029	11.952	27.208
48	3.32	2.00	1.24		10.753	6.478	4.016	21.247
47	2.66	1.34	4.35		8.616	4.340	14.089	27.045
46	0.71	0.87	3.55		2.299	2.883	11.498	16.680
45	1.07	4.12	3.86		3.466	13.345	12.503	29.314
44	3.79	6.81	1.77		12.276	22.058	5.733	40.067
43	1.19	1.36	4.85		3.854	4.405	15.709	23.969
42	0.93	6.94	1.80		3.012	22.479	5.830	31.321
41	2.92	4.08	2.07		9.458	13.215	6.705	29.378
40	1.58	2.05	2.57	3.239	5.118	6.640	8.324	20.082
39	1.68	1.94	1.74		5.442	6.284	5.636	17.362
38	2.59	4.42	4.38		8.389	14.316	14.187	36.892
37	0.83	2.01	2.31		2.688	6.514	7.482	16.684
36	2.88	1.25	2.75		9.328	4.049	8.907	22.284
35	0.14	2.80	7.04		0.453	9.069	22.803	32.325
34	1.63	2.82	3.11		5.279	9.134	10.073	24.486
33	1.28	4.15	3.94		4.146	13.442	12.762	30.350
32	1.47	2.01	1.10		4.761	6.510	3.563	14.834
31	1.59	1.60	3.67		5.150	5.182	11.887	22.219
30	0.88	0.99	2.17		2.850	3.207	7.029	13.086
29	2.57	1.60	1.50		8.324	5.182	4.859	18.365

Table 9 (Continued)

Precipitation Data

Precip. Station - Boulder State-Colo. Long. 105°17' Lat. 40°00'

Date: From 1911 through 1951 Total 41 Years

Year	Month			Thiessen Area Factor	Area factor x Month Precip.			
	March	April	May		March	April	May	Sum of 3 mos.
1928	2.72	1.55	5.48		8.810	5.020	17.750	31.580
27	2.66	3.46	1.72		8.616	11.207	5.571	25.394
26	2.69	3.05	3.22		8.713	9.879	10.430	29.022
25	0.35	0.25	1.61		1.134	0.809	5.215	7.158
24	1.77	1.98	2.77		5.733	6.413	8.972	21.118
23	2.99	1.29	3.47		9.685	4.178	11.239	25.102
22	0.81	3.32	1.02		2.624	10.753	3.304	16.681
21	0.77	4.81	1.50		2.494	15.579	4.859	22.932
20	0.58	4.07	1.61	3.239	1.879	13.183	5.215	20.277
19	1.49	1.65	0.88		4.826	5.344	2.850	13.020
18	0.72	2.98	2.03		2.332	9.652	6.575	18.559
17	1.75	2.81	6.17		5.668	9.102	19.985	34.755
16	1.02	2.36	3.77		3.304	7.644	12.211	23.159
15	1.68	4.46	3.83		5.442	14.446	12.405	32.293
14	1.77	3.38	3.57		5.733	10.948	11.563	28.244
13	0.71	1.58	1.85		2.299	5.117	5.992	13.408
12	3.05*	1.71	2.82		9.879	5.539	9.134	24.552
11	0.64	2.68	0.90		2.073	8.681	2.915	13.669

* Data obtained from correlation studies.

Table 10

Precipitation Data

Precip. Station-Cheyenne (Airport) State-Wyo. Long. 104°49 Lat. 41°09

Date: From 1911 through 1951 Total 41 years

Year	Month March	Month April	Month May	Area Factor	Area Factor x Month Precip. March	April	May	Sum of 3 mos.
1951	0.51	1.94	2.77		3.405	12.951	18.493	34.849
50	0.89	1.81	2.48		5.942	12.084	16.556	34.582
49	2.44	1.61	4.27		16.289	10.748	28.507	55.544
48	0.41	0.73	0.92		2.737	4.873	6.142	13.752
47	0.81	1.55	2.19		5.408	10.348	14.620	30.376
46	2.29	0.35	4.15		15.288	2.337	27.705	45.330
45	1.02	3.08	1.31		6.810	20.562	8.746	36.118
44	1.98	2.85	2.00		13.218	19.027	13.352	45.597
43	0.95	1.34	4.21		6.342	8.946	28.106	43.394
42	1.02	5.04	3.27		6.810	33.647	21.831	62.288
41	1.37	3.70	0.68	6.676	9.146	24.701	4.540	38.387
40	1.21	1.36	1.29		8.078	9.079	8.612	25.769
39	1.73	1.81	1.69		11.549	12.084	11.282	34.915
38	1.33	2.11	2.31		8.879	14.086	15.422	38.387
37	2.09	1.59	1.19		13.953	10.615	7.944	32.512
36	1.17	1.26	2.90		7.811	8.412	19.360	35.583
35	0.32	2.95	5.89		2.136	19.694	39.322	61.152
34	0.86	1.54	1.66		5.741	10.281	11.082	27.104
33	0.88	4.79	3.44		5.875	31.978	22.965	60.818
32	1.40	1.67	1.47		9.346	11.149	9.814	30.309
31	1.16	1.72	1.57		7.744	11.483	10.481	29.708
30	0.88	1.19	4.95		5.875	7.944	33.046	46.865
29	1.51	4.79	1.46		10.081	31.978	9.747	51.806

Table 10 (continued)

Precipitation Data

Precip. Station-Cheyenne (Airport) State-Wyo. Long. 104°49 Lat. 41°09

Date: From 1911 through 1951 Total 41 years

Year	Month March	Month April	Month May	Area Factor	Area Factor x Month Precip. March	Area Factor x Month Precip. April	Area Factor x Month Precip. May	Sum of 3 mos.
1928	1.52	0.83	2.67		10.148	5.541	17.825	33.514
27	1.93	2.25	2.01		12.885	15.021	13.419	41.325
26	1.04	1.27	1.75		6.943	8.479	11.683	27.105
25	0.59	1.23	1.56		3.939	8.211	10.415	22.565
24	1.71	1.41	3.58		11.416	9.413	23.900	44.729
23	1.49	3.26	2.58		9.947	21.764	17.224	48.935
22	0.33	3.23	2.00		2.203	21.563	13.352	37.118
21	0.39	2.00	2.40		2.604	13.352	16.022	31.978
20	0.66	3.97	2.15		4.406	26.504	14.353	45.263
19	1.52	1.23	0.70	6.676	10.148	8.211	4.673	23.032
18	0.19	3.92	2.60		1.268	26.170	17.358	44.796
17	0.69	1.75	4.65		4.606	11.683	31.043	47.332
16	0.20	0.48	1.93		1.335	3.204	12.885	17.424
15	1.61	3.29	2.21		10.748	21.964	14.754	47.466
14	0.72	2.58	2.10		4.807	17.244	14.019	36.070
13	0.33	1.35	2.22		2.203	9.013	14.821	26.037
12	1.33	1.62	1.37		8.879	10.815	9.146	28.840
11	0.16	1.93	0.33		1.068	12.885	2.203	16.156

Table 11 (continued)

Precipitation Data

Precip. Station - Laramie State - Wyo. Long. 105°34'Lat. 41°18'

Date: From 1911 through 1951 Total 41 years

Year	Month March	Month April	Month May	Area Factor	Area Factor x Month Precip. March	April	May	Sum of 3 Mos.
1928	0.44	0.58	1.88		2.160	2.847	9.227	14.234
27	0.68	1.30	0.68		3.337	6.380	3.337	13.054
26	0.31	2.12	2.16		1.521	10.405	10.610	22.536
25	0.48	1.59	0.99		2.356	7.804	4.859	15.019
24	0.45	0.36	2.33		2.209	1.767	11.436	15.412
23	0.98	0.55	0.75		4.810	2.699	3.681	11.190
22	0.96	1.95	1.26		4.712	9.571	6.184	20.467
21	0.41	2.40	1.21		2.012	11.779	5.939	19.730
20	0.48	4.45	1.66		2.356	21.841	8.147	32.344
19	0.55	0.85	0.22	4.908	2.699	4.172	1.080	7.951
18	0.85	1.27	0.74		4.172	6.233	3.632	14.037
17	0.93	1.37	2.63		4.564	6.724	12.908	24.196
16	1.10	0.30	0.90		5.399	1.472	4.417	11.288
15	1.70	1.32	1.91		8.344	6.479	9.374	24.197
14.	0.37	1.00	1.81		1,816	4.908	8.883	15.607
13	0.19	0.41	0.19		0.933	2.012	0.933	3.878
12	0.72*	1.53	0.90		3.534	7.509	4.417	15.460
11	0.20	1.02	0.30		0.482	5.006	1.472	7.460

* Data obtained from correlation studies.

Table 12

Mean Depth of Precipitation on Target Area

Year	Month Precipitation in Inches			
	March	April	May	Sum of 3 mos.
1951	0.495	1.394	2.469	4.358
50	0.326	1.788	2.710	4.825
49	2.203	1.432	3.273	6.908
48	0.964	0.913	1.599	3.477
47	1.072	1.619	3.311	6.002
46	1.024	0.847	3.191	5.062
45	0.564	3.388	2.431	6.383
44	2.010	4.040	1.725	7.775
43	0.849	1.495	4.405	6.749
42	0.507	4.740	2.161	7.408
41	1.411	3.371	1.460	6.242
40	1.254	1.309	1.894	4.458
39	1.282	1.166	1.449	3.897
38	1.354	2.386	2.826	6.567
37	1.163	1.822	1.589	4.575
36	0.935	1.097	1.696	3.729
35	0.237	1.939	5.726	7.902
34	0.654	1.354	1.754	3.762
33	0.463	2.661	3.084	6.207
32	1.098	1.090	1.465	3.653
31	0.794	1.289	2.247	4.330
30	0.693	0.728	2.790	4.210

Table 12 (continued)

Mean Depth of Precipitation on Target Area

Year	Month Precipitation in Inches			
	March	April	May	Sum of 3 mos.
1929	1.485	2.037	1.368	4.891
28	1.310	1.115	3.340	5.765
27	1.575	2.433	0.983	4.990
26	1.418	2.596	1.808	5.822
25	0.488	0.321	1.232	2.042
24	1.888	1.157	3.616	6.661
23	2.371	1.605	3.139	7.115
22	0.572	2.404	1.173	4.148
21	0.582	3.054	1.847	5.483
20	0.308	4.014	1.422	5.743
19	1.200	1.233	0.782	3.215
18	0.463	2.741	2.106	5.310
17	1.302	1.576	5.051	7.929
16	0.595	1.124	3.029	4.749
15	1.854	4.029	3.086	8.969
14	0.880	2.500	2.453	5.834
13	0.404	1.640	2.100	4.145
12	1.939	1.473	2.865	6.277
11	0.314	1.733	0.744	2.719
Summation	41.806	79.262	94.932	216.000
Normal	1.05	1.98	2.37	5.40

Table 13

Frequency Analysis

Mean Depth of Precipitation on Target Area

Period	Range of Precipitation	Frequency of Occurrence(g)	Summation (n)	Percent of Occurrence of Particular Precip. or Higher *
March 1911-1950	0.30-0.50	8	40	90.00
	0.50-0.70	7	32	71.25
	0.70-0.90	3	25	58.75
	0.90-1.10	5	22	48.75
	1.10-1.30	4	17	37.50
	1.30-1.50	6	13	25.00
	1.50-1.70	1	7	16.25
	1.70-1.90	2	6	12.50
	1.90-2.10	2	4	7.50
	2.10-2.30	1	2	3.75
	2.30-2.50	1	1	1.25
April 1911-1950	0.30-0.50	1	40	98.75
	0.50-0.70	0	39	97.50
	0.70-0.90	2	39	95.00
	0.90-1.10	3	37	88.75
	1.10-1.30	6	34	77.50
	1.30-1.50	5	28	63.75
	1.50-1.70	4	23	52.50
	1.70-1.90	3	19	43.75
	1.90-2.10	2	16	37.50
	2.10-2.30	0	14	35.00
	2.30-2.50	3	14	31.25

Table 13 (continued)

Frequency Analysis

Mean Depth of Precipitation on Target Area

Period	Range of Precipitation	Frequency of Occurrence(g)	Summation (n)	Percent of Occurrence of Particular Precip. or Higher *
April (cont)				
1911-1950	2.50-2.70	3	11	23.75
	2.70-2.90	1	8	18.75
	2.90-3.10	1	7	16.25
	3.10-3.30	0	6	15.00
	3.30-3.50	2	6	12.50
	3.50-3.70	0	4	10.00
	3.70-3.90	0	4	10.00
	3.90-4.10	3	4	6.25
	4.10-4.30	0	1	2.50
	4.30-4.50	0	1	2.50
	4.50-4.70	0	1	2.50
	4.70-4.90	1	1	1.25
May				
1911-1950	0.70-0.90	2	40	97.50
	0.90-1.10	1	38	93.75
	1.10-1.30	2	37	90.00
	1.30-1.50	5	35	81.25
	1.50-1.70	3	30	71.25
	1.70-1.90	5	27	61.25
	1.90-2.10	0	22	55.00
	2.10-2.30	4	22	50.00
	2.30-2.50	2	18	42.50
	2.50-2.70	0	16	40.00

Table 13 (continued)

Frequency Analysis

Mean Depth of Precipitation on Target Area

Period	Range of Precipitation	Frequency of Occurrence(g)	Summation (n)	Percent of Occurrence of Particular Precip. or Higher *
May (cont) 1911-1950	2.70-2.90	4	16	35.00
	2.90-3.10	3	12	26.25
	3.10-3.30	4	9	17.50
	3.30-3.50	1	5	11.25
	3.50-3.70	1	4	8.75
	3.70-3.90	0	3	7.50
	3.90-4.10	0	3	7.50
	4.10-4.30	0	3	7.50
	4.30-4.50	1	3	6.25
	4.50-4.70	0	2	5.00
	4.70-4.90	0	2	5.00
	4.90-5.10	1	2	3.75
	5.10-5.30	0	1	2.50
	5.30-5.50	0	1	2.50
	5.50-5.70	0	1	2.50
	5.70-5.90	1	1	1.25
Sum of three Months	2.00-2.20	1	40	98.75
	2.20-2.40	0	39	97.50
	2.40-2.60	0	39	97.50
	2.60-2.80	0	39	97.50
	2.80-3.00	1	39	96.25
	3.00-3.20	0	38	95.00

Table 13 (continued)

Frequency Analysis

Mean Depth of Precipitation on Target Area

Period	Range of Precipitation	Frequency of Occurrence(g)	Summation (n)	Percent of Occurrence of Particular Precip. or Higher *
Sum of three Months (cont)	3.20-3.40	1	38	93.75
	3.40-3.60	1	37	91.25
	3.60-3.80	3	36	86.25
	3.80-4.00	1	33	81.25
	4.00-4.20	2	32	77.50
	4.20-4.40	2	30	72.50
	4.40-4.60	2	28	67.50
	4.60-4.80	1	26	63.75
	4.80-5.00	3	25	58.75
	5.00-5.20	1	22	52.50
	5.20-5.40	1	21	51.25
	5.40-5.60	1	20	48.75
	5.60-5.80	2	19	45.00
	5.80-6.00	2	17	40.00
	6.00-6.20	1	15	36.25
	6.20-6.40	4	14	30.00
	6.40-6.60	1	10	23.75
	6.60-6.80	2	9	20.00
	6.80-7.00	1	7	16.25
	7.00-7.20	1	6	13.75
	7.20-7.40	0	5	12.50
	7.40-7.60	1	5	11.25
	7.60-7.80	1	4	8.75

Table 13 (continued)

Frequency Analysis

Mean Depth of Precipitation on Target Area

Period	Range of Precipitation	Frequency of Occurrence (g)	Summation (n)	Percent of Occurrence of Particular Precip. or Higher *
Sum of three Months (cont)	7.80-8.00	2	3	5.00
	8.00-8.20	0	1	2.50
	8.20-8.40	0	1	2.50
	8.40-8.60	0	1	2.50
	8.60-8.80	0	1	2.50
	8.80-9.00	1	1	1.25

* Percent of Occurrence of Particular Precipitation or Higher $= 100 \times \frac{n-0.5g}{40}$

Table 14

Secular Trend Exhibited by Mean Depth of

Precipitation on Target Area 1911-1950

Year	P Precip.*	N	NP	N^2	T Time	T^2	TP
1950	4.825	+19.5	+94.0875	380.25	39	1521	188.175
49	6.908	+18.5	+127.7980	342.25	38	1444	262.504
48	3.477	+17.5	+60.8475	306.25	37	1369	128.649
47	6.002	+16.5	+99.0330	272.25	36	1296	216.072
46	5.062	+15.5	+78.4610	240.25	35	1225	177.170
45	6.383	+14.5	+92.5535	210.25	34	1156	217.022
44	7.775	+13.5	+104.9625	182.25	33	1089	256.575
43	6.749	+12.5	+84.3625	156.25	32	1024	215.968
42	7.408	+11.5	+85.1920	132.25	31	961	229.648
41	6.243	+10.5	+65.5515	110.25	30	900	187.290
40	4.458	+ 9.5	+42.3510	90.25	29	841	129.282
39	3.897	+ 8.5	+33.1245	72.25	28	784	109.116
38	6.567	+ 7.5	+49.2525	56.25	27	729	177.309
37	4.575	+ 6.5	+29.7375	42.25	26	676	118.950
36	3.729	+ 5.5	+20.5095	30.25	25	625	93.225
35	7.995	+ 4.5	+35.9775	20.25	24	576	191.880
34	3.762	+ 3.5	+13.1670	12.25	23	529	86.526
33	6.207	+ 2.5	+15.5175	6.25	22	484	136.554
32	3.653	+ 1.5	+5.4795	2.25	21	441	76.713
31	4.330	+ 0.5	+2.1650	0.25	20	400	86.600
30	4.210	- 0.5	-2.1050	0.25	19	361	79.990
29	4.891	- 1.5	-7.3365	2.25	18	324	88.038
28	5.696	- 2.5	-14.2400	6.25	17	289	96.832

Table 14 (continued)

Secular Trend Exhibited by Mean Depth of

Precipitation on Target Area 1911-1950

Year	P Precip.*	N	NP	N^2	T Time	T^2	TP
1927	4.990	- 3.5	-17.4650	12.25	16	256	79.840
26	5.822	- 4.5	-26.1990	20.25	15	225	87.330
25	2.042	- 5.5	-11.2310	30.25	14	196	28.588
24	6.661	- 6.5	-43.2965	42.25	13	169	86.593
23	7.115	- 7.5	-53.3625	56.25	12	144	85.380
22	4.148	- 8.5	-35.2580	72.25	11	121	45.628
21	5.483	- 9.5	-52.0885	90.25	10	100	54.830
20	5.743	-10.5	-60.3015	110.25	9	81	51.687
19	3.215	-11.5	-36.9725	132.25	8	64	25.720
18	5.310	-12.5	-66.3750	156.25	7	49	37.170
17	7.929	-13.5	-107.0415	182.25	6	36	47.574
16	4.749	-14.5	-68.8605	210.25	5	25	23.745
15	8.969	-15.5	-139.0195	240.25	4	16	35.876
14	5.834	-16.5	-96.2610	272.25	3	9	17.502
13	4.145	-17.5	-72.5375	306.25	2	4	8.290
12	6.277	-18.5	-116.1245	342.25	1	1	6.277
11	2.816	-19.5	-54.9120	380.25	0	0	0
Summation			+1140.1305				
	216.050		-1080.9875	5330.00	780	20540	4272.118

* Precipitation for period of March, April and May

Norm. Precipitation for 40 year period = 5.40 inches

Trend in inches per year = $\frac{(\text{Sum})NP}{(\text{Sum})N^2} = \frac{140.1305 - 1080.9875}{5330} - \frac{59.1430}{5330} = +0.0111$

Required eq.: $P = a + b\,T$

Table 14 (continued)

Secular Trend Exhibited by Mean Depth of

Precipitation on Target Area 1911-1950

(con't)

From eqs.: $(Sum)P = Ma + b\,(Sum)T = 40a + 780\,b = 216.050$

$(Sum)\,TP = a\,(Sum)T + b(Sum)\,T^2 = 780a + 20540b = 4272.118$

Solve: $b = + 0.0111$ $a = 5.185$

Therefore: $P = 5.185 + 0.0111T$ T = No. of Years from 1911

M = Period of Investigation in years

Table 15

Secular Trend Exhibited by Mean Depth of

Precipitation on Target Area 1936-1950

Year	P Precip.*	N	NP	N^2	T Time	T^2	TP
1950	4.825	+7	+33.775	49	14	196	67.550
49	6.908	+6	+41.448	36	13	169	89.804
48	3.477	+5	+17.385	25	12	144	41.724
47	6.002	+4	+24.008	16	11	121	66.022
46	5.062	+3	+15.186	9	10	100	50.620
45	6.383	+2	+12.766	4	9	81	57.447
44	7.775	+1	+ 7.775	1	8	64	62.200
43	6.749	0	0	0	7	49	47.243
42	7.408	-1	- 7.408	1	6	36	44.448
41	6.243	-2	-12.486	4	5	25	31.215
40	4.458	-3	-13.374	9	4	16	17.832
39	3.897	-4	-15.588	16	3	9	11.691
38	6.567	-5	-32.835	25	2	4	13.134
37	4.575	-6	-27.450	36	1	1	4.575
36	3.729	-7	-26.103	49	0	0	0
Summation	84.058		+152.343 -135.244	280	105	1015	605.505

* Precipitation for period of March, April and May

Norm. Precipitation for 15 year period = 5.60 inches

Trend in in. per yr. $= \frac{(\text{Sum})NP}{(\text{Sum})N^2} = \frac{152.343 - 135.244}{280} = \frac{17.099}{280} = {}^{+}0.0611$

Required eq.: $P = a + bT$

Table 15 (continued)

Secular Trend Exhibited by Mean Depth of

Precipitation on Target Area 1936-1950

From eqs.: $(\text{Sum})P = Ma + b\,(\text{Sum})T = 15a + 105b = 84.058$

$(\text{Sum})TP = a\,(\text{Sum})T + b\,(\text{Sum})T^2 = 105a + 1015b = 605.505$

Solve: $b = \frac{17.099}{28} = +0.0611$ $\qquad a = 5.176$

Therefore: $P = 5.176 + 0.0611T$ $\qquad T$ = No. of Years from 1936

M = Period of Investigation in Years.

Table 16

Moving Ten-Year Secular Trend Exhibited

by Mean Depth of Precipitation on Target Area

1911-1950

Years	P * Precip.	1000P	N	NP	N^2	T	T^2	TP
41-50	6.083	6083.148	15	∕91.245	225	30	900	182.490
40-49	6.046	6046.398	14	∕84.644	196	29	841	175.334
39-48	5.745	5745.260	13	∕74.685	169	28	784	160.860
38-47	6.054	6054.254	12	∕72.648	144	27	729	163.458
37-46	5.912	5911.524	11	∕65.032	121	26	676	153.712
36-45	5.778	5778.228	10	∕57.780	100	25	625	144.450
35-44	5.939	5939.440	9	∕53.451	81	24	576	142.536
34-43	5.538	5538.118	8	∕44.304	64	23	529	127.374
33-42	5.484	5483.914	7	∕38.388	49	22	484	120.648
32-41	5.108	5108.452	6	∕30.648	36	21	441	107.268
31-40	4.917	4917.211	5	∕24.585	25	20	400	98.340
30-39	4.892	4892.483	4	∕19.568	16	19	361	92.948
29-38	4.992	4991.884	3	∕14.976	9	18	324	89.856
28-37	4.905	4904.852	2	∕ 9.810	4	17	289	83.385
27-36	4.946	4946.330	1	∕ 4.946	1	16	256	79.136
26-35	5.156	5155.651	0	0	0	15	225	77.340
25-34	4.560	4560.323	-1	- 4.560	1	14	196	63.840
24-33	4.850	4850.208	-2	- 9.700	4	13	169	63.050
23-32	4.941	4940.990	-3	-14.823	9	12	144	59.292
22-31	4.991	4990.525	-4	-19.964	16	11	121	54.901
21-30	5.106	5105.840	-5	-25.530	25	10	100	51.060
20-29	5.259	5259.148	-6	-31.554	36	9	81	47.331
19-28	5.092	5091.601	-7	-35.644	49	8	64	40.736

Table 16 (continued)

Moving Ten-Year Secular Trend Exhibited

by Mean Depth of Precipitation on Target Area

1911-1950

Years	P * Precip.	1000P	N	NP	N^2	T	T^2	TP
18-27	5.053	5052.999	-8	-40.424	64	7	49	35.371
17-26	5.347	5346.864	-9	-48.123	81	6	36	32.082
16-25	5.240	5239.560	-10	-52.400	100	5	25	26.200
15-24	5.932	5932.266	-11	-65.252	121	4	16	23.728
14-23	5.850	5849.544	-12	-70.200	144	3	9	17.550
13-22	5.553	5552.583	-13	-72.189	169	2	4	11.106
12-21	5.765	5765.443	-14	-80.710	196	1	1	5.765
11-20	5.499	5498.726	-15	-82.485	225	0	0	0
Summation				+686.710				
166.533				-653.558	2480	465	9455	2531.147

* Precipitation for period of March, April and May

Norm. precipitation for 40 year period = 5.37 inches

Trend in inches per year = $\frac{(\text{Sum})NP}{(\text{Sum})N^2} = \frac{686.710 - 653.558}{2480} = \frac{33.152}{2480} = +0.0134$

Required eq.: $P = a + bT$

From eqs.: $(\text{Sum})\ P = Ma + b\ (\text{Sum})T = 31a + 465b = 166.533$

$(\text{Sum})\ TP = a\ (\text{Sum})T + b(\text{Sum})T^2 = 465a + 9455b = 2531.147$

Solve: $b = +0.0134$

$a = \frac{166.533 - 465 \times 0.01337}{31} = \frac{160.316}{31} = 5.171$

Therefore: $P = 5.171 + 0.0134T$ T = No. of Ten-Yr. Periods from 1911

M = No. of Ten-Yr. Periods of Investigation

Table 17

Mean Depth of Precipitation Using Isohyetal Method on Target and Control Areas for Normal Month of March

Target Area

Planimeter Readings				
Initial	Final	Differential	Average Precipitation	Diff. x Average Precipitation
7.680	7.728	0.048	1.17	0.056
7.728	8.810	1.082	1.25	1.353
9.301	9.470	0.169	1.15	0.194
9.470	9.539	0.069	1.07	0.074
9.816	10.046	0.230	1.35	0.350
0.046	0.113	0.067	1.45	0.097
0.116	0.173	0.057	1.55	0.088
0.173	0.208	0.035	1.65	0.058
0.189	0.237	0.048	1.75	0.084
0.237	0.287	0.050	1.85	0.093
0.239	0.295	0.056	1.95	0.109
0.295	0.326	0.031	2.05	0.064
0.278	0.305	0.027	2.15	0.058
0.305	0.325	0.020	2.25	0.045
0.282	0.300	0.018	2.35	0.042
0.300	0.309	0.009	2.45	0.022
0.284	0.290	0.006	2.55	0.015
0.290	0.300	0.010	2.65	0.027
0.264	0.280	0.016	2.75	0.044
0.280	0.285	0.005	2.85	0.014
3.904	4.203	0.299	1.15	0.344
4.203	4.463	0.260	1.05	0.273
5.003	5.215	0.212	0.95	0.201
5.215	5.583	0.368	0.85	0.313
6.018	7.056	1.038	0.75	0.778

Table 17 (Continued)

Mean Depth of Precipitation Using Isohyetal Method on Target and Control Areas for Normal Month of March

Target Area

Planimeter Readings				
Initial	Final	Differential	Average Precipitation	Diff. x Average Precipitation
7.056	7.771	0.715	0.65	0.465
7.473	7.531	0.058	0.59	0.034
	Total	5.003	(1.06)	5.295

Mean Depth of Precipitation on Target Area for Normal Month of March. $= \frac{5.295}{5.003} = 1.06$ inches

Table 17 (Continued)

Control Area

Planimeter Readings				
Initial	Final	Differential	Average Precipitation	Diff. x Average Precipitation
1.603	1.611	0.008	0.99	0.008
1.611	1.682	0.071	1.05	0.075
1.459	1.383	0.076	1.15	0.087
0.550	0.927	0.377	1.25	0.471
0.927	1.251	0.324	1.35	0.437
1.076	1.219	0.173	1.45	0.207
1.219	1.311	0.112	1.55	0.174
1.206	1.231	0.025	1.65	0.041
1.231	1.307	0.076	1.73	0.131
9.535	10.414	0.879	1.15	1.010
0.414	0.952	0.538	1.05	0.565
9.397	9.431	0.034	1.21	0.041
8.444	8.899	0.455	1.05	0.478
8.899	8.964	0.065	0.95	0.062
8.494	8.590	0.096	0.85	0.082
8.590	8.936	6.346	0.75	0.259
6.978	7.002	0.024	0.69	0.017
0.446	2.213	1.767	0.95	1.679
2.213	2.620	0.407	0.85	0.346
2.687	3.003	0.316	0.75	0.237
		Total 6.139		6.407

Mean Depth of Precipitation on Control Area = $\frac{6.407}{6.139}$ = 1.04 inches for Normal Month of March.

Table 18

Mean Depth of Precipitation Using Isohyetal Method on Target and Control Areas for Month of March, 1951

Target Area

Planimeter Readings				
Initial	Final	Differential	Average Precipitation	Diff. x Aver. Precipitation
8.667	8.676	0.009	2.33	0.021
8.676	8.703	0.027	2.25	0.061
8.715	8.730	0.015	2.15	0.032
8.730	8.752	0.022	2.05	0.045
8.765	8.783	0.018	1.95	0.035
8.783	8.806	0.023	1.85	0.043
8.937	8.969	0.032	1.75	0.056
8.969	8.996	0.027	1.65	0.045
9.413	9.451	0.038	1.55	0.059
9.451	9.500	0.049	1.45	0.071
9.530	9.577	0.047	1.35	0.063
9.577	9.620	0.043	1.25	0.054
9.659	9.709	0.050	1.15	0.058
9.709	9.760	0.051	1.05	0.054
0.332	0.382	0.050	0.95	0.048
0.382	0.439	0.057	0.85	0.048
0.432	0.439	0.007	0.85	0.006
0.462	0.550	0.088	0.75	0.066
0.550	2.036	1.486	0.65	0.966
2.035	2.043	0.008	0.59	0.005
3.869	4.220	0.351	0.55	0.193
4.220	5.056	0.836	0.43	0.359
7.546	7.981	0.435	0.35	0.152
7.981	8.444	0.463	0.25	0.116

Table 18 (Continued)

Mean Depth of Precipitation Using Isohyetal Method on Target and Control Areas for Month of March, 1951

Target Area

Planimeter Readings				
Initial	Final	Differential	Average Precipitation	Diff. x Average Precipitation
9.024	9.652	0.628	0.15	0.094
9.652	9.811	0.159	0.07	0.011
	Total	5.019		2.761

Mean Depth of Precipitation on Target Area for Month of March, 1951 $= \frac{2.761}{5.019} = 0.55$ inches

Percent of Normal $= \frac{0.55}{1.06} = 52\%$.

Table 18 (Continued)

Control Area

Planimeter Readings				
Initial	Final	Differential	Average Precipitation	Diff. X Average Precipitation
6.479	6.483	0.004	0.28	0.001
6.483	6.530	0.057	0.35	0.020
6.470	6.541	0.071	0.45	0.032
6.541	6.647	0.106	0.55	0.038
6.609	7.160	0.551	0.65	0.358
1.728	2.250	0.522	0.75	0.392
2.250	2.965	0.715	0.85	0.608
3.691	3.794	0.103	0.73	0.075
4.681	5.437	0.756	0.93	0.713
5.437	5.779	0.342	1.05	0.359
6.372	6.921	0.549	1.14	0.625
6.612	6.995	0.383	0.55	0.211
7.287	7.583	0.296	0.45	0.133
5.953	6.342	0.389	0.35	0.136
6.342	6.901	0.559	0.25	0.140
6.197	6.834	0.637	0.15	0.096
6.834	6.913	0.079	0.09	0.001
	Total	6.119		3.958

Mean Depth of Precipitation on Control Area for Month of March, 1951. $= \frac{3.958}{6.119} = 0.64$ inches

Percent of Normal $= \frac{0.64}{1.04} = 62\%$.

Table 19

Snow-Water Content Data for Target and Control Areas

Target Area

Snow Course	'38	'39	'40	'41	'42	'43	'44	'45	'46	'47	'48	'49	'50	38-50 Normal	5
Years															
(Snow-Water Content in Inches on March 1)															
Big South	1.7	1.0	2.7	1.3	1.4	2.5	0.7	3.4	1.6	2.1	3.3	2.9	2.0	2.0	3.
Cameron Pass	20.2	17.2	15.4	13.6	13.6	17.0	11.8	15.2	18.6	17.9	15.4	19.6	15.0	16.2	16.
Chamber's Lake	5.9	5.0	5.6	4.1	4.9	8.3	2.3	7.5	5.8	6.0	8.0	9.2	5.4	6.0	10.
Deadman Hill	12.0	10.6	9.0	5.3	9.0	13.9	6.8	10.7	11.5	12.4	10.6	16.7	11.7	10.8	13.
Lake Irene	20.7	18.2	14.8	11.4	13.4	21.1	6.8	15.8	17.7	13.4	19.5	26.1	17.0	16.6	25.
Hour Glass Lake	5.2	6.1	5.0	2.5	5.7	--	1.7	7.5	5.4	---	6.6	9.2	5.3	5.5	8.
Wild Basin	9.1	9.1	6.9	4.9	10.9	15.5	4.8	9.5	8.9	11.3	11.1	15.5	11.0	9.9	18.
(Snow-Water Content in inches on April 1)															
Big South	2.5	1.3	2.6	2.4	1.1	3.3	1.9	3.5	2.3	4.0	4.3	3.5	2.5	2.7	3.
Cameron Pass	26.7	23.0	17.6	17.5	18.6	20.3	15.6	19.2	23.2	23.2	21.8	27.8	18.5	21.0	25.
Chambers Lake	7.6	7.3	7.8	5.5	6.0	9.2	5.0	8.2	8.7	8.4	9.6	9.6	7.0	7.7	11.
Deadman Hill	16.3	15.5	11.8	9.1	10.5	18.7	12.2	14.5	16.3	17.0	13.4	20.6	15.4	14.7	18.
Lake Irene	28.5	20.9	19.4	14.0	18.0	23.0	14.4	17.8	19.4	23.1	23.8	29.9	20.9	21.0	30.
Hour Glass Lake	7.9	8.4	6.7	4.2	6.9	14.6	---	---	5.8	8.5	8.8	10.8	13.0	8.7	12.
Wild Basin	13.7	13.9	9.6	7.6	12.4	20.2	9.5	13.1	10.8	15.8	13.1	19.6	13.7	13.3	21.

Table 19 (Continued)

Snow-Water Content Data for Target and Control Areas

Target Area

Snow Course (Snow-Water Content in Inches on May 1)	'38	'39	'40	'41	'42	'43	'44	'45	'46	'47	'48	'49	'50	38-50 Normal	'5
	Years														
Big South	0	0	0	0.3	1.7	0	2.4	0.6	0	2.1	0.3	0.1	1.1	0.7	1.
Cameron Pass	31.6	26.4	22.4	22.3	22.0	18.0	17.4	24.1	28.5	25.9	21.4	24.5	24.2	23.7	23.
Chamber's Lake	5.6	3.1	1.9	3.4	4.7	0.6	5.3	5.7	0.4	8.0	4.9	2.5	3.9	3.8	10.
Deadman Hill	20.5	16.5	12.3	14.2	---	---	19.6	18.8	11.6	20.7	16.0	18.9	17.4	17.0	22.
Lake Irene	31.4	23.6	20.5	23.5	22.6	20.9	21.4	26.8	15.2	27.1	24.2	26.1	21.0	23.4	34.
Hour Glass Lake	6.9	6.8	4.1	6.7	10.2	10.9	---	---	1.0	8.1	6.6	11.5	7.0	7.3	14.
Wild Basin	12.8	12.6	10.2	12.4	14.5	14.6	17.1	19.0	4.7	15.6	12.2	16.2	14.5	13.6	22.
Mean Depth of Snow-Water Content Change, Mar 1 - April 1	+4.0	+3.3	+2.3	+2.4	+2.1	+2.5	+4.8	+2.8	+2.5	+3.8	+2.9	+3.2	+3.4	+3.1	+3.
" " April 1 - May 1	+0.8	-0.2	-0.6	+3.0	+2.1	-4.8	+4.1	+3.1	-3.6	+1.1	-1.3	-3.1	-0.3	0.0	+1.
" " Mar. 1 - May 1	+4.8	+3.1	+1.7	+5.4	+4.2	-2.3	+8.9	+5.9	-1.1	+4.9	+1.6	+0.1	+3.1	+3.1	+4.

Table 19 (Continued)

Snow-Water Content Data for Target and Control Areas

Control Area

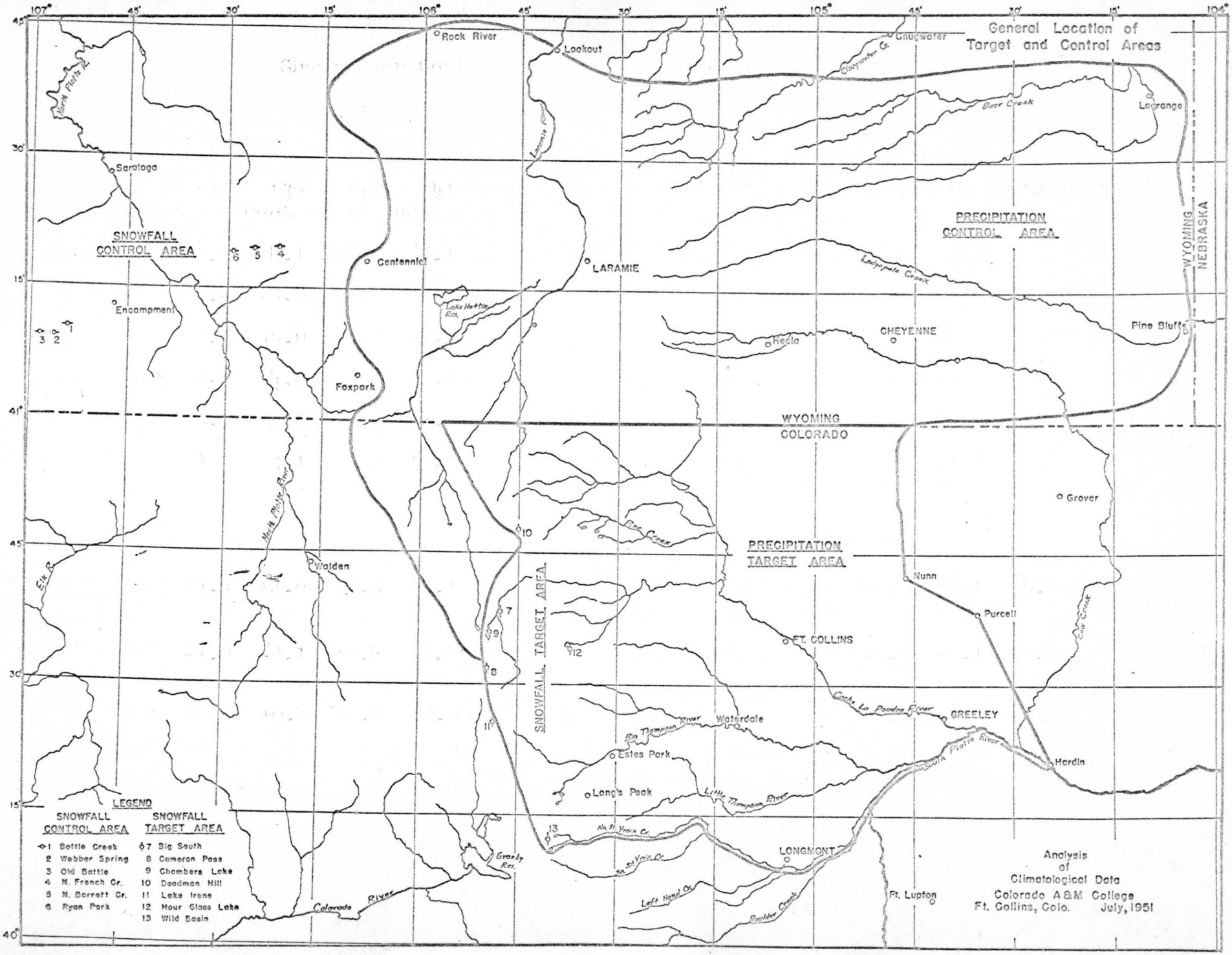
Snow Course	Years '38	'39	'40	'41	'42	'43	'44	'45	'46	'47	'48	'49	'50	38-50 Normal	'51
(Snow-Water Content in Inches on March 1)															
Battle Creek	13.2	13.7	8.3	7.0	9.1	12.0	6.3	10.8	8.8	10.2	9.1	18.4	14.9	10.9	10.8
Webber Spring	13.8	16.0	11.3	9.3	12.7	15.6	9.3	13.8	11.8	15.4	13.4	23.6	17.3	14.1	15.5
Old Battle	24.4	27.5	21.6	19.0	24.8	26.0	17.9	21.2	21.3	32.7	22.9	36.1	30.5	25.1	25.7
N.French Cr.	30.4	25.6	25.9	17.0	18.3	29.4	12.2	22.4	23.9	21.0	20.0	28.7	21.3	22.8	25.9
N.Barrett Cr.	19.9	18.0	18.2	12.2	12.3	16.4	7.7	12.9	13.9	14.2	13.0	20.1	12.4	14.7	15.6
Ryan Park	11.3	11.4	11.2	7.3	8.3	7.3	3.9	7.6	7.0	7.3	8.2	13.6	7.2	8.6	8.9
(Snow-Water Content in Inches on April 1)															
Battle Creek	15.7	13.0	9.8	8.8	10.6	14.9	10.4	16.9	10.6	11.0	14.8	19.7	18.8	13.5	13.9
Webber Spring	20.8	17.5	14.1	12.2	14.1	20.5	14.9	21.2	15.2	17.4	17.3	29.9	24.3	18.4	19.0
Old Battle	31.9	29.5	24.7	23.0	27.6	34.9	26.6	35.4	26.7	33.2	30.6	47.7	37.0	31.4	33.3
N.French Cr.	35.1	33.9	29.2	22.4	25.7	39.4	20.6	33.1	30.7	28.2	24.7	34.6	31.0	29.9	34.2
N.Barrett Cr.	26.2	23.7	21.6	15.8	15.1	21.9	13.6	22.2	19.1	18.0	17.5	25.3	20.5	20.0	18.8
Ryan Park	14.6	10.2	12.3	8.1	11.5	10.0	8.0	14.0	10.5	10.6	10.4	16.7	10.6	12.7	10.3

Table 19 (Continued)

Snow-Water Content Data for Target and Contorl Areas

Control Area

Snow Course (Snow-Water Content in Inches on May 1)	Years '38	'39	'40	'41	'42	'43	'44	'45	'46	'47	'48	'49	'50	38-50 Normal	'51
Bottle Creek	9.5	4.1	4.3	8.1	7.0	2.0	6.6	16.7	1.0	10.8	11.7	6.8	14.9	7.95	12.8
Webber Spring	19.8	15.8	12.3	15.3	13.4	12.1	15.8	20.2	7.6	16.1	16.0	16.0	19.6	15.4	17.1
Old Battle	32.5	35.0	26.9	29.7	31.5	29.8	28.9	39.3	24.9	36.1	34.9	36.9	37.7	32.6	34.9
N.French Cr.	37.1	34.6	35.2	31.9	32.0	32.0	26.3	35.5	29.4	36.1	27.5	33.2	35.1	32.8	38.3
N.Barrett Cr.	25.1	22.8	25.4	24.6	17.3	14.6	17.4	27.5	13.9	25.2	18.7	23.6	22.1	21.4	21.7
Ryan Park	9.3	3.1	9.9	12.1	4.9	0.0	6.8	13.4	0.0	12.3	7.0	8.2	8.5	7.35	8.4
Mean Depth of Snow-Water Content Change, Mar 1 - Apr.1	+4.7	+2.6	+2.5	+3.1	+2.9	+5.8	+6.1	+9.0	+4.4	+2.9	+4.1	+5.6	+5.7	+4.6	+4.5
" " Apr. 1-May 1	-1.9	-2.1	+0.4	+5.2	+0.3	-8.5	+1.3	+1.6	-6.0	+3.1	-0.1	-8.2	-0.7	-1.1	+0.6
" " Mar 1- May 1	+2.8	+0.5	+2.9	+8.3	+3.2	-2.7	+7.4	+10.0	-1.6	+6.0	+4.0	-2.6	-5.0	+3.5	+5.1


General Location of
Target and Control Areas
SNOWFALL
CONTROL AREA
PRECIPITATION
CONTROL AREA
PRECIPITATION
TARGET AREA
SNOWFALL TARGET AREA
WYOMING
COLORADO
WYOMING
NEBRASKA
Rock River
Lookout
Chugwater
Laramie River
Chugwater Cr.
Beer Creek
Lagrange
Saratoga
North Platte R.
Centennial
LARAMIE
Encampment
Lake Hattie
Lodgepole Creek
Hecla
CHEYENNE
Pine Bluff
Foxpark
Grover
North Platte River
Walden
Elk R.
Pole Creek
Nunn
Purcell
Cow Creek
FT. COLLINS
Cache La Poudre River
GREELEY
Big Thompson River
Waterdale
Estes Park
South Platte River
Hardin
Long's Peak
Little Thompson River
No. St. Vrain Cr.
So. St. Vrain Cr.
LONGMONT
Ft. Lupton
Left Hand Cr.
Boulder Creek
Grandy Res.
Colorado River
LEGEND
SNOWFALL CONTROL AREA
1 Battle Creek
2 Webber Spring
3 Old Battle
4 N. French Cr.
5 N. Barrett Cr.
6 Ryan Park
SNOWFALL TARGET AREA
7 Big South
8 Cameron Pass
9 Chambers Lake
10 Deadman Hill
11 Lake Irene
12 Hour Glass Lake
13 Wild Basin
Analysis
of
Climatological Data
Colorado A&M College
Ft. Collins, Colo. July, 1951

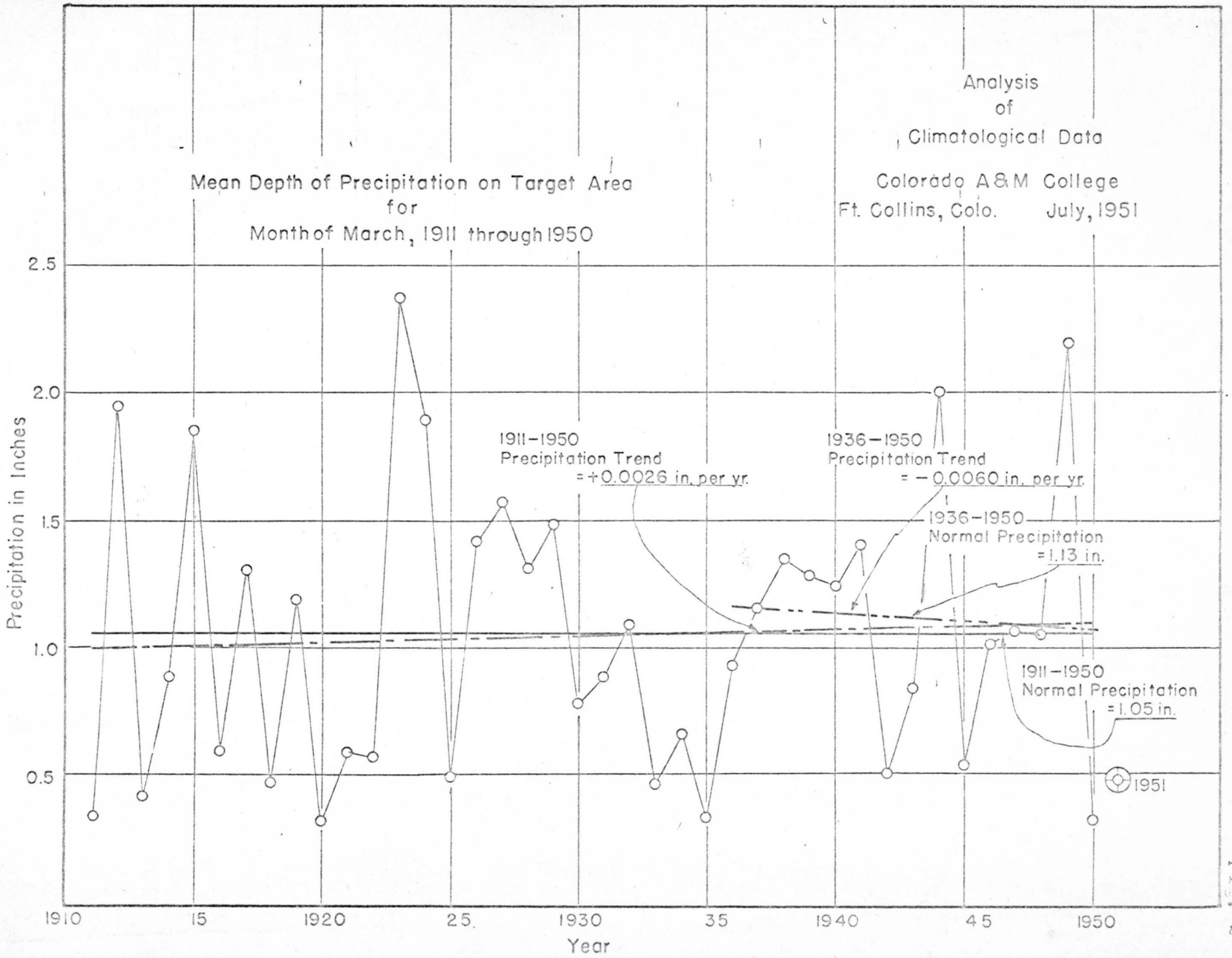
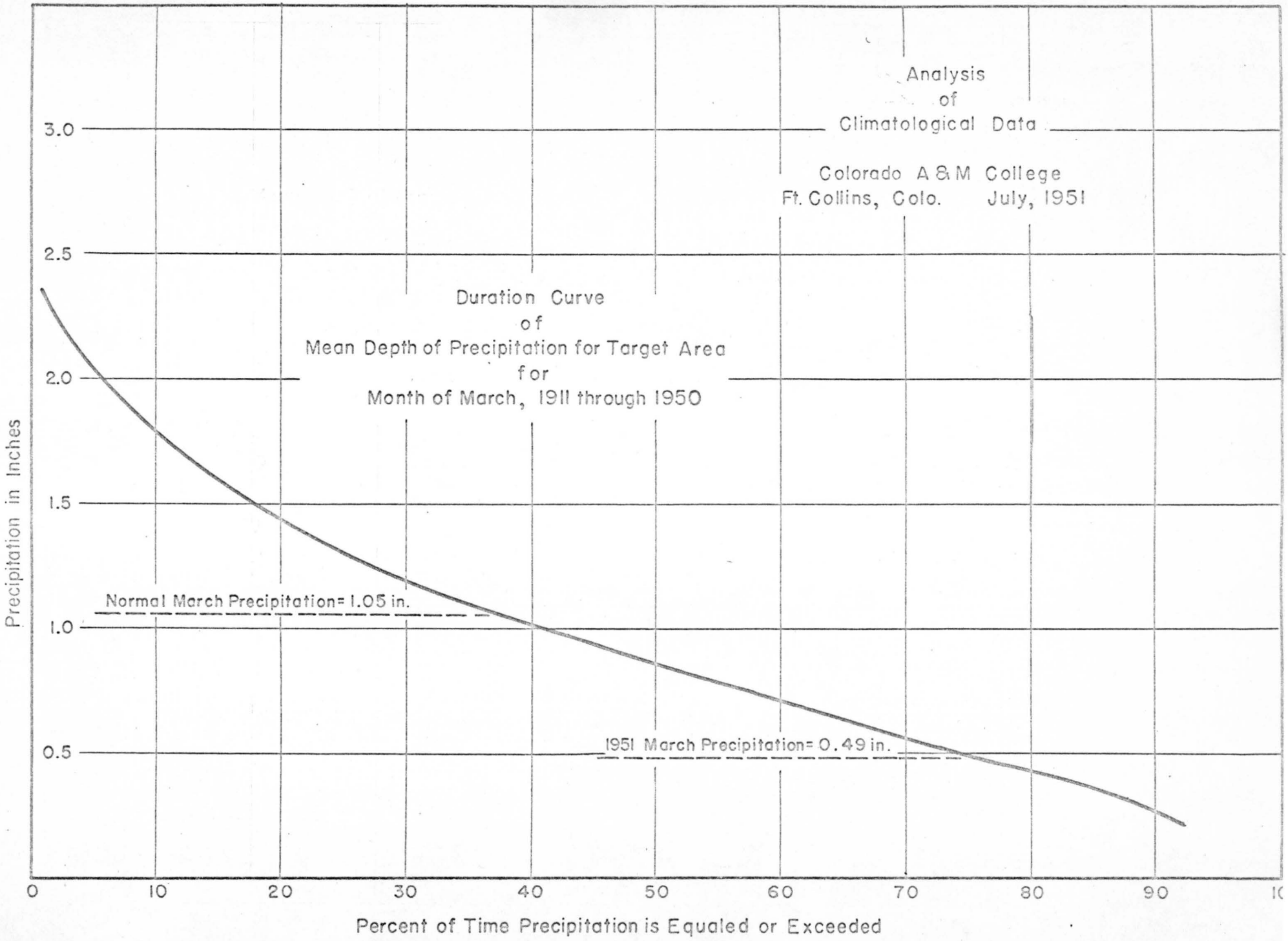

Analysis
of
Climatological Data
Colorado A&M College
Ft. Collins, Colo. July, 1951
Mean Depth of Precipitation on Target Area
for
Month of March, 1911 through 1950
1911–1950
Precipitation Trend
= +0.0026 in. per yr.
1936–1950
Precipitation Trend
= −0.0060 in. per yr.
1936–1950
Normal Precipitation
= 1.13 in.
1911–1950
Normal Precipitation
= 1.05 in.
1951
Precipitation in Inches
2.5
2.0
1.5
1.0
0.5
1910
15
1920
25
1930
35
1940
45
1950
Year

Fig. 2


Analysis
of
Climatological Data
Colorado A & M College
Ft. Collins, Colo. July, 1951
Duration Curve
of
Mean Depth of Precipitation for Target Area
for
Month of March, 1911 through 1950
Normal March Precipitation= 1.05 in.
1951 March Precipitation= 0.49 in.
Precipitation in Inches
3.0
2.5
2.0
1.5
1.0
0.5
0
10
20
30
40
50
60
70
80
90
Percent of Time Precipitation is Equaled or Exceeded

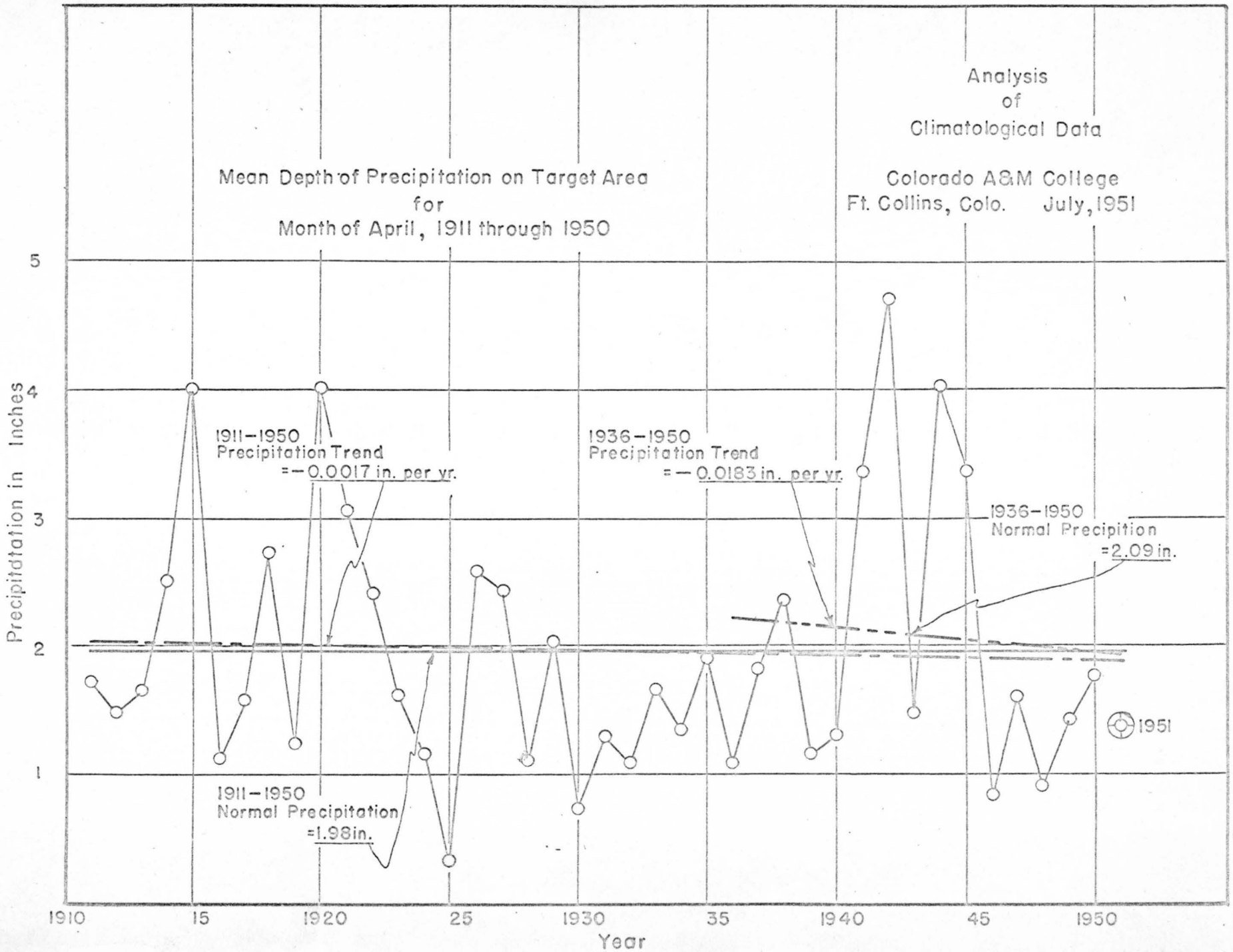

Analysis
of
Climatological Data
Colorado A&M College
Ft. Collins, Colo. July, 1951
Mean Depth of Precipitation on Target Area
for
Month of April, 1911 through 1950
1911–1950
Precipitation Trend
= — 0.0017 in. per yr.
1936–1950
Precipitation Trend
= — 0.0183 in. per yr.
1936–1950
Normal Precipition
= 2.09 in.
1911–1950
Normal Precipitation
= 1.98 in.
1951
Precipitation in Inches
Year
1910
15
1920
25
1930
35
1940
45
1950
1
2
3
4
5

Fig. 4

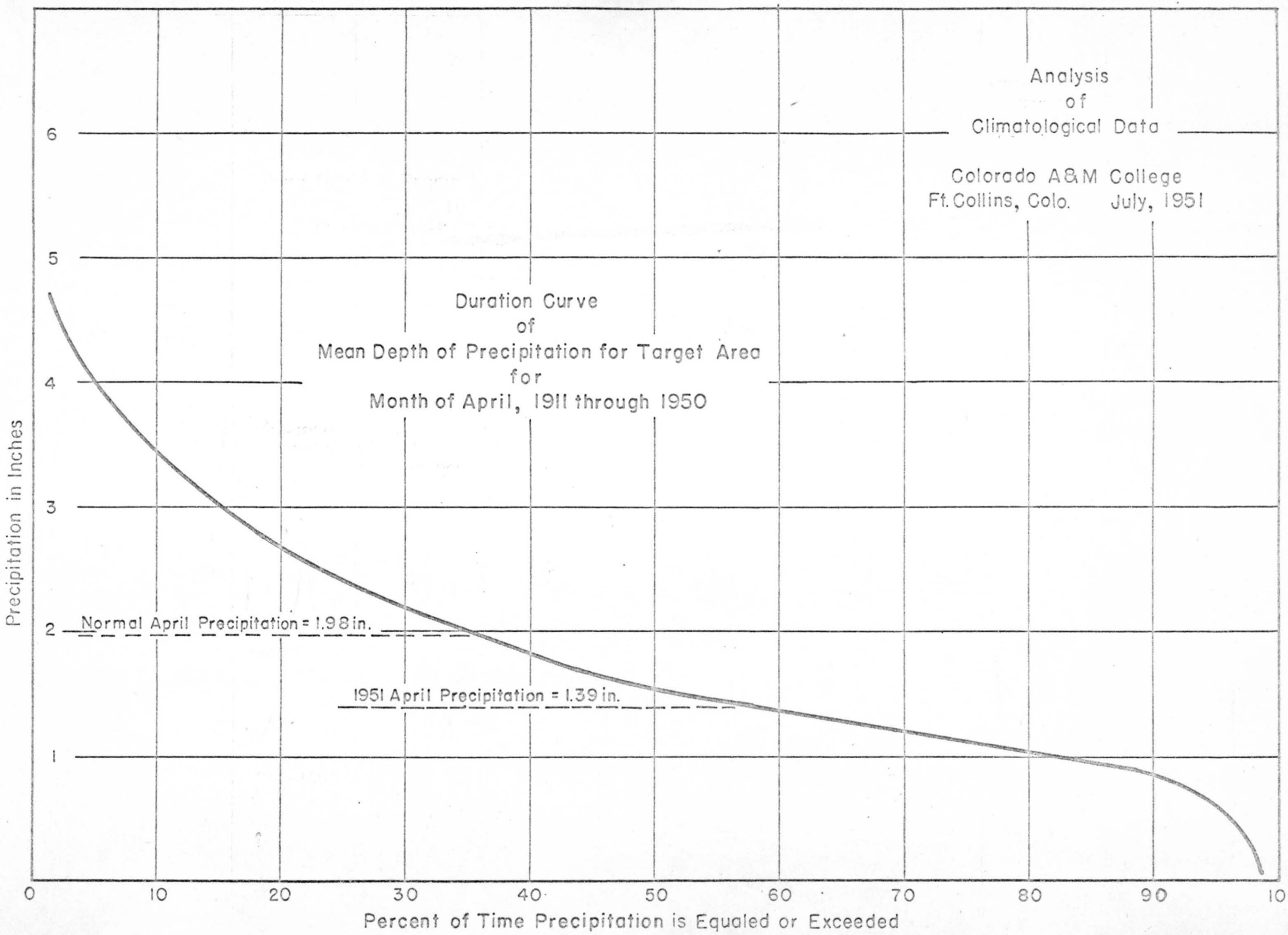

Analysis
of
Climatological Data
Colorado A&M College
Ft. Collins, Colo. July, 1951
Duration Curve
of
Mean Depth of Precipitation for Target Area
for
Month of April, 1911 through 1950
Normal April Precipitation = 1.98 in.
1951 April Precipitation = 1.39 in.
Precipitation in Inches
Percent of Time Precipitation is Equaled or Exceeded
0
10
20
30
40
50
60
70
80
90
100
1
2
3
4
5
6

Fig. 5

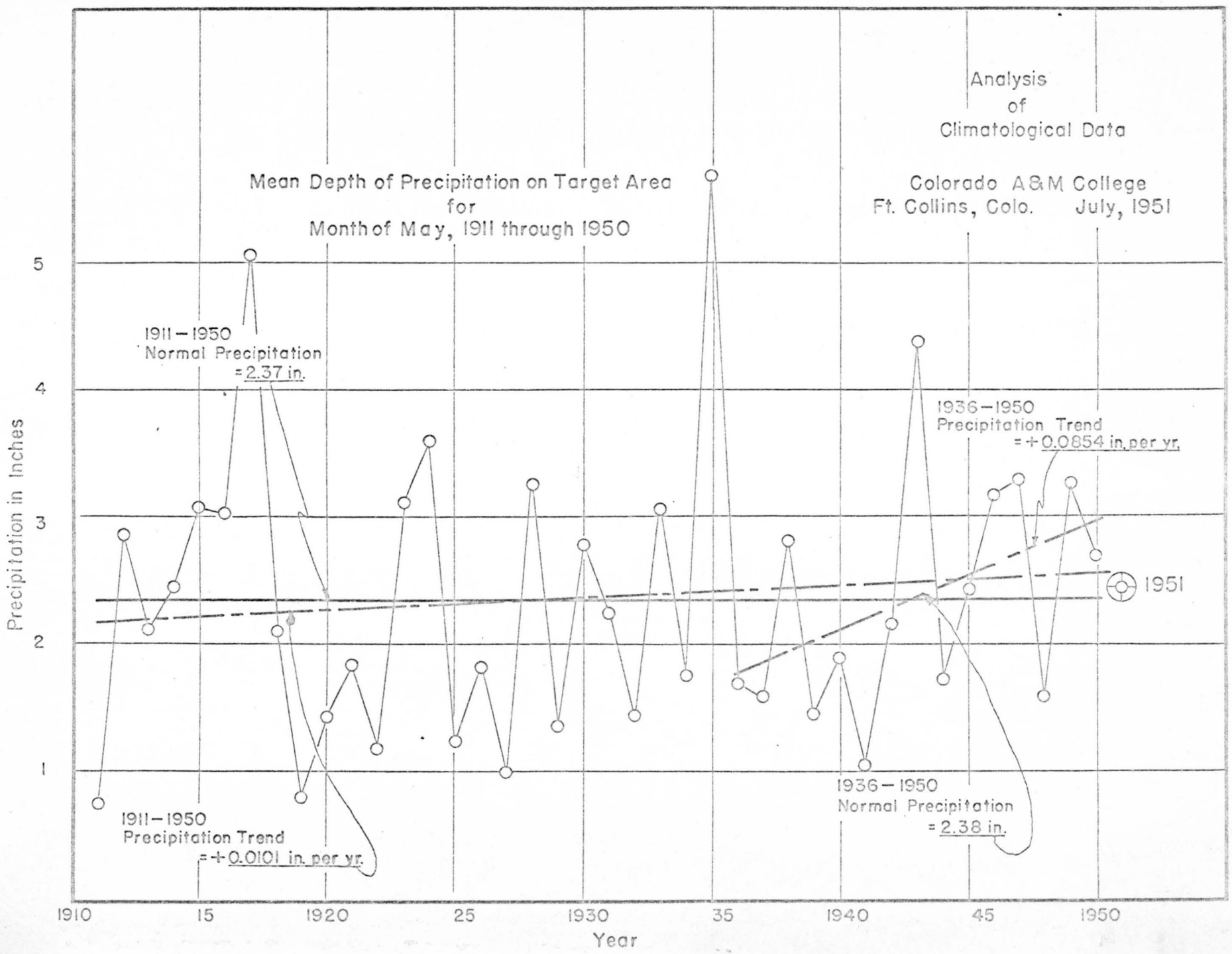
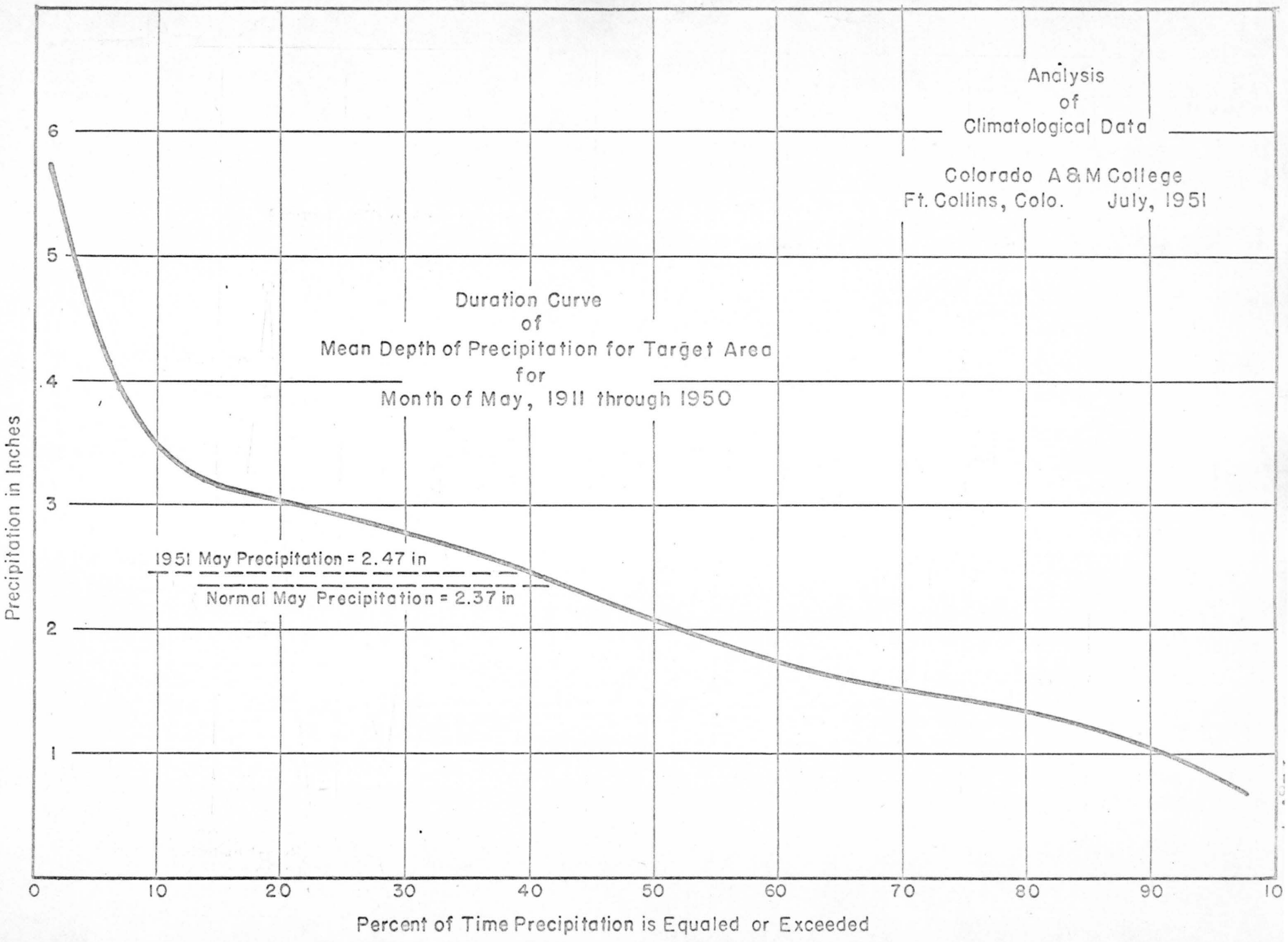

Analysis
of
Climatological Data
Colorado A&M College
Ft. Collins, Colo. July, 1951
Mean Depth of Precipitation on Target Area
for
Month of May, 1911 through 1950
1911–1950
Normal Precipitation
= 2.37 in.
1911–1950
Precipitation Trend
= + 0.0101 in. per yr.
1936–1950
Precipitation Trend
= + 0.0854 in. per yr.
1936–1950
Normal Precipitation
= 2.38 in.
1951
Precipitation in Inches
Year
1910
15
1920
25
1930
35
1940
45
1950
1
2
3
4
5

Fig. 6


Analysis
of
Climatological Data
Colorado A & M College
Ft. Collins, Colo. July, 1951
Duration Curve
of
Mean Depth of Precipitation for Target Area
for
Month of May, 1911 through 1950
1951 May Precipitation = 2.47 in
Normal May Precipitation = 2.37 in
Precipitation in Inches
6
5
4
3
2
1
0
10
20
30
40
50
60
70
80
90
10
Percent of Time Precipitation is Equaled or Exceeded

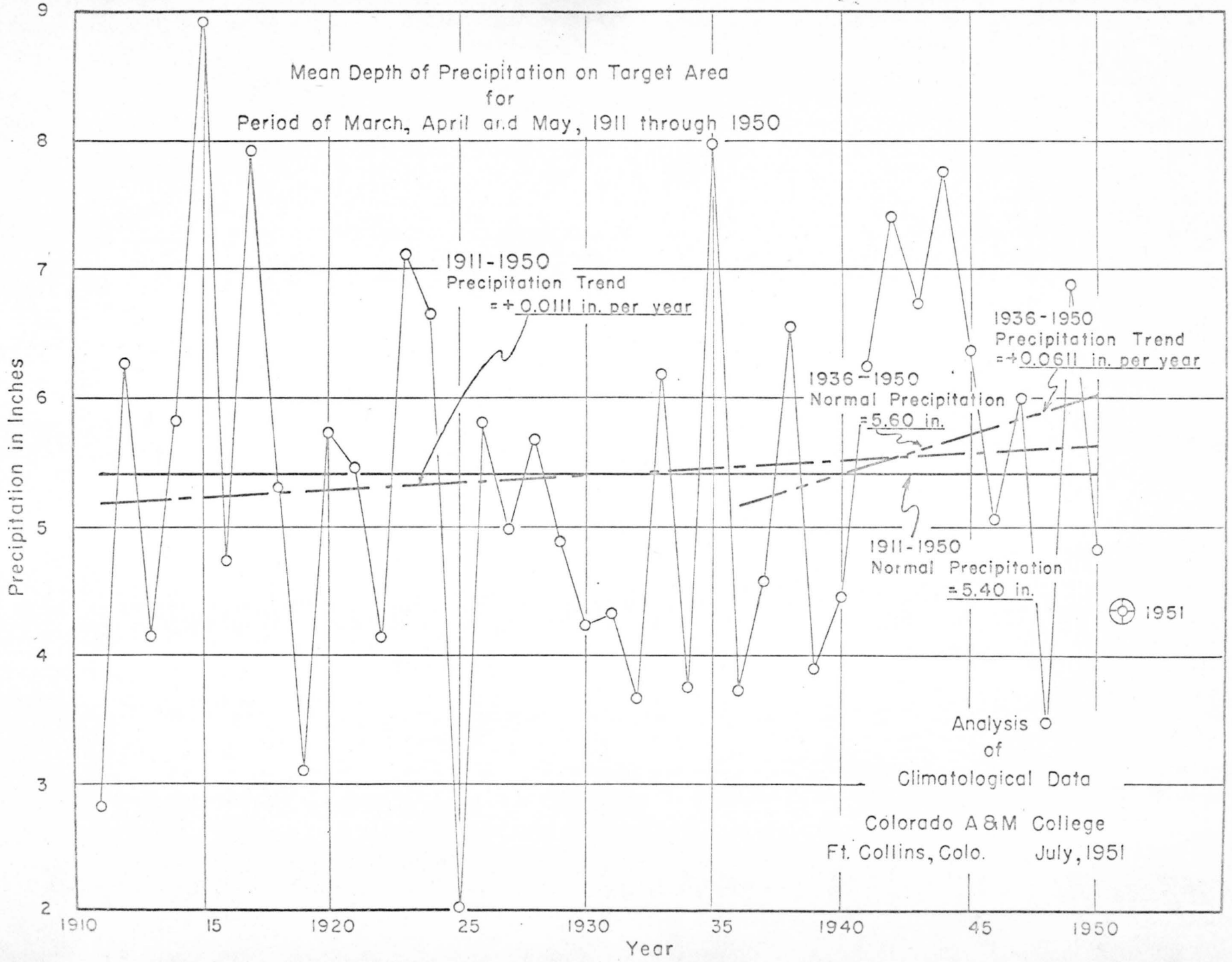
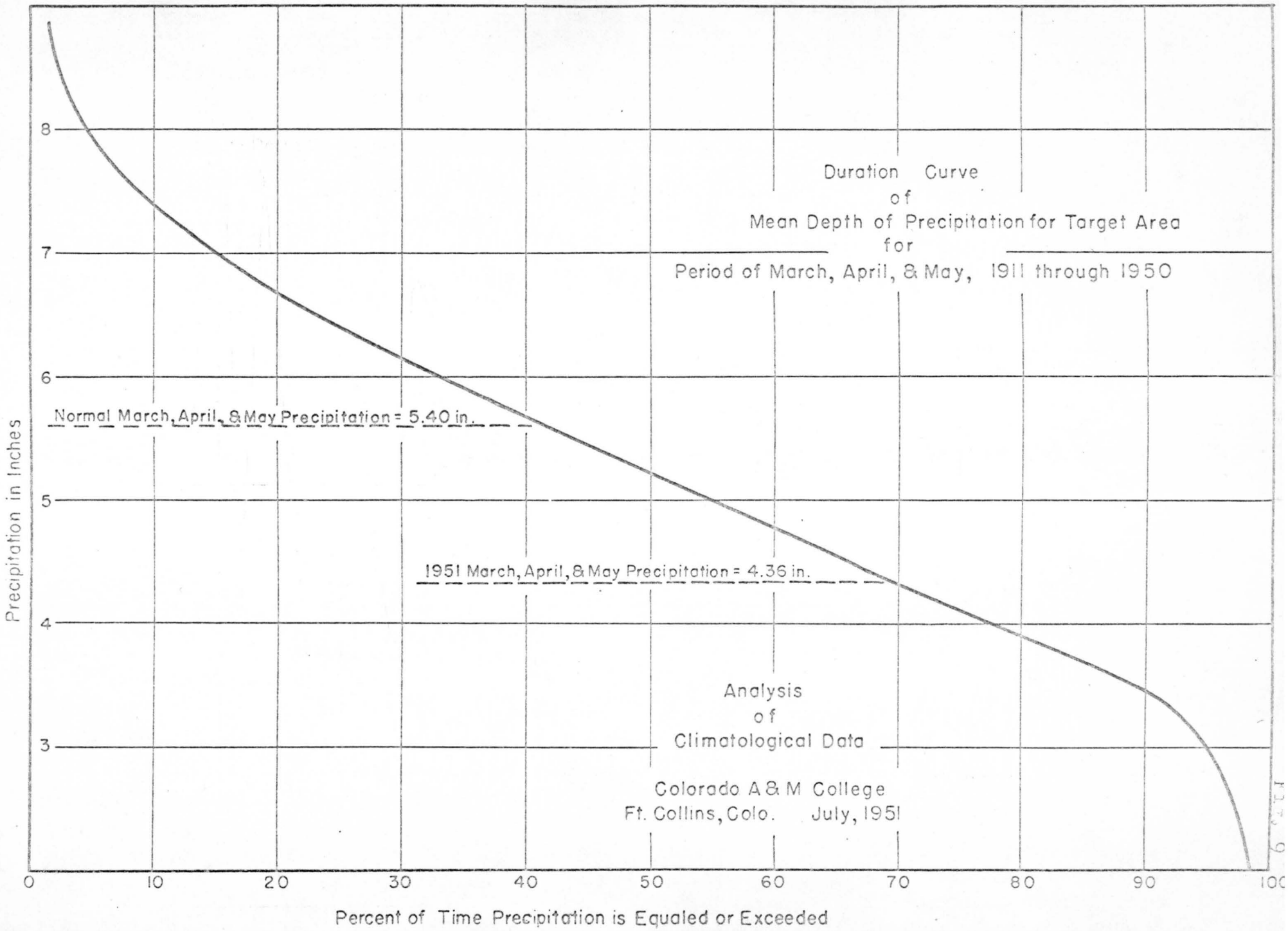

Mean Depth of Precipitation on Target Area
for
Period of March, April and May, 1911 through 1950
1911-1950
Precipitation Trend
= +0.0111 in. per year
1936-1950
Precipitation Trend
= +0.0611 in. per year
1936-1950
Normal Precipitation
= 5.60 in.
1911-1950
Normal Precipitation
= 5.40 in.
1951
Analysis
of
Climatological Data
Colorado A&M College
Ft. Collins, Colo. July, 1951
Precipitation in Inches
Year
9
8
7
6
5
4
3
2
1910
15
1920
25
1930
35
1940
45
1950

Fig. 2


Duration Curve
of
Mean Depth of Precipitation for Target Area
for
Period of March, April, & May, 1911 through 1950
Normal March, April, & May Precipitation = 5.40 in.
1951 March, April, & May Precipitation = 4.36 in.
Analysis
of
Climatological Data
Colorado A & M College
Ft. Collins, Colo. July, 1951
Precipitation in Inches
Percent of Time Precipitation is Equaled or Exceeded
0
10
20
30
40
50
60
70
80
90
100
3
4
5
6
7
8

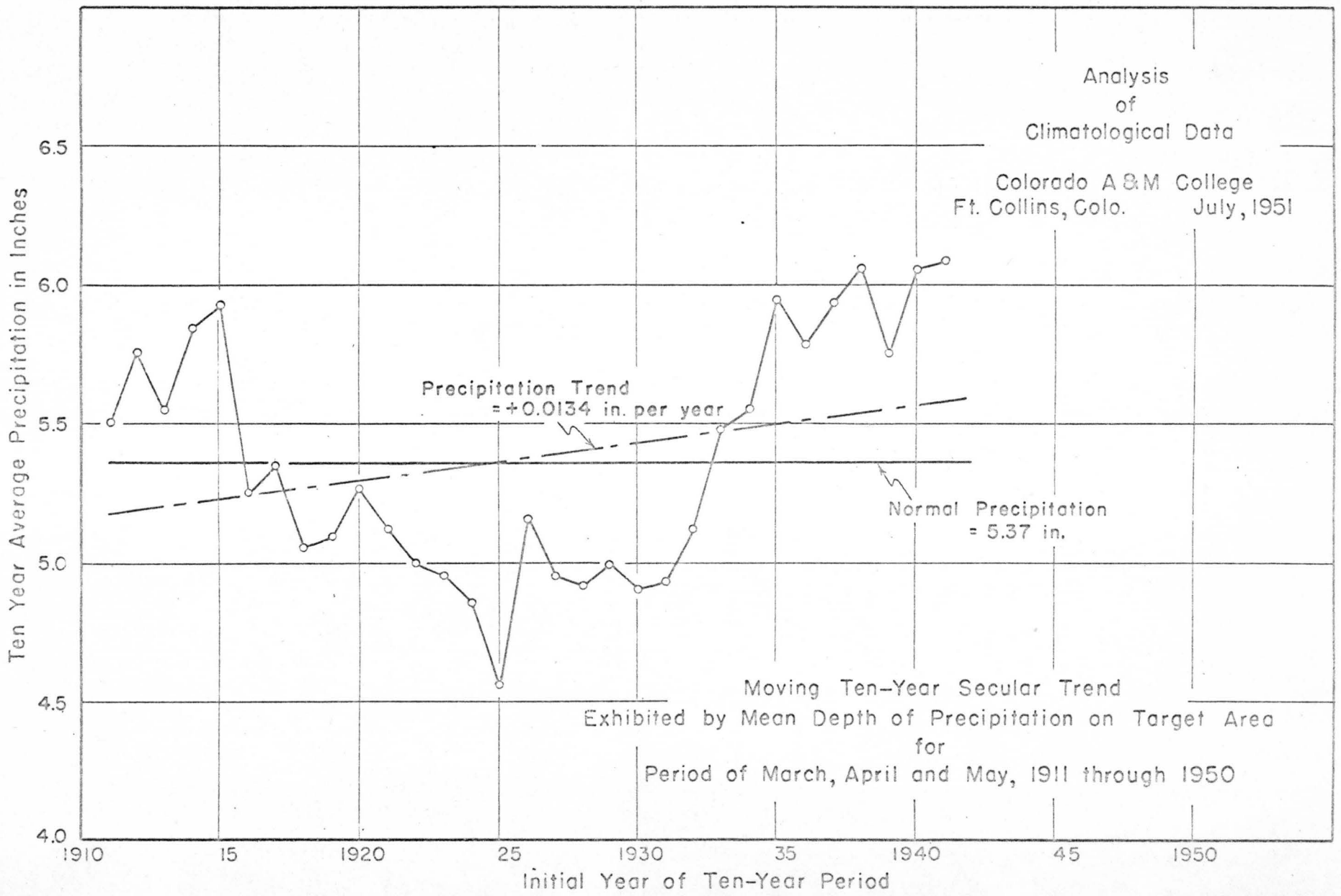
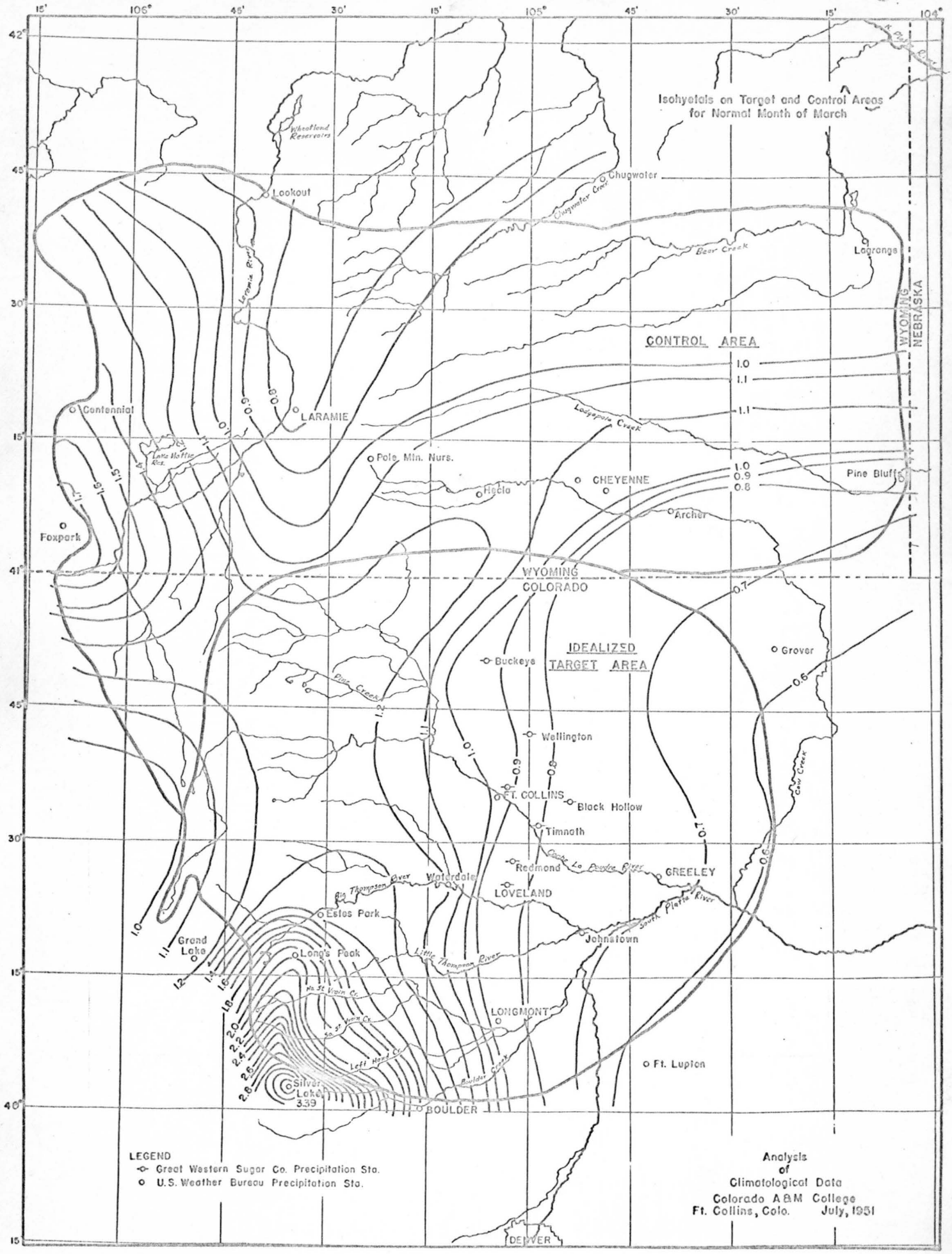
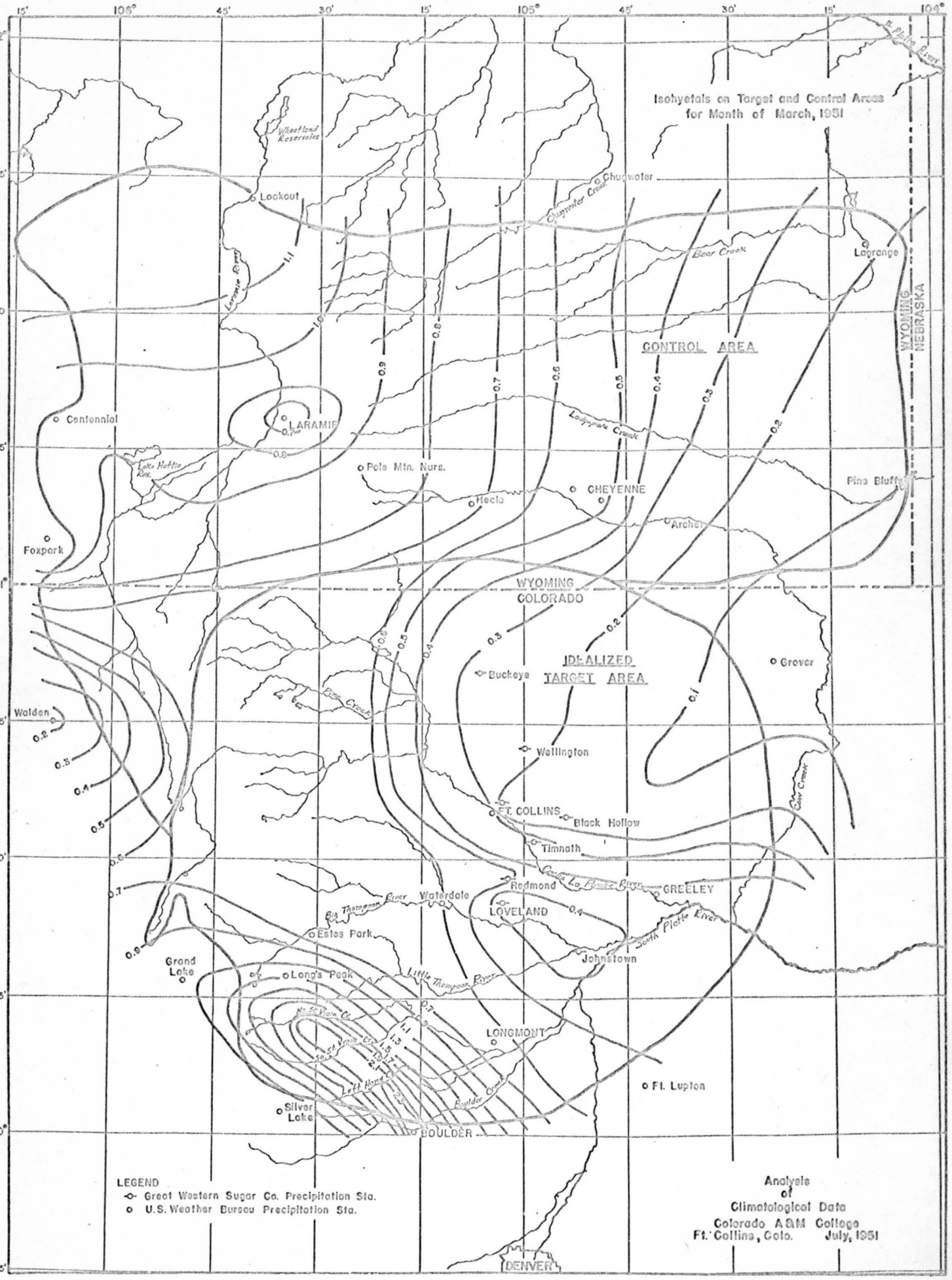

Analysis
of
Climatological Data
Colorado A&M College
Ft. Collins, Colo. July, 1951
Precipitation Trend
= +0.0134 in. per year
Normal Precipitation
= 5.37 in.
Moving Ten-Year Secular Trend
Exhibited by Mean Depth of Precipitation on Target Area
for
Period of March, April and May, 1911 through 1950
Ten Year Average Precipitation in Inches
6.5
6.0
5.5
5.0
4.5
4.0
1910
15
1920
25
1930
35
1940
45
1950
Initial Year of Ten-Year Period

Fig. 10


Isohyetals on Target and Control Areas
for Normal Month of March
CONTROL AREA
IDEALIZED
TARGET AREA
WYOMING
COLORADO
WYOMING
NEBRASKA
Chugwater
Lookout
Lagrange
Centennial
LARAMIE
Pole Mtn. Nurs.
CHEYENNE
Hecla
Archer
Pine Bluff
Foxpark
Buckeye
Grover
Wellington
FT. COLLINS
Black Hollow
Timnath
Redmond
GREELEY
LOVELAND
Waterdale
Estes Park
Grand Lake
Long's Peak
Johnstown
LONGMONT
Ft. Lupton
Silver Lake
3.39
BOULDER
DENVER
LEGEND
Great Western Sugar Co. Precipitation Sta.
U.S. Weather Bureau Precipitation Sta.
Analysis
of
Climatological Data
Colorado A&M College
Ft. Collins, Colo. July, 1951


Isohyetals on Target and Control Areas
for Month of March, 1951
CONTROL AREA
IDEALIZED
TARGET AREA
WYOMING
COLORADO
WYOMING
NEBRASKA
Wheatland Reservoir
Lookout
Chugwater
Chugwater Creek
Lagrange
Bear Creek
Laramie River
Centennial
LARAMIE
Lodgepole Creek
Lake Hattie Res.
Pole Mtn. Nurs.
Hecla
CHEYENNE
Pine Bluffs
Archer
Foxpark
Buckeye
Grover
Walden
Box Creek
Wellington
Cache La Poudre River
FT. COLLINS
Black Hollow
Timnath
Cow Creek
GREELEY
Redmond
Waterdale
Big Thompson River
LOVELAND
South Platte River
Estes Park
Johnstown
Grand Lake
Long's Peak
Little Thompson River
North St. Vrain Cr.
South St. Vrain Cr.
Left Hand Cr.
Boulder Cr.
LONGMONT
Ft. Lupton
Silver Lake
BOULDER
DENVER
LEGEND
Great Western Sugar Co. Precipitation Sta.
U.S. Weather Bureau Precipitation Sta.
Analysis
of
Climatological Data
Colorado A&M College
Ft. Collins, Colo. July, 1951

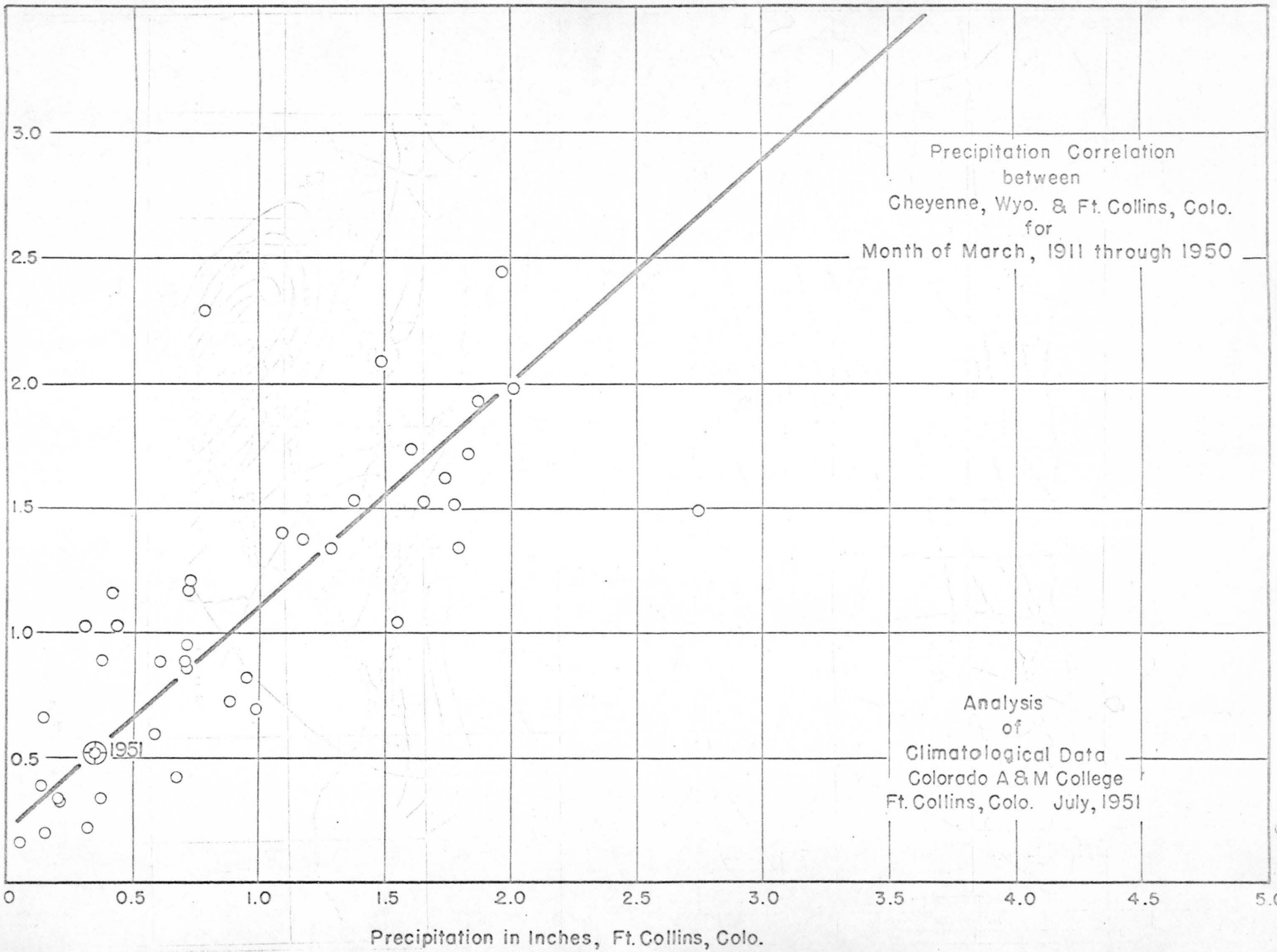

Precipitation Correlation
between
Cheyenne, Wyo. & Ft. Collins, Colo.
for
Month of March, 1911 through 1950
Analysis
of
Climatological Data
Colorado A & M College
Ft. Collins, Colo. July, 1951
1951
Precipitation in Inches, Cheyenne, Wyo.
Precipitation in Inches, Ft. Collins, Colo.
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0

Fig. 13

Fig. 14


Analysis
of
Climatological Data
Colorado A&M College
Ft. Collins, Colo. July, 1951
Control Area
Normal Water Content Change
on Control Area = +4.6 in.
Target Area
Normal Water Content Change
on Target Area = +3.1 in.
1951
1951
Snow Water Content Change in Inches
+8
+6
+4
+2
0
-2
-4
-6
38
1940
42
44
46
48
1950
Year
Mean Depth of Snow Water Content Change
on Target and Control Areas
for
Month of March, 1938 through 1950

Fig. 15

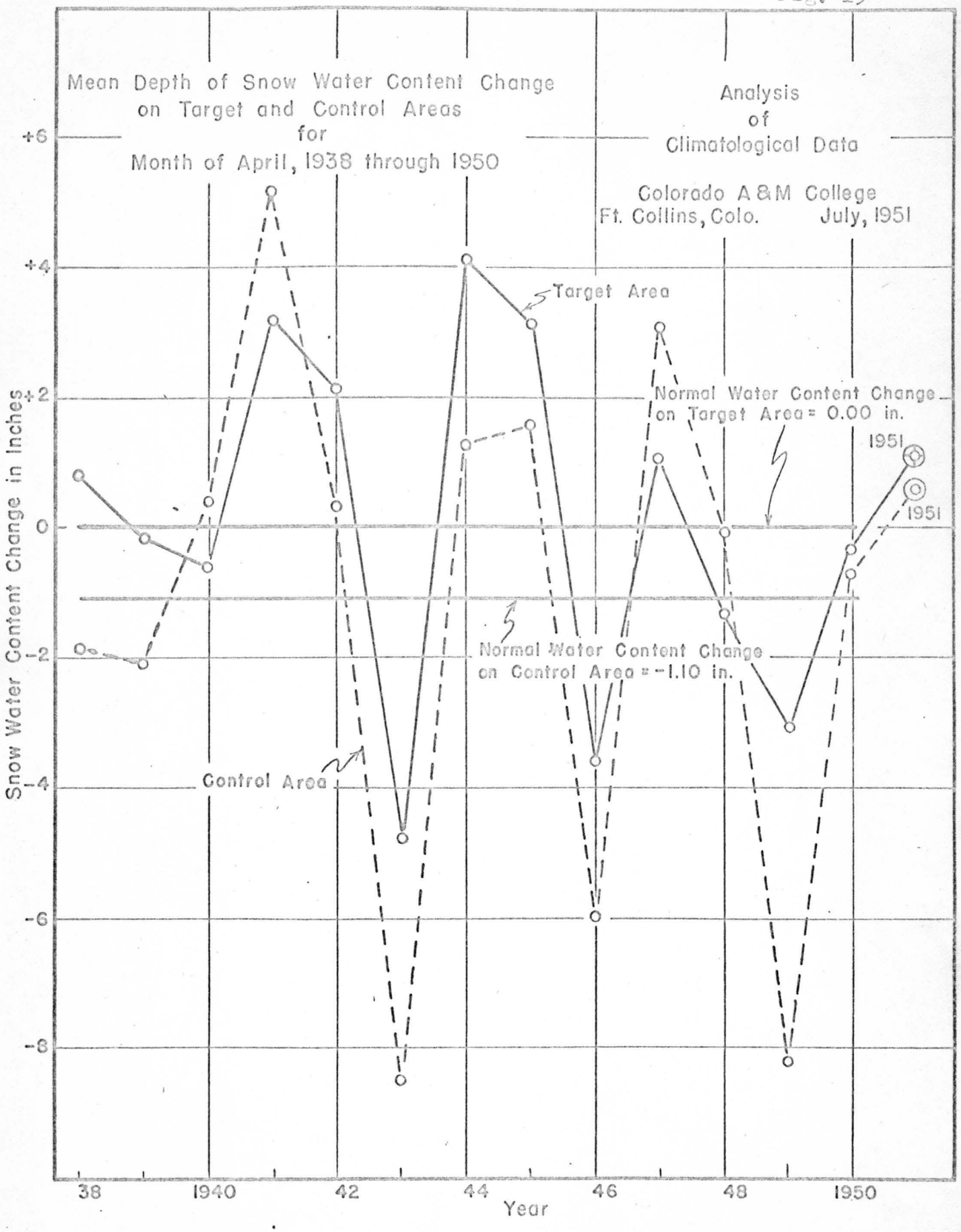
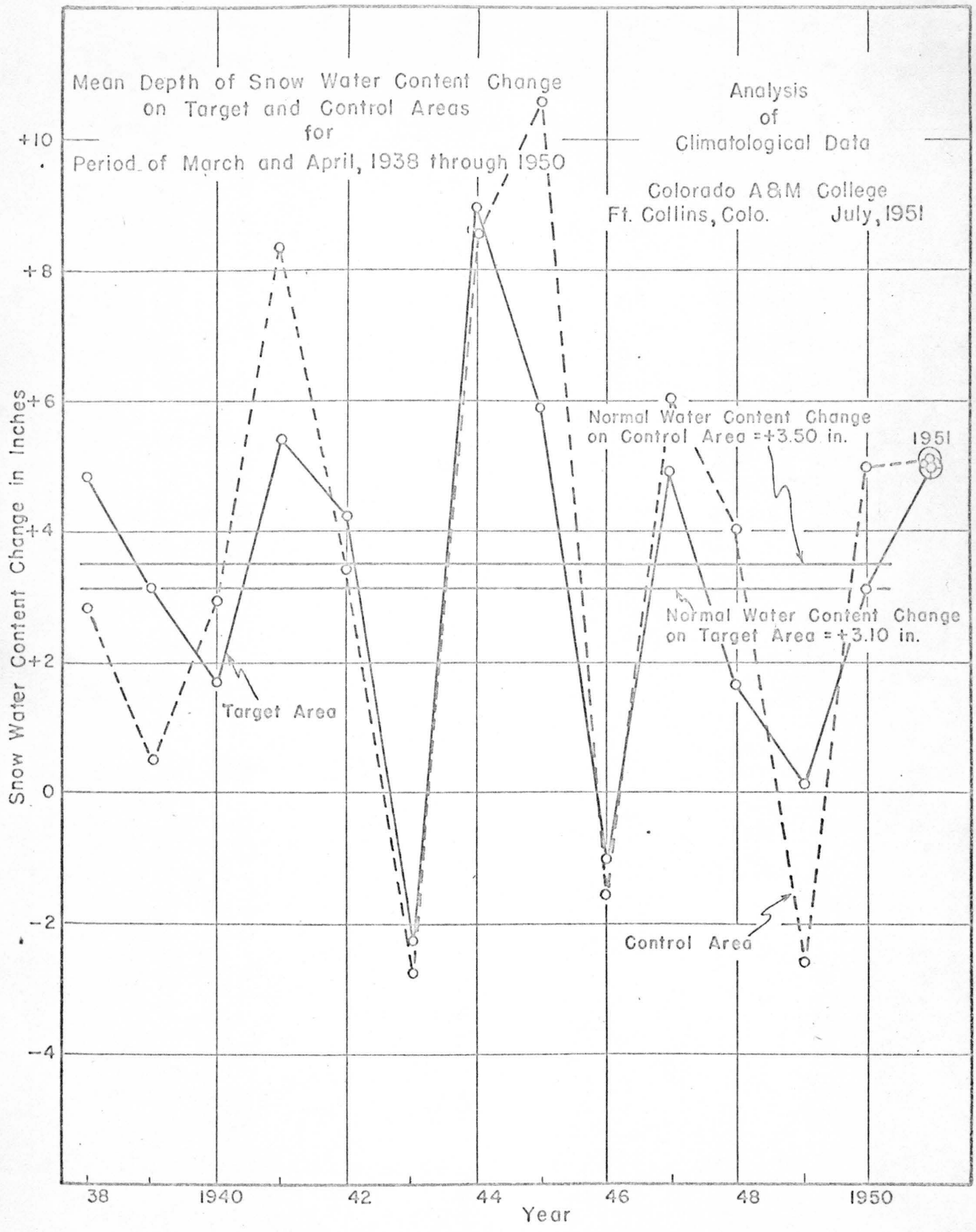
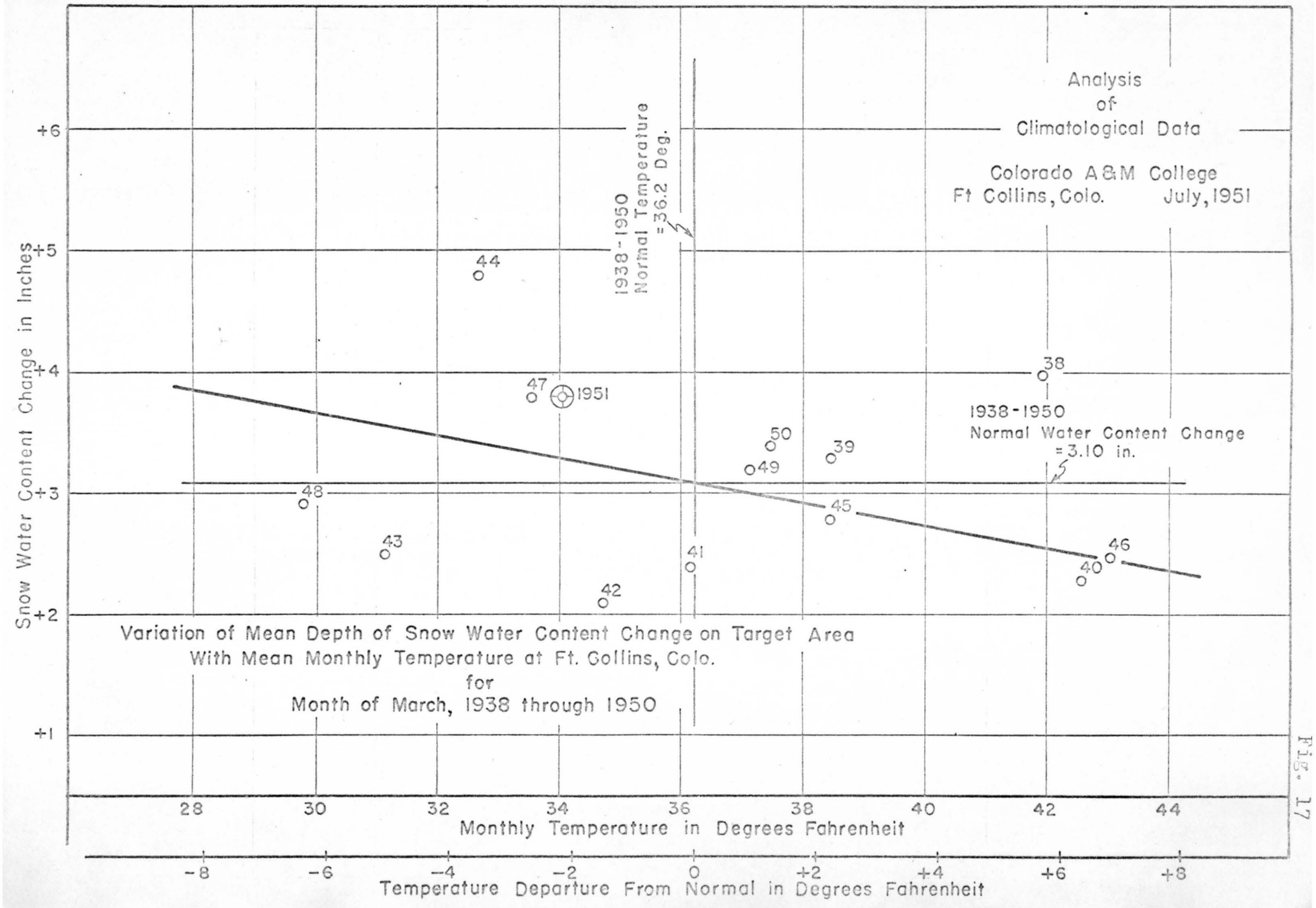

Mean Depth of Snow Water Content Change
on Target and Control Areas
for
Month of April, 1938 through 1950
Analysis
of
Climatological Data
Colorado A&M College
Ft. Collins, Colo. July, 1951
Target Area
Control Area
Normal Water Content Change
on Target Area = 0.00 in.
Normal Water Content Change
on Control Area = -1.10 in.
1951
1951
Snow Water Content Change in Inches
+6
+4
+2
0
-2
-4
-6
-8
38
1940
42
44
46
48
1950
Year

Fig. 16


Mean Depth of Snow Water Content Change
on Target and Control Areas
for
Period of March and April, 1938 through 1950
Analysis
of
Climatological Data
Colorado A&M College
Ft. Collins, Colo. July, 1951
Normal Water Content Change
on Control Area = +3.50 in.
1951
Normal Water Content Change
on Target Area = +3.10 in.
Target Area
Control Area
Snow Water Content Change in Inches
+10
+8
+6
+4
+2
0
-2
-4
38
1940
42
44
46
48
1950
Year



Variation of Mean Depth of Snow Water Content Change on Target Area
With Mean Monthly Temperature at Ft. Collins, Colo.
for
Month of March, 1938 through 1950

Fig. 17

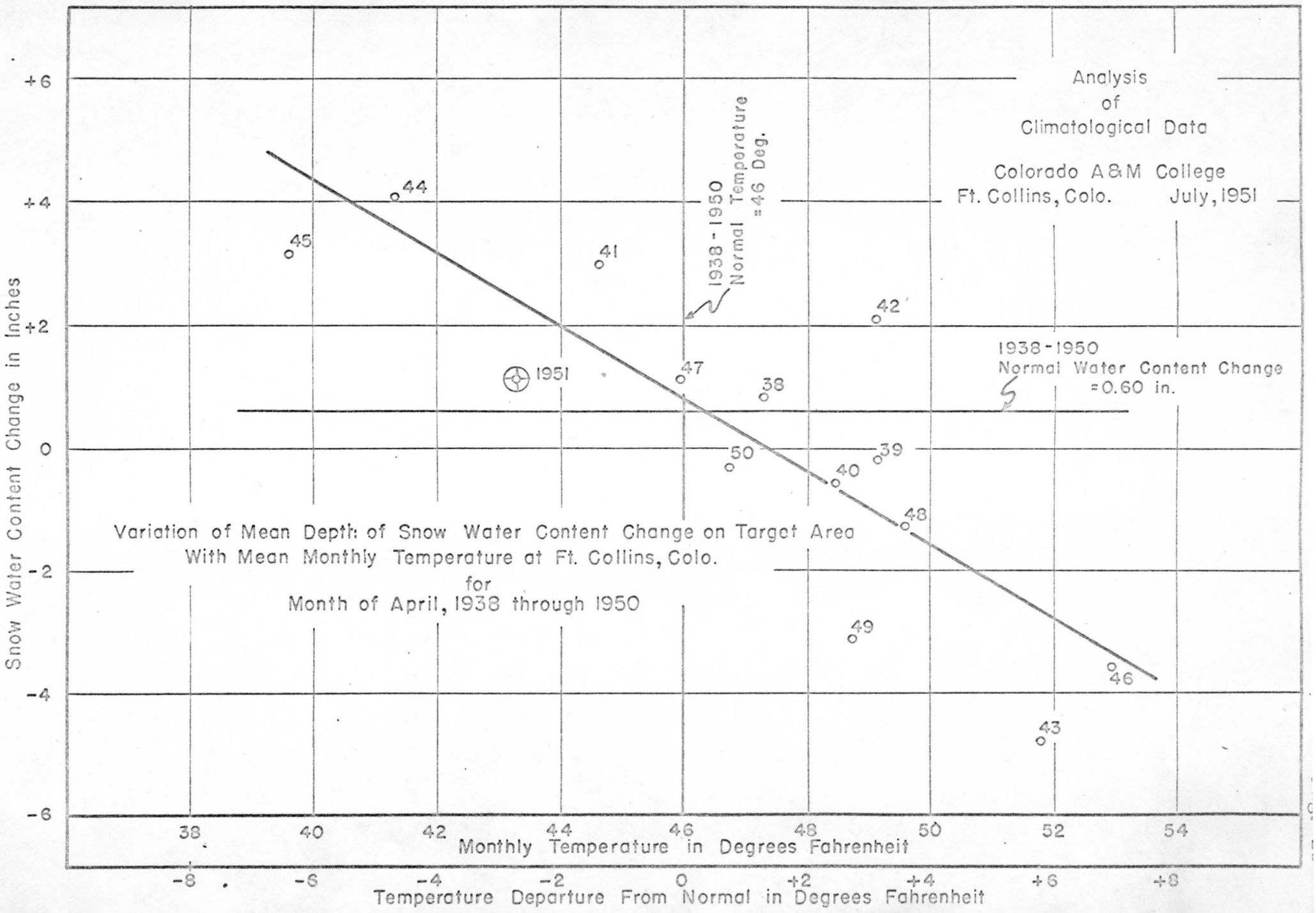

Analysis
of
Climatological Data
Colorado A&M College
Ft. Collins, Colo. July, 1951
1938-1950
Normal Temperature
=46 Deg.
1938-1950
Normal Water Content Change
=0.60 in.
1951
Variation of Mean Depth of Snow Water Content Change on Target Area
With Mean Monthly Temperature at Ft. Collins, Colo.
for
Month of April, 1938 through 1950
Snow Water Content Change in Inches
+6
+4
+2
0
-2
-4
-6
38
40
42
44
46
48
50
52
54
Monthly Temperature in Degrees Fahrenheit
-8
-6
-4
-2
0
+2
+4
+6
+8
Temperature Departure From Normal in Degrees Fahrenheit
45
44
41
42
47
38
50
39
40
48
49
46
43

Fig 19

LEGEND

20% Interval

Less than 100%

100% to 140%

Over 140%

COLORADO A & M COLLEGE
CIVIL ENGINEERING DEPT.

Percent Rainfall Variation from Normal
for
March, April, & May, 1951

MAY 1951 | 1 Inch = 100 Miles | Drawn By GRIMV

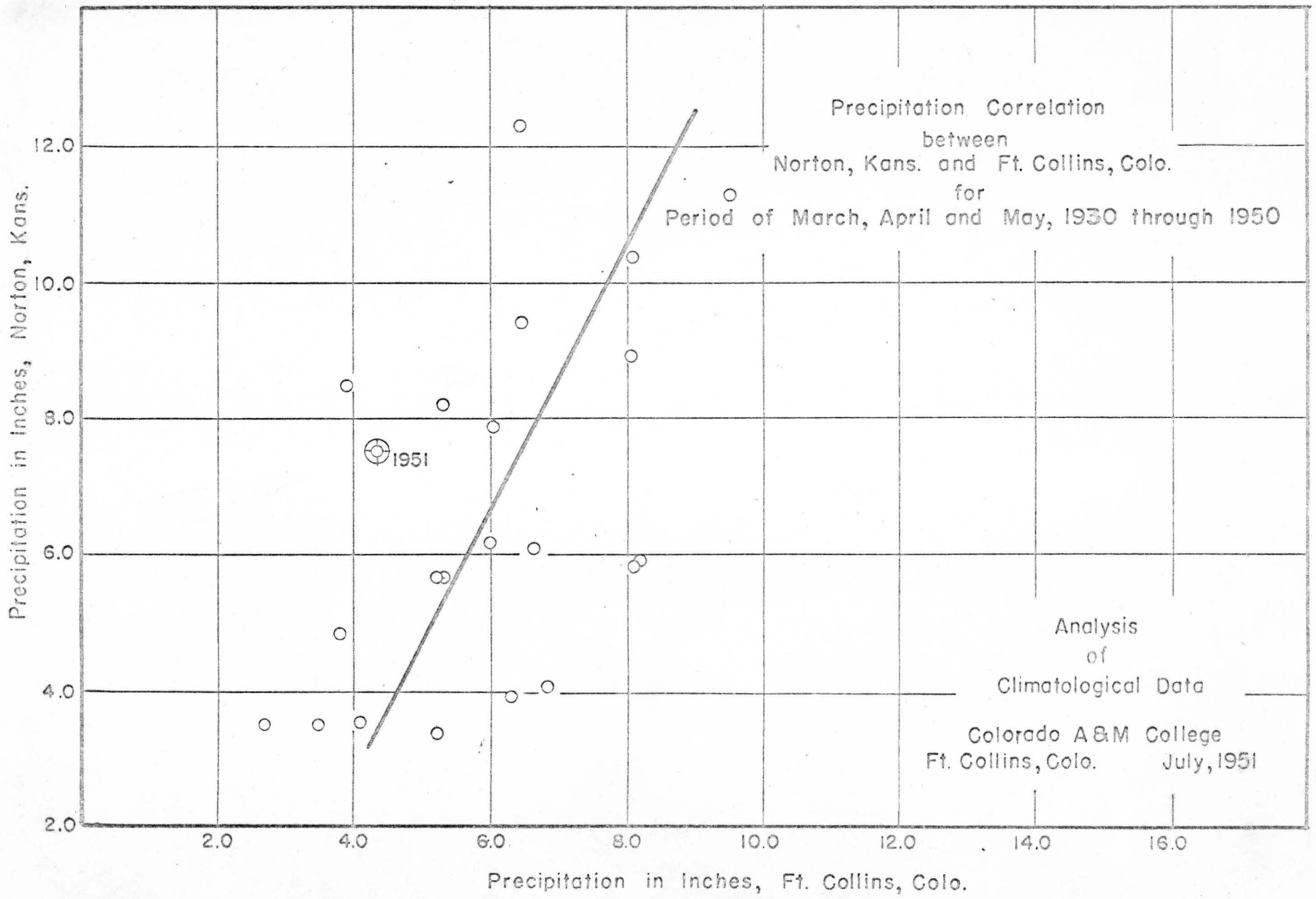

Precipitation Correlation
between
Norton, Kans. and Ft. Collins, Colo.
for
Period of March, April and May, 1930 through 1950
1951
Analysis
of
Climatological Data
Colorado A&M College
Ft. Collins, Colo. July, 1951
Precipitation in Inches, Norton, Kans.
Precipitation in Inches, Ft. Collins, Colo.
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0

Plate 20

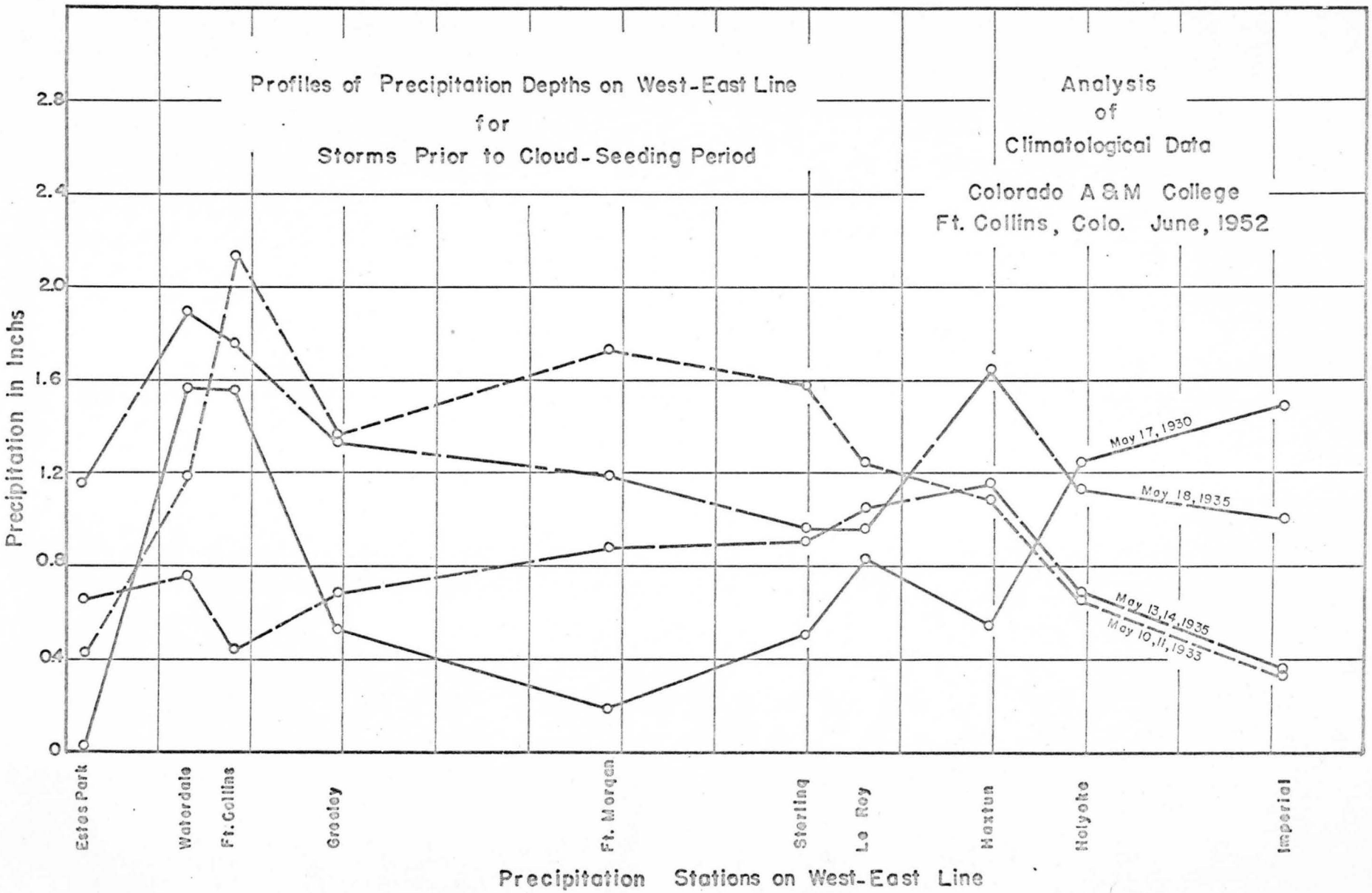

Profiles of Precipitation Depths on West-East Line
for
Storms Prior to Cloud-Seeding Period
Analysis
of
Climatological Data
Colorado A & M College
Ft. Collins, Colo. June, 1952
Precipitation in Inches
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0
May 17, 1930
May 18, 1935
May 13, 14, 1935
May 10, 11, 1933
Estes Park
Waterdale
Ft. Collins
Greeley
Ft. Morgan
Sterling
La Roy
Haxtun
Holyoke
Imperial
Precipitation Stations on West-East Line

Fig. 21

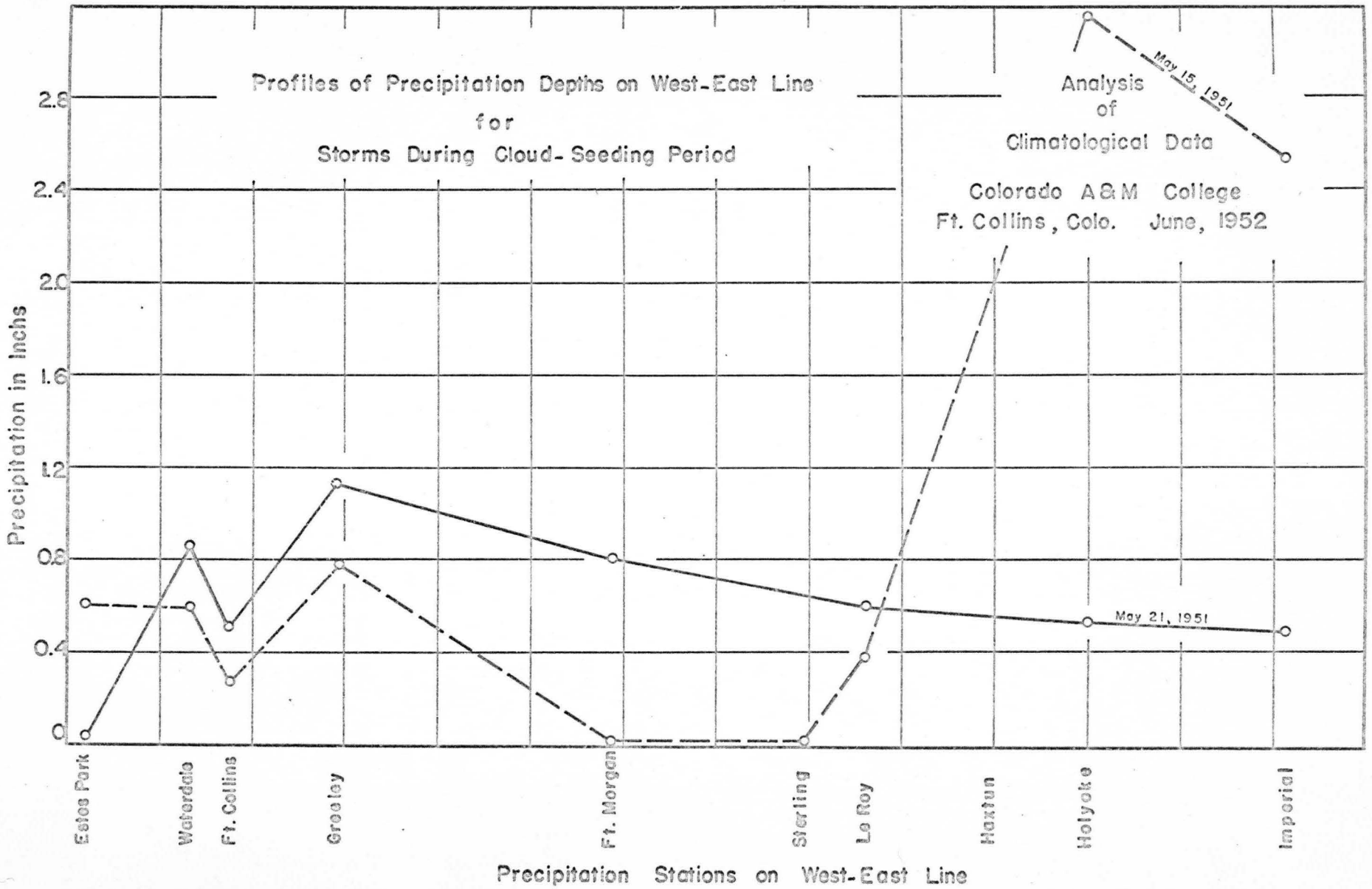

Profiles of Precipitation Depths on West-East Line
for
Storms During Cloud-Seeding Period
Analysis
of
Climatological Data
Colorado A&M College
Ft. Collins, Colo. June, 1952
May 15, 1951
May 21, 1951
Precipitation in Inchs
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0
Estes Park
Waterdale
Ft. Collins
Greeley
Ft. Morgan
Sterling
Le Roy
Haxtun
Holyoke
Imperial
Precipitation Stations on West-East Line

Fig. 22