CORRESPONDENCE AND GEOLOGICAL
REPORT CONCERNING SEWAGE AND WATER SUPPLY
PROBLEM OF GRAND LAKE, COLORADO
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October 29, 1947

Mr. Avery Batson  
Director of Region Seven  
U. S. Bureau of Reclamation  
Denver, Colorado

Dear Mr. Batson:

Re: Grand Lake

As agreed, we transmit herewith the interim report of Mr. Wahlstrom.

Very truly yours,

/s/ Charles J. Beise

of

FAIRFIELD AND WOODS

CJB:JT

ENC.
Statement to Subcommittee on Appropriations
Hon. Ben F. Jensen, Chairman

October 23, 1947
Grand Lake, Colo.

Gentlemen:

We are indeed happy that we have been allowed the privilege of meeting with you here this afternoon. No doubt, we are indebted to the Bureau of Reclamation, for which we wish to thank them. As I understand the purpose of this get-together is so that you may become acquainted with the problem which we, the residents and business people of Grand Lake are confronted with. It so appears that this problem is a mutual problem with the Bureau of Reclamation and the town's people in the area which is affected by the high water table, which we believe firmly is caused by the filling of the Shadow Mountain Reservoir.

Briefly I wish to outline the situation as it has developed during this summer and up to now. The Grand Lake area is, as you all know, the western entrance to the Rocky Mountain National Park and has for years been a vacation area of note. This area has become one of the favorite spots for the people in the United States to visit. Approximately one-half million people come through the gates of the Rocky Mountain National Park per year. So, consequently, our problem here is not entirely a local problem but affects the people of all of the states. This problem is one of a high water table caused by a stoppage in our natural drainage. The water in Shadow Mountain Reservoir acts as a dam and slows down the natural drainage of this area. Our normal high water table, from what we call our spring run-off, is from May to the middle of June. Then there is a gradual recession of water from that time until the following year in March and April, at which time there is the low water period. This year our low water period was normal, but by a gradual raising of the Shadow Mountain Reservoir our water table continued to go higher and higher until it reached the point of actual flooding, in a good number of places, within two and one-half feet of the surface. The damage created was this: It caused a lateral distribution of contamination of the wells, also caused the flooding of basements, leaching pools and cesspools ran over and were unable to take care of their normal sewage disposal. This became noticeable in July and has continued since.

On August 12, the Town Clerk notified the Reclamation of the existing condition. Town meetings were held from then till now. The Bureau of Reclamation was called into this to meet with the group of the town people and summer residents of the whole area, at which time the Bureau of Reclamation officials promised a report for October 10, which they produced.
On September 18, the committee which is meeting with you today was elected at large to represent the town and the community with the Bureau of Reclamation officials and plans were made for conducting a survey, at which time it was decided to stick entirely to the facts which would be found by the survey which the Bureau of Reclamation is conducting. We feel that this survey has been conducted in this manner with very few exceptions.

Now what is our position in this problem? This is briefly what we believe: The State Board of Health has condemned our wells and our present summer water supply so it is imperative that this situation be corrected before June 1, 1948. We feel that this high water which caused the lateral contamination and made our wells insecure was directly caused by the Shadow Mountain Reservoir. Consequently, we feel and look to the Reclamation to alleviate this situation. Also, the high water table has made our present method of sewage disposal impracticable and impossible to use. Consequently, this also must be remedied. The reversal of flow of Shadow Mountain Lake contained considerable contamination and algae; the algae is more or less harmless except for the fact that algae creates a bad odor, stains, has a bad taste and discolors the water of Grand Lake and, consequently, destroys its scenic attraction at the time in which the algae is at a bloom stage. So this must be corrected.

It is obvious that for a sewage and water system to work successfully the area which is affected must be drained, because the water and sewage system could not successfully operate unless the water table was below these lines. Senate Document 80 is premised on the protection of these factors.

We have had but a short time to study the reports which the Bureau of Reclamation, tentative in nature, has given to us, but we find in this report an admission of liability for certain areas and asking for further time to find the effect in other areas. We believe that this report in its final stages will find that the liability may extend over the entire area. Except, of course, the area east of the North Inlet which, we agree, has not been affected with the exception of the lake shore homes which are affected by the reversal of flow of Shadow Mountain Reservoir, through the algae and contamination in the water.

We believe that sufficient data has been assembled to fix the responsibility of the Bureau of Reclamation in principle, questionable only in minor manners of degree. It seems obvious to us that there is only one primary solution: (1) Water which will be approved by the State Board of Health by June 1, 1948. (2) Sewage disposal to follow draining of the area. (3) Control of the Algae going into Grand Lake from Shadow Mountain.
control, in no manner, are we suggesting poison as a solution. We believe that this project is one that the Reclamation should not delay over. A great deal of damage has already been done. A great deal more damage can be incurred by taking too much time for investigations which will not help the immediate condition.

Again let me thank you gentlemen for the committee for allowing us the privilege of meeting with you. No doubt, you will become more familiar with our problem as time goes on.

(Signed) LESTER PIPER

CHAIRMAN - GRAND LAKE WATER & SEWER BOARD

(Note - all copies of this document were distributed and the foregoing is as accurate as possible a reproduction of the same.)
September 29, 1947

Mr. Avery Batson, Regional Director
Region Seven
U. S. Bureau of Reclamation
New Customs Building
Denver, Colorado

Dear Mr. Batson:

We have been retained as attorneys for the property owners within and without the Town of Grand Lake, Colorado, whose water supply and sewage disposal systems have been rendered unsafe and ineffective. We believe this condition to be the result of an increased ground water level caused by the filling of Shadow Mountain Reservoir.

For your information, at a public meeting held at Grand Lake on September 18, 1947, and attended by a majority of the property owners in the area, a committee of seven was selected to represent all the property owners in this matter. The personnel of that committee is as follows: Lester H. Piper, chairman; Henry Rhone, vice chairman; Homer G. Smith, secretary; Cloyd Redburn, G. A. Spitzmiller, Carl Breeze and Arthur Brandenburg.

As you know, it is our sincere belief that the water supply not only of the town but of all other residents in vicinity of the town and of Grand Lake itself has been rendered permanently unsafe and the present methods of sewage disposal have been destroyed. These conditions, we believe, have been caused by the increased height in the ground water level of the area by the filling of Shadow Mountain Reservoir. Other problems of residents around the lake itself opposite the town arises from the reversal of flow of water. The only permanent solution to this problem lies in the construction of an adequate water supply system and adequate sewage disposal system. It might also be necessary to drain the area involved.

The Committee has had several conferences with representatives of the Bureau and a tentative outline of procedure has
been agreed upon. In order to avoid any misunderstanding which might otherwise arise, this letter is written to give you our idea of the procedure which will be followed.

The Bureau is currently undertaking such surveys as it deems necessary to establish responsibility for the condition. It is now planned that a report, possibly tentative in nature, will be made available, to us October 10. This report is to contain not mere drafts, charts and tables, but conclusions on matters of principle pertinent to the inquiry in so far as data will permit the same to be made. You will make this report available to the committee on or about October 10 and you will also furnish to proper representatives of the committee, i.e., the writer of this letter or Mr. Ernest Wahlstrom, geologist, all of such data, files, tables, etc., that you have collected which bear upon the matter and which they may request of you.

Inasmuch as you are tabulating much of the data involved, it will not be possible for our geologist to reach any conclusions until that data is available. He will review your report and data and promptly reach a conclusion. A copy of his conclusion will be furnished to you. We will also furnish you, on request, all other material which he has considered in reaching his conclusion.

Mr. Wahlstrom has been advised by some of the members of your geologic staff that the report of October 10 is to be cooperative but not collaborative in nature. Since this is your choice, it is acceptable to us.

Our committee will endeavor to conduct its negotiations with you on the highest possible plane and we are confident that you will reciprocate with like treatment. We take this opportunity to express our appreciation for the prompt, courteous and efficient manner in which you are attending to our mutual problem.

Very truly yours,

(Signed) CHARLES J. BEISE

of

FAIRFIELD AND WOODS

CJB:JT
October 15, 1947

Grand Lake Water and Sewage Board
Grand Lake, Colorado

Gentlemen:

I have the honor herewith to transmit my preliminary report on the water pollution problem at Grand Lake, Colorado.

Respectfully,

(Signed) ERNEST E. WAHLSTROM

EEW:fd
PART I

GRAND LAKE WATER POLLUTION STUDY

by Ernest E. Wahlstrom, Geologist
738 15th Street
Boulder, Colo.

INTRODUCTION

The writer has been retained by the Grand Lake Water and Sewer Board to make a study of the water pollution problem in Grand Lake town and adjacent area. In his capacity as consulting geologist he has felt that his functions fall into the following categories and that it is his responsibility

1. To obtain an adequate grasp of the geological and other features that affect the ground water conditions in Grand Lake and adjacent area.

2. To assess critically the findings of the engineering and geological field parties working on the problem for the Bureau of Reclamation.

3. To assist the Grand Lake Water and Sewer Board and Grand Lake residents in reaching a clear understanding of the facts and implications arising from the field studies and reports of the Bureau of Reclamation and to present his own findings based on all available data.

4. To assist in the final settlement of any differences that may arise between the Bureau of Reclamation and the Grand Lake Sewer and Water Board and the residents of Grand Lake and vicinity.
The writer, in fulfilling his responsibilities, has been engaged in the following activities:

1. He has made maps showing the geological features related to the ground water problem.

2. He has collected available data regarding weather conditions, seasonal variations in the ground water level, and the nature of the material encountered in wells dug in critical areas.

3. He has kept in close contact with the geologists and engineers working on the problem for and in behalf of the Bureau of Reclamation.

4. He has interviewed residents of Grand Lake and vicinity in order to obtain information based on their experience with ground water conditions in the area over a period of many years.

5. He has maintained close contact with the Grand Lake Water and Sewer Board and their attorney, Mr. Charles Beise, in order that settlement of the claims for damages made by the Grand Lake residents may be expedited.
GEOLGY OF GRAND LAKE AND VICINITY

General Considerations

Grand Lake town is situated in a broad glaciated valley similar to hundreds of other valleys in the higher portions of the Front Range of Colorado. Ice that accumulated in bowl shaped cirques at the heads of the valleys moved down the valleys as ice rivers, gouging out and grinding up vast quantities of solid rock which were deposited in moraines and fluvio-glacial accumulations in the lower reaches of the valleys.

The moraines form ridges of jumbled large and small boulders embedded in a heterogeneous mixture of gravel, sand, and rock flour. The ridges that form at the terminus of the glacier are called terminal moraines - those that develop along the sides of the valley glacier are called lateral moraines. It is common for the terminal moraine to connect with the lateral moraines on either side of the valley, thus forming a more or less continuous curved ridge which in plan resembles an elongate horseshoe and behind which a lake may be impounded. Terminal moraines of considerable size develop only when the terminus of a glacier maintains a fairly constant position over a long period of time as a result of the fact that the glacier is melting back just as rapidly as it is moving forward.

The melt water flowing over, under, through, and along the sides of glacier transports considerable sediment which is deposited beyond the end of the glacier to form fluvio-glacial deposits. These deposits, commonly blanket the floor of the valley for a con-
siderable distance below the point of origin. The fluvio-glacial deposits consist of irregularly layered, sorted cobbles, pebbles, sand, silt, and clay. Commonly the permeability of fluvio-glacial material is high, and ground water moves easily, if somewhat erratically, through such material. If streams of glacial origin enter a lake a delta is built up, which, near the point of entrance of the stream, contains abundant rounded pebbles and small boulders in a matrix of sand. Farther out in the lake the coarse material grades into clean sand and gravel, and in the deeper, quieter portions of the lake silt and mud are deposited. The coarse material and the sandy material are permeable and permit the easy lateral migration or vertical penetration of ground water. In general, sandy deltaic deposits are more permeable than fluvio-glacial deposits.

Glacial Geology of Grand Lake and Vicinity

Grand Lake fills a basin behind a terminal moraine deposited from a glacier moving westward down the valley of East Inlet. This same glacier probably gouged part of the lake basin out of solid rock east of the natural dam formed by the deposition of the glacial till in the morainal ridge. But there is clear evidence of two advances of ice, for a later smaller terminal moraine was deposited within and a short distance of the moraine which serves to contain Grand Lake. The distribution of the inner and outer moraines is shown on the accompanying geologic map.

Grand Lake town is to a large extent situated on a flat, relatively low strip of ground lying between the inner and outer moraines.
Study of the surface materials and sections exposed in wells suggests that the subsurface in this strip consists of rounded stream gravels deposited in varying thicknesses over lake sediments. It seems reasonable to suppose that highly permeable zones are numerous in this material but, perhaps, more or less erratically distributed.

The recent glacial history of the Grand Lake area as interpreted from field studies seems to be as follows:

1. Westward movement of a glacier down the valley of East Inlet to a position just west of the present outlet of Grand Lake. Melt water from this glacier filled the valley below the glacier with fluvio-glacial material, and, as the glacier advanced, it shoved some of this material ahead as shown by the abundance of rounded cobbles in the outer portion of the terminal moraine. The glacier reached a point where melting equaled its forward movement, and a morainal ridge was developed, containing not only stream worn materials but typical bouldery glacial till. Actually the moraine is composite and consists of two distinct ridges separated by a shallow valley a few feet deep. The moraine rests on a thick pile of fluvio-glacial sediment - the same material as that piled up on the outer portion of the moraine.

The glacier diverted the flow of North Inlet and caused this stream to flow around the outside of the morainal ridge with the deposition of considerable additional sediment beyond the western periphery of the morainal ridge.
2. The ice retreated leaving a natural basin in which a lake formed. Rounded pebbles at a constant elevation of from 20 to 25 feet above the present surface of Grand Lake are found around the lake shore and suggest the probability that the surface of Grand Lake immediately after the withdrawal was 20 to 25 feet higher than it is now.

3. The glacier advanced a second time and deposited the inner moraine, leaving a submerged valley between the inner and outer moraines. At about this time or later the lake probably broke through the outer moraine and was lowered about 15 to 20 feet. Also it is possible that at this time North Inlet broke through the outer moraine and together with the melt water from the second glacier began to fill the depression between the inner and outer moraines with sand, gravel, and silt.

4. The second glacier retreated, allowing the lake to fill again. In the meantime it is probable that North Inlet continued to dump sediments in the submerged intermorainal valley, eventually filling the valley to the level of the lake surface that then existed. In the upper end of the valley, near the present site of the Rapids Hotel North Inlet deposited a layer of coarse stream gravel on the earlier valley filling, and this gravel deposit gradually advanced down the valley at least as far as the present site of Daven Haven Lodge, where it is relatively thin and contains pebbles much smaller on the average than those at the Rapids Hotel. The gravel deposit formed in this manner probably was laid down as a veneer of varying thickness
and built up an attenuated alluvial fan which was confined to the intermural depression.

5. Eventually North Inlet broke through the inner moraine, and it is now building a delta consisting of well sorted gravel and extending into Grand Lake.

The above supposed events lead to the following conclusions:

1. A sediment filled valley between the inner and outer moraines contains stream and lake sediments which would be expected to be highly permeable to circulating ground water. However, the supposed mode of origin also implies that channels of circulation might be more or less erratically disposed, but that, considering the whole cross section of the valley fill, little overall resistance would be offered to the flow of ground water.

2. The inner moraine serves as a relatively impermeable barrier to the water saturating the valley fill. The outer moraine, however, being a superficial deposit consisting of materials and to a large extent laid down on materials not unlike those comprising the valley fill does not serve as an effective barrier. It is probable that ground water flow beneath the outer moraine is not impeded appreciably except where local conditions have resulted in an impermeable barrier.

Ground Water in the Grand Lake Area

The ground water body or bodies in the filled valley upon which Grand Lake village is situated is supplied by water from North Inlet and/or Tonahutu Creek and from melted snow and rain water. The ground water fluctuates with fluctuations in these sources. Generally
speaking, the ground water level is lowest in late winter, that is in March and April, and is at a maximum shortly after the spring thaw.

Old time residents testify that the flow of ground water between the Rapids Hotel and Daven Haven Lodge is from the northeast and is most pronounced in the spring of the year after the ice has broken up in North Inlet and Tonahutu Creek. This suggests a highly permeable connection between the source and the various points where the direction of flow has been observed. The geological observations offer an explanation for this apparently high order of permeability of the subsurface sediments.

Not only does the elevation of the ground water table tend to change constantly, but there is evidence that the configuration of the surface is also subject to change. Prolonged pumping, a change in the proportions of water contributed by the stream and surface precipitation, etc. all tend to modify the positions of the contours that mark the upper limit of the saturated zone. There may even be reason to suspect the local presence of perched water bodies, or water bodies whose flow is contained within relatively impermeable layers above and below.

One fact is apparent: that during the summer of 1947 the average ground water level was higher than it has ever been within the memory of old time residents. Weather records dating back to 1936 indicate that the month by month and annual precipitation, although somewhat above normal, in view of testimony of old time residents could hardly have caused the widespread and continued extreme elevation of the ground water level observed in numerous wells and basements.
It can hardly be a chance circumstance that the abnormal elevation of ground water level and the filling of Shadow Mountain reservoir were nearly contemporaneous.

Conclusions

In the light of the available evidence the writer has arrived at the following conclusions.

1. The geological features of Grand Lake town and vicinity suggest that the flat area lying between the inner and outer morainal ridges on the northwest side of Grand Lake is underlain by unusually permeable sediments.

2. Assuming the truth of the above statement it would be expected that any disturbance of pre-existing ground water conditions near the outlet of Grand Lake, i.e., disturbance resulting from the filling of Shadow Mountain Reservoir, would produce noticeable effects on the water level in much if not most of the intermorainal area. The exact nature and extent of these effects can be determined only after completion of the studies now being made by the engineers and geologists of the U. S. Bureau of Reclamation. However, notwithstanding any refinements in the determination of the exact extent of the effects based on accurate and repeated water level measurements, it seems clear that not only would it be expected that the filling of Shadow Mountain Reservoir would affect the ground water level in all or most of the intermorainal depression, but observations in the field bear out the contention that the ground water level actually has been affected. The effect has been the apparently persistent and widespread elevation of the water level.
PART II
GRAND LAKE WATER POLLUTION STUDY
by Ernest E. Wahlstrom, Geologist
738 15th Street
Boulder, Colo.

GENERAL STATEMENT

As an integral part of the study of the water pollution at
Grand Lake several types of data were collected. This section of
the report includes these data together with an evaluation of their
significance.

WEATHER DATA

Records of precipitation since 1936 were obtained from Fred
D. McLaren, Park Ranger, stationed at the Grand Lake Ranger Station.
Copies of these records accompany this report.

It is unfortunate that accurate weather records were not kept
prior to 1936. It is true that the precipitation for the period
including late 1946 and early 1947 is somewhat higher than normal,
but testimony of old time residents of Grand Lake and vicinity in-
validates the suggestion that the 1946-1947 precipitation was at an
all time high.

In connection with ground water elevation as related to surface
precipitation old time residents affirm that an elevation comparable
to that of the summer of 1947 has never before been observed in wet
years or dry.
AFFIDAVITS CONCERNING GROUND WATER CONDITIONS IN GRAND LAKE AND VICINITY

Under the supervision of and with the assistance of Mr. Charles J. Beise several citizens of Grand Lake and vicinity made statements under oath which have a direct bearing on the present problem. Affidavits made by these citizens are appended to this section of the report.

These affidavits, although couched in gentle mannered phrases, emphasize the conviction among the residents that the filling of Shadow Mountain Reservoir has had a widespread and devastating effect on the winter water supply in Grand Lake town and adjacent areas. Without exception and with good reason the affiants are convinced that the abnormal elevation of the ground water level due to the filling of Shadow Mountain Reservoir has caused their difficulties.
YEARY AND MONHTLY PRECIPITATION

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<tr>
<td>1945-1946</td>
<td>85</td>
</tr>
<tr>
<td>1946-1947</td>
<td>163 to date Apr. 30</td>
</tr>
</tbody>
</table>

Ten year mean 1936-1937 to 1945-1946, 112.5 inches
GRAND LAKE RANGER STATION

The dates on which Grand Lake was frozen over in the winter, and free from ice in the spring.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>FREE FROM ICE IN SPRING</th>
<th>FROZEN OVER IN FALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1937</td>
<td>May 14</td>
<td>Dec. 20</td>
</tr>
<tr>
<td>1938</td>
<td>May 16</td>
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<td>1939</td>
<td>May 3</td>
<td>Dec. 24</td>
</tr>
<tr>
<td>1940</td>
<td>Apr. 26</td>
<td>Dec. 14</td>
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<td>1941</td>
<td>May 13</td>
<td>Dec. 16</td>
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<td>1942</td>
<td>May 12</td>
<td>Dec. 8</td>
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<td>Apr. 27</td>
<td>Dec. 17</td>
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<td>1944</td>
<td>May 20</td>
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<td>May 20</td>
<td>Dec. 12</td>
</tr>
<tr>
<td>1946</td>
<td>Apr. 26</td>
<td>Dec. 18</td>
</tr>
<tr>
<td>1947</td>
<td>May 10</td>
<td></td>
</tr>
</tbody>
</table>

Fred D. McLaren
District Ranger
STATE OF COLORADO  }  ss.
COUNTY OF GRAND  }

AFFIDAVIT

DONALD E. WOODS, of lawful age, being first duly sworn, upon oath deposes and says:

That affiant attended a meeting of the Lions Club which, as nearly as affiant can recall, was held at Hot Sulphur Springs, Colorado, sometime during the year 1937; that at said meeting, which was attended by residents of Grand County including a number of people from Grand Lake, the matter of the proposed Colorado Big Thompson Project was presented by Porter J. Preston, the chief engineer in charge of investigations of the Colorado Big Thompson Project; that during the discussion affiant heard Lester H. Piper propound substantially the following query to Mr. Preston:

QUERY: If the water table from Shadow Mountain Reservoir should raise sufficiently to destroy the use of my septic tank and leaching fields and also my water system, what would the Bureau of Reclamation do in the event such a thing should happen?

ANSWER: (Which was given by Mr. Preston) If such a thing should happen, the Bureau of Reclamation would either pay for damages incurred, or
provide suitable sewage disposal and water systems.

That there were many others present who heard these statements and recall the same; that these statements were made prior to commencement of any construction work and in reliance thereon the residents of Grand County in dealing with the Eastern Slope water interests finally agreed to approve the plan for the construction of the Colorado Big Thompson Project.

FURTHER AFFIANT SAITH NOT.

(Signed) D. E. WOODS

Subscribed and sworn to before me this 21st day of October, 1947.

My commission expires:

July 27, 1949

(Signed) HENRY W. RHONE
Notary Public
STATE OF COLORADO } ss.
COUNTY OF GRAND } ss.

AFFIDAVIT

CARL G. BREEZE, of lawful age, being first duly sworn, upon oath deposes and says:

That affiant attended a meeting of the Lions Club which, as nearly as affiant can recall, was held at Hot Sulphur Springs, Colorado, sometime during the year 1937; that at said meeting, which was attended by residents of Grand County including a number of people from Grand Lake, the matter of the proposed Colorado Big Thompson Project was presented by Porter J. Preston, the chief engineer in charge of investigations of the Colorado Big Thompson Project; that during the discussion affiant heard Lester H. Piper propound substantially the following query to Mr. Preston:

QUERY: If the water table from Shadow Mountain Reservoir should raise sufficiently to destroy the use of my septic tank and leaching fields and also my water system, what would the Bureau of Reclamation do in the event such a thing should happen?

ANSWER: (Which was given by Mr. Preston) If such a thing should happen, the Bureau of Reclamation would either pay for damages
incurred, or provide suitable sewage disposal and water systems.

That there were many others present who heard these statements and recall the same; that these statements were made prior to commencement of any construction work and in reliance thereon the residents of Grand County in dealing with the Eastern Slope water interests finally agreed to approve the plan for the construction of the Colorado Big Thompson Project.

FURTHER AFFIANT SAITH NOT.

(Signed) CARL G. BREEZE

Subscribed and sworn to before me this 21st day of October, 1947.

My commission expires: March 7, 1950

(Signed) HARRY B. JONES
Notary Public
STATE OF COLORADO  } SS.
COUNTY OF GRAND  }

LESTER H. PIPER, being first duly sworn, on his oath deposes and says:

That he first came to Grand Lake in 1927, purchased property in 1929 and in 1930 started an expansion cabin-building program; that he now has a business, estimated to be worth a quarter of a million dollars, which has accommodations for 118 guests besides 24 employees; that ordinarily his season is from Decoration Day until the 1st of October;

That when the first cabins were built the present summer community water system was not available so he had a well dug at the Northeast corner of his property; that the well is 12½ feet deep and three feet in diameter, has a cement top and cement down for a depth of three feet, the balance of the way being rock; that the high water mark in this well in early Spring had never come closer than six feet from the surface; that usually from July 1 the water gradually recedes until it hits its low water mark in March; that the maximum fluctuation in his well has been about five feet;

That upon the Bureau of Reclamation dredging the outlet of Grand Lake for the purpose of the channel connecting Shadow Mountain Lake and Grand Lake, his water table receded to the point where in August, 1946, he was unable to pump sufficient water from his well to operate Daven-Haven In The Pines; That in August, 1947, (the same time of year) the water
was within 2½ feet of the surface, having risen a distance of four feet above any previous high water line and about eight feet above the previous August level; that an accurate record regarding the water level in his well has been kept by the Bureau of Reclamation because of his complaints in regard to lack of water in August, 1946;

That his sewage disposal system is entirely composed of septic tanks and leaching fields which are constructed of cement and iron. That the closest distance of a leaching field to a septic tank is 110 feet; that never before in the history of his sewage disposal system has he had any trouble with it running over; that this August a leaching field for the lodge building ran over; that he had both the septic tank and leaching field pumped out and within twenty-four hours they were both running over because of the high water table;

That directly North of Daven-Haven across the road is a tract of ground known as Cairns Meadow; that in former years this was irrigated and used as a meadow during which period of time the well described above was in use. That the meadow was flooded constantly, having several inches of water standing on it and a stream of water draining from the meadow into the outlet of Grand Lake; that this surface water never affected the ground water height in his well nor did it affect the water level in the septic tanks; that in his opinion as a layman it is conclusive proof that excessive precipitation has no relationship whatsoever with the present ground water level in the area
of Daven-Haven.

That in his opinion the entire situation existing at Daven-Haven is caused by the filling of Shadow Mountain Lake; that he particularly believes this to be true because during the dredging of the outlet for the channel his supply of water lowered and the filling of the Lake has now caused the abnormal elevation of the water in his well and septic tanks as above set forth.

FURTHER AFFIANT SAITH NOT.

(Signed) LESTER H. PIPER

Subscribed and sworn to before me, this 10th day of October, 1947.

(Signed) HENRY W. RHONE
Notary Public

My commission expires:

July 27, 1949
STATE OF COLORADO }  ss.
COUNTY OF LARIMER }  

AFFIDAVIT

E. E. BASHOR, being first duly sworn, on his oath deposes and says:

That he is the owner of a cabin situated near the outlet about 300 yards from the weir; that he purchased it in 1940 and operates it as a lodge to accommodate forty guests; that he obtains his water supply from a well situated near the river;

That the well is approximately 14 feet deep; that there is a 24 inch pipe right straight up from the bottom to the top; that it is a well constructed well; that in past years he has frequently sampled the water and sent the samples to Fort Collins to be tested; that those tests have never before indicated the water to be unsafe;

That in July of this year before the guest season he was particularly careful, pumped the well out and cleaned it; that the water then was clear and sparkling; that shortly thereafter and almost simultaneously with the filling of Shadow Mountain Lake the water in his well raised a minimum of six feet; that the test taken on August 11, 1947, showed a bacillic colon count in his water of 38 whereas 2 is a safe count; that his water is unfit for human consumption because the count showed a possibility of typhoid or other infection from bacillus and in addition the
water is very muddy in color, being almost the color of strong coffee, and has an odor which has caused people to complain; that people see the dirty water in the toilet bowls, flush the toilet, and the water which rushes in is just as dirty;

That the sewage system for Kikapoo Lodge is a series of septic tanks and leaching fields which are located at a distance of at least 450 feet from his well besides which there is a high moraine separating the sewage system and the well; that there has never been any contamination of his drinking water caused by the septic tanks;

That in all prior years he has operated until approximately the middle of October and in some years as late as October 26th; that this year as soon as he had knowledge that his water supply was unsafe he furnished the guests with jugs in which they hauled drinking water from town; that on September 1 when word came out to boil all water he closed the lodge and has thereby lost the revenues from approximately two months' operation.

FURTHER AFFIANT SAITH NOT.

(Signed) E. E. BASHOR

Subscribed and sworn to before me, this 8th day of October, 1947.

(Signed) JEAN DUNBAR
Notary Public

My Commission expires: May 7, 1950
STATE OF COLORADO  
{ ss.  
CITY & COUNTY OF DENVER  

AFFIDAVIT

HENRY W. RHONE, being first duly sworn, upon oath deposes and says:

That he has been a resident of Grand Lake for some 28 years and operates the Corner Cupboard, consisting of guest cabins, hotel and dining room, and has been engaged in that business during all of such time; that in the fall of 1946, affiant desired to construct new cesspool which would be more adequate for the purposes of his establishment and accordingly constructed three new cesspools, two of which were dug to a depth of 13 feet in dry gravel, the same being completed in the fall of 1946; that said cesspools had scarcely been used but commencing in July of 1947 the one for the Corner Cupboard kitchen overflowed during balance of the season necessitating the pumping out of the grease traps and other emergency work.

The cesspool for the Everest House, in the rear of the Texaco Station, filled up within six feet of the surface during the summer, although very little
sewage was flowing into it.

FURTHER AFFIANT SAITH NOT.

(Signed) HENRY W. RHONE

Subscribed and sworn to before me this 16th day of October, 1947.

My commission expires: August 25, 1951

(Signed) CAROLYN T. GOODRICH
Notary Public
STATE OF COLORADO } ss.
COUNTY OF GRAND } ss.

AFFIDAVIT

JAKE PETTINGELL, being first duly sworn, upon oath deposes and says:

That he moved into this area on October 14, 1944; that he has one well of his own and four cesspools; that he serves four cabins besides his own; that he went through the first three years fine using town water in summer and his own well during the winter.

That his well is well constructed, cased with glazed tile 32 inches above high water line and at the top there is a 6' x 6' x 6' room built of wood; that affiant's well is 27 feet deep and the high water mark in any year prior to 1947 has been 9½ feet and low water mark 14 inches from bottom of well; that these fluctuations between high and low water were constant by years and the highest the water has ever been at any time in any year was approximately 17½ feet below the surface of the ground; that in 1947, commencing the latter part of July, this water level in affiant's well has raised to within 15 feet of the surface of the ground and this high water level was measured by the Bureau of Reclamation in August, 1947, and that since said date the water level has dropped to about 11 feet 6 inches from bottom of well.
That in addition to the operation of cabins affiant in 1946 purchased the necessary equipment to pump out the cesspools and did so primarily for the benefit of himself and Mr. Paul Trinder; however, commencing in July of this year, affiant had so many requests to clean cesspools that it was impossible for him to accept other employment and affiant had to limit his efforts to a very few commercial houses and his own personal holdings;

That in July Mr. Paul Trinder and he were called to pump out the cesspool at the Rapids Hotel which was just put in this spring; that even though the cesspool had never been used before it was running over the top of the ground; that after they pumped it out it ran over again within 24 hours; that this same condition occurred when they pumped out the Zick Hotel cesspool and the grease traps and cesspools at Daven-Haven.

That from his experience in working on these cesspools and septic tanks, he has observed that the flow into the cesspools has increased because of the ground water table.

FURTHER AFFIANT SAITH NOT.

(Signed) JAKE PETTINGELL

Subscribed and sworn to before me this 15th day of October, 1947.

My commission expires: July 27, 1949

(Signed) HENRY W. RHONE
Notary Public
STATE OF COLORADO  
COUNTY OF GRAND  

AFFIDAVIT

T. T. OYLER, being first duly sworn, upon oath deposes and says:

That he has lived at Grand Lake since 1937; that he is the proprietor of Mountain Mercantile Company; that he has a 21 foot well which is located in his four foot deep basement underneath his store; that when said well was dug affiant believes it intercepted a spring which formerly flowed through another outlet in the area, but due to the construction of the tunnel approach road the flow of the spring was changed; that affiant believes this to be true because the water in his well bubbles up of its own force and the water level in his well has been unusually constant, whereas other wells in the vicinity fluctuate in water level between high and low water seasons; that the water level in affiant's well has varied only a few inches between seasons;

That affiant installed a steel casing the entire depth of the well and water can only enter the same at the bottom; that affiant installed a new pump and pipe earlier in 1947 and at that time particularly observed the water level of his well; that the water today is approximately
four feet higher than it was at the time said pump and
pipe were installed; that even though the affiant believes
the source of his well to be a spring, nevertheless the
water level in his well is approximately four feet higher
than it has been heretofore and affiant personally
believes that an increase in ground water pressure has
affected the spring and his well and caused the water in
the same to rise.

FURTHER AFFIANT SAITH NOT.

(Signed) T. T. OYLER

Subscribed and sworn to before me this 16th
day of October, 1947.

My commission expires: July 27, 1949

(Signed) HENRY W. RHONE
Notary Public
STATE OF COLORADO  
COUNTY OF GRAND  

ss.

AFFIDAVIT

RALPH BACHMAN, being first duly sworn, upon oath deposes and says:

That he first came into the area twenty years ago; that about the 10th of September, 1946, he dug a well up at the house; he hit water at 28 feet and in all the well is 40 feet deep; that the ground all the way down was large and small boulders mixed with some gravel and dirt; that the formation of the ground is that of a moraine; that the gravel was so clean he used it for concrete but did not have enough for the entire job;

That he checked the water level during the winter and found that it was about 2 feet off the bottom of the well sometime in February; that he lowered the pipe 14 inches and barely got through without the well going dry; that when the water came in this spring it came in with a rush up to a point within a foot or two of where he struck water originally; that this occurred at the same time the North inlet broke up, in fact, approximately three or four days after the break up; that he noticed it because he had talked about the low water level in his well and Mr. Spitzmiller had told him
that when the break came his well would fill up; that the
time was about the first of May;

That when the Bureau of Reclamation checked
his well for the first time in August they found the
water was just about 3 1/2 feet higher than when he
struck water last year; that the Bureau checked it again
since that time and said that it has gone down some but
it is still about 3 feet above where he struck water.

FURTHER AFFIANT SAITH NOT.

(Signed) RALPH W. BACHMAN

Subscribed and sworn to before me this 10th
day of October, 1947.

My commission expires: July 27, 1949

(Signed) HENRY W. RHONE
Notary Public
STATE OF COLORADO  

COUNTY OF GRAND  

AFFIDAVIT

A. W. HORN, of lawful age, being first duly sworn, upon oath deposes and says:

That affiant lives fifteen miles southwest of Grand Lake on Colorado River, U. S. Highway 40. He has a drilled well three hundred feet in depth. This well is an artesian well which has been in use for six years. The water has not varied in this well over this period of time with the exception of the spring of 1947, when there was a reduced amount of flow and the pump was necessary in order to secure a sufficient amount of water to operate my home. Otherwise, there has been no increased or decreased flow of water over this period of years.

I formerly owned the Stillwater Ranch, which the Government purchased from me and which I now lease from the Government. On this ranch, there is a shallow well which, during the irrigation time, reaches its high water level. This water level has been normal this year. As other years, the water table reduces quickly after the irrigation water is shut off and just furnishes enough water for this ranch house. It can be pumped dry and has been
pumped dry this year.

I have not noticed any increased water table in 1947 over any previous years.

FURTHER AFFIANT SAITH NOT.

(Signed) A. W. HORN

Subscribed and sworn to before me this 22nd day of October, 1947.

My commission expires: June 18, 1951

(Signed) MAXINE McWILLIAMS
Notary Public
STATE OF COLORADO

COUNTY OF GRAND

AFFIDAVIT

JOHN HOLZWARTH, of lawful age, being first duly sworn, upon oath deposes and says:

That affiant lives ten miles north of Grand Lake, in the North Fork Valley, on the Holzwarth Ranch and is the owner of same. I have lived there for the past twenty-eight years.

I have a well and have observed its water level and the water table in this area at various times every year. The low water season usually occurs during March and the first part of April; the high water season from about May 20 to June 20. These seasons of low and high water have been fairly uniform throughout the years regardless of dry and wet years.

In 1947, I have, as usual observed my well at frequent intervals. The highest water level in the well occurred during the month of June and reached a peak slightly higher than in 1946, but not as high as in some other years. Commencing with the month of July, the water level of the well began to lower and has lowered steadily since then. About September 15, 1947, I dug a cesspool on my property and found the water
table to be about six inches lower than usual at this time of year.

This affidavit is made to prove that the ground water table on my property, in 1947, is not higher than in other years.

FURTHER AFFIANT SAITH NOT.

(Signed) JOHN G. HOLZWARTH

Subscribed and sworn to before me this 16th day of October, 1947.

My commission expires: July 27, 1949

(Signed) HENRY W. RHONE
Notary Public
STATE OF COLORADO   } ss.
COUNTY OF GRAND    } ss.

AFFIDAVIT

CARL NELSON, of lawful age, being first
duly sworn, upon oath deposes and says:

That affiant lives three and one-half
miles north of Grand Lake on Highway 34 and lives
within the park boundaries. Mr. Nelson has resided
at the Green Mountain Ranch, of which he is the
owner, since 1936.

In 1940, he drilled a well 147 feet
deep and cased it with steel pipe. The water came
up in the well to a height of 117 feet, or thirty
feet from the top. This well stays constant in
height of water.

The water has not varied a great deal
over previous years; however, having had the cover
off of the well two weeks ago, I noticed that the
water is approximately ten feet lower than the thirty
feet depth from the top.
This year we have not noticed any higher water table than in many other years and have seen nothing unusual in the way of high water during the summer of 1947.

FURTHER AFFIANT SAITH NOT.

(Signed) CARL NELSON

Subscribed and sworn to before me this 14th day of October, 1947.

My commission expires: July 27, 1949

(Signed) HENRY W. RHONE
Notary Public
STATE OF COLORADO  }  ss.
COUNTY OF GRAND  }

AFFIDAVIT

CLYDE SARGENT, of lawful age, being first duly sworn, upon oath deposes and says:

That affiant lives three and one-half miles north of Grand Lake on Highway 34. I have lived on the Onahu Ranch and am the owner of the same. I have lived there since the fall of 1944.

In 1944, we had a well dug thirty-five feet deep in which the water rose to the height of twenty-one feet. In 1945 during the summer, we had ample water in this well. In 1946 in the latter part of August, this same well did not produce sufficient water to operate our place. In 1947, this well compared favorably with the year of 1945 and did not go dry. In 1945 and 1947, the water went to a low point in the latter part of August but there was sufficient water to operate our lodge and guest cabins. The water in these two years varied very little.

In watching our well, we found the high water mark was in June from which time it gradually reduced in volume until April of the following year when again it started to rise.
I know that we have not had an excessive amount of water in the summer of 1947.

FURTHER AFFIANT SAITH NOT.

(Signed) CLYDE F. SARGENT

Subscribed and sworn to before me this 15th day of October, 1947.

My commission expires: July 27, 1949

(Signed) HENRY W. RHONE
Notary Public
STATE OF COLORADO
COUNTY OF GRAND

AFFIDAVIT

LESTER MOORE, being first duly sworn, or his oath deposes and says:

That I own a home east of the North Inlet in Grand Lake, Colorado. In the basement of this home, I have a "dug" well which I dug in 1946 to the depth of ten feet in which it has two feet of water which is spring water. I have not had any unfavorable tests.

I also have a cesspool and in the year of 1947, or any other year, I have not had any trouble with it overflowing.

I am positive the water table has not increased in 1947 over 1946 or any other year. It has been quite normal. The high water table is from May to the middle of June.

FURTHER AFFIANT SAITH NOT.

(Signed) LESTER MOORE

Subscribed and sworn to before me, this 22nd day of October, 1947.

My commission expires: July 27, 1949

(Signed) HENRY W. RHONE
Notary Public
STATE OF COLORADO
COUNTY OF GRAND ss.

AFFIDAVIT

FLETCHER E. LOVE, being first duly sworn, on his oath deposes and says:

That I live east of the North Inlet in Grand Lake, Colorado and I have lived in the present home since 1940. I have a "dug" well which is eighteen feet deep in which I have six feet of water. The water in my well rises in the spring to nine feet and starts going down in May and June. This well, I believe to be spring water. From 1940 through 1947, I have observed this well a good number of times and I have not noticed any change in the water table in 1947 over any other year.

FURTHER AFFIANT SAITH NOT.

(Signed) FLETCHER E. LOVE

Subscribed and sworn to before me, this 22nd day of October, 1947.

My commission expires: July 27, 1949

(Signed) HENRY W. RHONE
Notary Public
STATE OF COLORADO } ss.
COUNTY OF GRAND } ss.

AFFIDAVIT

MILTON CORNELIUS, being first duly sworn, on his oath deposes and says:

That I live east of the North Inlet in Grand Lake, Colorado and own my home which I have owned since 1939 in which I had a "dug" well which was four feet in depth. It was of a spring variety and ran over the top through the years of 1940 to 1947. When Lester Moore dug his well in his basement and tapped the spring from which I got my water, I dug my well four feet lower. The water does not run over the top of the well now. I have noticed that the water in the well is one foot lower in 1947 than it was in 1946. I have had tests on this supply of water frequently and have not had any unfavorable tests. I have not noticed any increase in the water table for the year of 1947 over 1946 or any other previous year.

FURTHER AFFIANT SAITH NOT.

(Signed) MILTON CORNELIUS

Subscribed and sworn to before me, this 22nd day of October, 1947.

My commission expires: July 27, 1949

(Signed) HENRY W. RHONE
Notary Public
STATE OF COLORADO  
COUNTY OF GRAND  

ss.

AFFIDAVIT

RAY E. RUSKE, being first duly sworn, on his oath deposes and says:

That I live east of the North Inlet in Grand Lake, Colorado and have lived there since 1930.

In 1937, I dug a well on my property which was thirty-seven feet in depth, the bottom in solid rock. The water in this well came through cracks in this rock formation. The water rose to a height of three feet. I have observed this well very frequently since I dug it and this well has been normal in 1946 and 1947. I have not noticed any increase in the water depth of my well. I have had this well tested repeatedly and have not had any unfavorable tests. In the last few days, I had the cover off the well and measured it and found slightly over three feet of water. This is not unusual. The depth of the water is perfectly normal with reference to previous years.

FURTHER AFFIANT SAITH NOT.

(Signed) RAY E. RUSKE

Subscribed and sworn to before me, this 21st day of October, 1947.

My commission expires: July 27, 1949

(Signed) HENRY W. RHONE  
Notary Public
STATE OF COLORADO  }  ss.
COUNTY OF GRAND  }

AFFIDAVIT

ARThUR THOMPSON, being first duly sworn, on
his oath deposes and says:

That I have lived east of the North Inlet in
Grand Lake, Colorado for sixteen years. I have a "dug"
well which is twenty-seven feet deep and has five feet
of water. This well has not increased in water height
in the year of 1947. Today, I measured the well and
found four feet of water; if anything, this is lower
than previous years.

I have a cesspool across the moraine from my
home which in previous years had overflowed, but, in the
year of 1947, this cesspool did not overflow.

I am positive that we people living on the
east side of the North Inlet have not experienced any
higher than usual water table in the year of 1947.

FURTHER AFFIANT SAITH NOT.

(Signed) A. C. THOMPSON

Subscribed and sworn to before me, this 18th
day of October, 1947.

My commission expires: July 27, 1949

(Signed) HENRY W. RHONE
Notary Public
PART III

GRAND LAKE WATER POLLUTION STUDY

by Ernest E. Wahlstrom, Geologist
738 15th Street
Boulder, Colo.


An objective survey of the factors leading to ground water and surface water contamination. Includes recommendations for overcoming hazards associated with both types of contamination. Recommends specifically:

1. Installation of an adequate public water supply system.

2. As a stop gap measure reconstruct all wells in use to comply with the recommendations of the Colorado State Department of Health. (In my opinion the damage is already done, and this measure will be ineffective. E.E.W.)

3. Abandonment of all open pit privies in the village with construction of concrete vault privies or chemical toilets.

4. Abandonment of all cesspools extending into the water table, with construction of water tight septic tanks and shallow leaching fields. Need for public sewage system is pointed out.

5. Inauguration of a study of the contamination of Grand Lake by or under the sponsorship of the U. S. Bureau of Reclamation.

7. Boiling or chemical treatment of all water used for domestic purposes until safety is adequately demonstrated.


A preliminary report based admittedly on insufficient data. Contemplated additional work is outlined.

Tables are presented to emphasize the point that precipitation in the Grand Lake area was unusually heavy during the winter of 1946-47. Precipitation at the Grand Lake station shows a plus value when compared with a mean value based on 22 years of measurements. The precipitation for 1946-47 at the Grand Lake Ranger Station similarly shows a plus value when compared to a 10 year mean.

The hazards of such comparisons should be emphasized. For these figures to have any significance data should be obtained as to the relationship between the ground water level and precipitation in any single prior year in which the winter was comparable to that of 1946-47. Such data are lacking, and we have only the experience of old time residents to fall back on. Most old time residents say that in their experience the water level of the summer of 1947 was at an all time high, and that in past years of excessive precipitation the water level was never as high as in the summer of 1947.
The Bureau of Reclamation geologists claim "moderate to low" permeability for "materials in the channels" i.e., the material deposited between the inner and outer moraines on the north and west shores of Grand Lake and elsewhere. With this statement I cannot agree (See Part I of my report). I think their statement should indicate "moderate to unusually permeability" for the lake and stream deposits.

The geologists' report includes the assertion that the area east of North Inlet could not have been affected by the filling of Shadow Mountain Reservoir, and the areas in which the ground water is tributary to Columbine Creek and Grand Lake likewise would not be affected. With these statements I tentatively agree. But it still remains to be shown just what portions of the ground water reservoir are tributary to each of these features.

The geologists admit cautiously that the Stevenson area, the Robinson area, and possibly the western section of the city between the outlet and Grand Avenue may have been adversely affected by the filling of Shadow Mountain Reservoir. However, they make a plea for more time and measurements before they reach a decision as to the remainder of the area. Part of their contemplated research program entails the lowering of the reservoir and study of the concomitant lowering of water level in wells. They hope to complete their program by April, 1948.
I feel that the report by the Bureau geologists is everything that could be expected considering the pressure of time and circumstance. However, I also note an element of subjectivity. This is natural, for the Bureau geologists would be poor representatives of their employers if they did not place emphasis on features which tend to substantiate the conclusion that the filling of Shadow Mountain Reservoir did not create widespread damage in the Grand Lake area.


This letter reports on a study made of the algal and fish relationships in connection with Shadow Mountain Lake. Algal contaminations are regarded as of negligible importance as permanent contaminative agents, but rather as beneficial for fish. He strongly opposes the use of chemical means to reduce the algal population of Shadow Mountain lake because of possible adverse effects on the fish.


This memorandum briefly summarizes the need for a program to be followed in studying the ground water conditions at Grand Lake. Of interest is the statement made by Mr. Iakisch regarding assertions of Grand Lake residents that the filling of Shadow Mountain Reservoir is the immediate cause of widespread contamination. Quote, "Such statements cannot go unchallenged as conditions are dangerous and critical."
Mr. Iakisch's statement that "there have been no determinations of ground water conditions and water table elevations in the area prior to those being made under the present investigations" should be revised.

The memorandum emphasized the advisability of waiting until all data are collected before a final report is made.

CONCLUSIONS

The present writer on the basis of his own field studies and study of the reports to the Bureau of Reclamation that are in his possession has arrived at the following conclusions:

1. All factors considered, it seems clear that the filling of Shadow Mountain Reservoir has caused extensive, but still not completely defined, effects in ground water conditions in the Grand Lake area. In the light of the information now available, I have reached the conclusion that the following areas have been affected: (a) The Stevenson area, (b) The area immediately west of the outer moraine known as the Robinson area, (c) The area between the inner and outer moraines extending from Grand Lake outlet as far northeast as Grand Avenue. It is my personal conviction that the area lying northeast of Grand Avenue and west of North Inlet and between the inner and outer moraines is also affected. The obvious result of the filling of Shadow Mountain Reservoir has been the general and permanent elevation of the ground water level over the area.

2. The algal contamination of Grand Lake by waters from Shadow Mountain Reservoir is a proved fact. The bacterial
contamination of Grand Lake as pointed out in Cornahan's report is now present and will become progressively worse as project features are developed.

3. Correction of these conditions is imperative and time is of the essence.

4. The health and prosperity of one of Colorado's most important tourist centers is at stake, and should not be imperiled by delaying tactics or by the time demands of careful quantitative scientific studies.