

REPORT ON

LEAK AT FONTENELLE DAM  
SEEDSKADEE PROJECT, WYOMING

September 1965



A TROUBLED DAM

by

David L. Crandall  
Regional Director, Region 4  
Bureau of Reclamation



## Introduction

By Commissioner Dominy

The safety margin built into Bureau of Reclamation structures was amply demonstrated in September 1966, when seepage developed into a major leak around the right abutment of Fontenelle Dam on the Green River in southern Wyoming.

This is the story of the dramatic events which surrounded the emergency at Fontenelle Dam. It demonstrated once again the value of good men, talented in their various fields and with an esprit de corps which welds them into an effective team of which I am very proud. At one critical instant during the emergency, the thickness of material between the reservoir water and the eroded downstream edge of the dam was no more than 45 feet, 15 of which was impervious core material. This extra width of impervious core put in by Bureau designers and dam builders provided that critical extra margin, the vital safety factor, which counteracted the hazard of the leak. Thus, our record of construction of more than 200 major storage dams without a failure was preserved.



## A TROUBLED DAM

D. L. Crandall

On Saturday morning, September 4, 1965, I had just reached Minidoka Project Headquarters to clean out my desk, preparatory to taking over as Director of Region 4. The next step was a drive to Salt Lake City. But an insistently ringing phone ended that. A hurried call brought this chilling report from Salt Lake City:

"Fontenelle Dam has begun to leak badly and the water is eroding away the dam embankment. If it continues to erode, the dam could possibly fail. What's more, the reservoir is full and a failure could be a disaster downstream."

I first consulted the Reclamation data book to learn more about Fontenelle Dam. The dam, I read, was built across the Green River in the barren land northeast of Kemmerer between 1961 and 1964. It was made of earthfill and was about a mile long and 140 feet high. At capacity, which it had just reached for the first time, the reservoir contained about 350,000 acre-feet of water.

Of course, the idea of routinely moving to Salt Lake City was dismissed. Instead, I chartered a plane and flew east to Wyoming.

A short while later, a wire service news story chronicled the start of my new job as follows: "A funny thing happened on Dave Crandall's way to work a few weeks ago--a dam started leaking." On the plane to Wyoming that difficult day in September, I could find nothing light or humorous. But later, the odd circumstances could be seen with some wonderment.





On the horizon just beyond Kemmerer I caught my first sight of Fontenelle Reservoir, an unnatural patch of blue amid the muted gray and tan of the high Wyoming plains.

We flew toward the dam, which is tucked in under low bluffs. Not knowing where to look for the troubled area, I missed it on the first pass. After the plane had proceeded along the unimpaired upstream length of the mile-long dam, I remember wondering why the concern. We then retraced our route along the downstream face. The powerplant, dewatered outlet stilling basin, and the contractor's pumping and excavating equipment all stood out clearly in the dam center. Then we saw the harsh reality of the flowing wound on the downstream face of the dam near the spillway. I realized then that Fontenelle had its full share of trouble. But even before I arrived, the Bureau was moving swiftly to bring the emergency under control.

Fontenelle Dam is the principal storage feature of the Seedskadee Unit of the Colorado River Storage Project, a five-state multipurpose water resource development authorized in 1956. The 345,000-acre Fontenelle Reservoir was designed to store water for a full supply of irrigation water to 58,000 acres of farming land, and for 19 1/2 million gallons of municipal and industrial water. The project also provides an 18,000-acre wildlife refuge development, and its powerplant generates enough power to supply the needs of a city of 10,000 people.

Construction on the 140-foot-high earthfill dam began in 1961. By midsummer of 1965, the dam was substantially completed and water was being stored for the first time. Some work was being done to finish the powerplant.



As the reservoir filled, the expected seepage developed around the abutments of the dam. This was not alarming as most earth dams have seeps, particularly during the initial filling. On June 29, 1965, a small eruption of water (about 1 c.f.s.) appeared on the right abutment near the spillway. The small area of fill that was washed away was repaired, and the seep water was channeled in a drainpipe to carry it away from the fill.

In the preceding weeks the reservoir had been filling by a much higher than normal runoff from the Upper Green River Basin. Peak flows passed over the spillway and through the outlet were 14,400 c.f.s. on June 29, 1965, which compares with an average annual peak of 8,500 c.f.s. After the peak had passed, the outlet was closed preparatory to making some minor repairs to its stilling basin. Inflows were passing over the spillway into a separate stilling basin and the reservoir was about 2 feet below its maximum allowable level.

On Friday morning, September 3, Construction Inspector Dick Horsburg noticed a wet spot about 50 feet above the toe of the dam where it enveloped the downstream portion of the right abutment near the spillway. Water soon began to flow from this wet spot, causing the embankment material to slough away. Waterflow increased dramatically as the fill material was carried away. By late afternoon a large deep cone-shaped cavity existed. Waterflow had grown to about 5 c.f.s. By the following morning the cavity had cut 150 feet into the downstream face of the dam. About 10,500 cubic yards of fill had been carried away by the swift flowing leak. Though most difficult to measure, the flow of the leak was estimated to be as much as 21 cubic feet per second.



By late afternoon on Friday, it was obvious that the fast-eroding dam posed a serious threat to people living downstream. Construction Engineer John Hatch alerted officials of both Sweetwater and Lincoln Counties and of the community of Green River, 59 miles downstream from the dam. Sheriff Nimmo spread the word from Green River upstream to about 23 miles below the dam. Bureau people patrolled the upper segment on both sides of the river. Inhabitants and all fishermen and campers were instructed to leave the flood plain of the river.

Barricades with warnings were placed at all points of access to the valley. Communications between the dam and downstream areas were obtained by stationing Lincoln County radio-equipped automobiles at the dam. The sheriff's department kept the radios continuously manned through the emergency. Neither the Bureau nor the sheriff made many friends that night among the pre-Labor Day fishermen who had to strike camp and abandon their favorite fishing holes. Project officials maintained a night-long vigil at the dam watching the leak by floodlight.

Chief Engineer B. P. Bellport had been alerted at the first sign of serious trouble and, with top members of his staff, arrived at Fontenelle early Saturday morning. After a quick survey of the situation, he ordered an immediate drawdown of the reservoir and placement of large broken rock to buttress the leak area.

While removing a temporary cofferdam to handle the emergency flow immediately below the outlet, a D-8 tractor became stuck. I vividly remember a mounting tension during those minutes while we watched the bogged-down tractor slowly yield to the pulling force and climb back to solid footing. All the while, about 200 feet to the west the



strength of the dam was ebbing away at some unknown rate in a chocolate-brown outpouring of water and fill from the leak area.

Later the irrigation outlets which had been provided for the future Seedskadee irrigation were opened to add to the flow through the outlet and over the spillway. By noon Sunday, the discharge reached about 18,300 c.f.s., causing some overbank flooding at several locations in the river valley downstream. This was not a serious problem, however, because of the emergency evacuation which we had worked out with the city and county officials downstream. It soon became apparent that the amount of flow in the leak area had stabilized. It was correctly concluded at the time that the water was emerging from openings in the abutment rock underneath the dam. At no time did water pass directly from the reservoir through the dam.

What was not known until late Sunday afternoon, September 5, was the formation of a cavity in the dam above the leak. As the water emerged from the abutment rock and as it carried away the impervious core material, an opening began to grow inside the dam above the point of water emergence. The tightly compacted earth materials forming the arch of this opening continued to fall and be carried away. By this process a dome-shaped opening, wider at its base than its top and about 30 feet in final depth, grew upward in the center of the dam until it broke through the crest at the upstream edge of the roadway over the dam late Sunday afternoon.

The sudden appearance of a "sinkhole" in the dam crest was electrifying. Word went out by radio to Green River, and Sheriff Nimmo





asked if evacuation of the residents should start. Meanwhile John Hatch tied himself to a safety line to observe the source of the leak and was able to verify that water was coming out of the abutment rock and not moving from the reservoir through the body of the dam. The opening was quickly filled with heavy rock and no further trouble was experienced. The Green River people were advised to stay put for the time being.

Moments before the collapse, one of the many spectators gathered on the bluff overlooking the leak walked onto the spillway bridge and demanded that he be allowed across the dam. He was loudly and abusively insisting that he be given this permission when the 10-foot-diameter "sinkhole" appeared in the middle of the roadway with a loud "whump" right before his eyes. He gasped and indefinitely deferred his request.

Another person who saw this collapse in the crest road leaped into his automobile and raced to a housetrailer parking area in Green River, about an hour's fast drive away. There he cried out that the dam had broken and the town would be engulfed by a wave of water. In his haste to connect his car to his housetrailer, he crashed into someone's automobile and trailer. Fortunately, Sheriff Nimmo of Sweetwater County was there and when the gathering crowd asked him about the report, he replied calmly, "You can do as you wish, but I have the Bureau of Reclamation on the radio and the water is still in the reservoir." No one panicked and no one left town. Throughout the emergency, Governor (now United States Senator) Clifford Hanson maintained continuous personal contact to assure maximum protection was being provided for people and property in the river valley. State agencies immediately stepped forward to assist in every needed way.



During the first few days, there was great public interest in what was taking place. Hundreds of spectators were there. Many press, wire service, and TV reporters were either at the site or in frequent communication. Their cooperation and insistence on checking out any wild story floating around contributed greatly to sensible public reaction.

Just after the collapse of the sinkhole, one of the reporters happened to be in a store several miles from the dam. A distraught lady rushed in and telephoned a relative in Green River to say that the dam had broken. Overhearing the conversation, the reporter quickly called his newspaper, reporting a breach of the dam as fact. But the news editor called the Project Office for verification and was assured that the water was still in the reservoir and the panic story was squashed.

Still, there was need to be concerned. It was roughly estimated that the 234,000 acre-feet remaining in the reservoir on September 9, 1965, could create peak flows of over 100,000 c.f.s. if the dam breached. This is five times the maximum ever recorded in the river. A rough estimate was that a peak would take 16 hours to travel the 59 river miles to Green River and could crest there at 40 feet, sufficient to inundate a good share of the community.

Meanwhile, water was roaring downstream from the wide-open outlets and the canal at bankfull capacity as the reservoir drawdown continued. There was no problem beyond the town of Green River because enough storage space existed at Flaming Gorge Reservoir downstream to handle five times the total storage capacity of Fontenelle Reservoir.

Our emergency at Fontenelle did not end suddenly but subsided gradually. We knew that as the water level dropped, it was held back by an



increasing thickness of dam. After a week of tension, it was agreed that the crisis had passed. The dam would not fail.

Repair of Fontenelle Dam was spread over the next 26 months. Of obvious importance was extension of the grouting into the abutments so that reservoir water could never again leak into the dam from the side. A total of 214,230 sacks of cement, equivalent to 126 railroad carloads, was used in this additional grouting of the foundation and abutments.

The portion of the dam embankment replaced was 345 feet long and 60 feet high. Erosion damage to the stilling basins below the spillway and river outlet tube was repaired at the same time.

As I look back on these first few critical days at Fontenelle, one ironic incident stands out.

During the summer of 1965 a Wyoming lady visited Fontenelle Dam. She then wrote her Congressman expressing a feeling of concern about the dam. At the time of her visit high flows were passing over the spillway and water was seeping from the shale cliffs below the right abutment. Learning of this lady's interest, a Bureau of Reclamation official wrote on September 2, 1965, to assure her that careful and expert attention was being given the dam and that it was safe. Neither the high spillway flows nor the seeps were abnormal or believed hazardous.

The timing of her inquiry and the response, as related to events which took place beginning the morning of September 3, is nothing less than amazing. Feminine intuition certainly scored a clean triumph over engineering prediction. But in the final analysis that lady received a correct answer for the dam weathered a time of serious trouble. But it was a critical emergency that I, for one, will never



forget. This experience reinforces my pride in the Bureau of Reclamation and renews a faith in the understanding, stability, and good judgment of the people in this country. These qualities were abundantly demonstrated by everyone concerned across the Nation and particularly by the people of southwest Wyoming.

---

Note:

Mr. Bellport has prepared a comprehensive paper entitled "Bureau of Reclamation Experience in Stabilizing Embankment of Fontenelle Earth Dam." This paper was presented at the Ninth Congress of the International Commission on Large Dams, Istanbul, Turkey, in September 1967. It is an excellent authoritative reference for anyone interested in more detail and the technical considerations. Copies may be obtained from the Chief Engineer.









LEAK AT FONTENELLE DAM  
SEEDSKADEE PROJECT, WYOMING

September 1965

INTRODUCTION

Fontenelle Dam was built as the key water storage and diversion point for the Seedskadee Participating Project of the Colorado River Storage Project. The dam, which was completed in August 1964, is located on the Green River about 60 river miles upstream from the town of Green River, Wyoming. Factual information on Fontenelle Dam is given on Table 1 at the end of the report.<sup>1/</sup> Briefly, however, Fontenelle Dam is a rolled earth and rock structure with a maximum height of 127 feet above streambed, with a crest length of 5,450 feet, and with a total volume of fill of 5,300,000 cubic yards. Storage of water in the reservoir began in April 1964, and the reservoir was filled and began to spill for the first time on June 15, 1965.

On the evening of September 3, a very serious leak developed in the right abutment rock adjacent to the spillway. Possible failure of the dam was recognized promptly by Project Construction Engineer John L. Hatch, and he took the necessary action to alert all downstream points to prepare for that possibility.

---

<sup>1/</sup> All tables, figures, and photographs referred to in the text are bound at the end of the report.



The leaking water eroded a large cavity in the downstream face of the dam. Heavy rock was dumped into the cavity to arrest erosion by the leak which was coming out of the abutment rock. This was a successful effort. The outlet works were opened to full capacity and the maximum permissible releases were made from the two canal headgates.

With these timely actions, plus the sound and conservative design and construction features of the dam, a failure was averted.

This report gives a detailed, factual recounting of what happened and what was done during this emergency.

#### SITUATION AT THE TIME THE LEAK WAS DISCOVERED

Fontenelle Reservoir was filled on June 15. It spilled from June 15 to discovery of the leak on September 3. At the time of the leak, the entire flow to Fontenelle Reservoir, which was 1,700 c.f.s. on September 3, was passing over the spillway. A number of leaks, which had developed with filling of the reservoir, were flowing rather freely through the abutment rock around both the east and west ends of the dam. These leak flows, which totaled an estimated 75 c.f.s., offered no danger to the dam, but were being watched carefully. Rectification of these leaks was planned.

The outlet works had been closed on June 19 so that the Saguaro Construction Company could proceed with repairs on the outlet works stilling basin. This repair work was under way. Construction at the Fontenelle powerplant was proceeding with the single, 10,000-kilowatt generator to go into operation in October.



## EVENTS AT FONTENELLE DAM DURING THE EMERGENCY

A chronological summary of the events that took place follows. It covers the period of time from the discovery of the leak on September 3 (Friday) until the lifting of the alert on September 12 (Sunday). Two illustrations in particular should be referred to in reading the text. One is the high aerial oblique photograph with overlay which identifies features referred to in the text (see Photograph 1). The other is the annotated drawdown curve which indicates the timing of significant occurrences in the sequence of events (see Figure 1).

### Friday, September 3

Project Construction Engineer Hatch had been keeping close watch on the several leaks in the abutment rock at both ends of the Fontenelle Dam. It was his procedure to make careful observation of these leak areas every Friday and to prepare and forward a weekly report to the Chief Engineer's office.

In making his inspection of the leaks on Friday morning, September 3, he noticed at 10 a.m. a trickle of seepage near the east spillway wall opposite spillway station 4+35 at about elevation 6,455<sup>±</sup> feet. A small V-notch channel had been eroded by this trickle of water to a depth of about 18 inches.

At about 4 p.m. in the afternoon, Mr. Hatch and Inspector Dick Horsburgh observed that seepage at this point had increased to an estimated 1 c.f.s. and that additional erosion was taking place. Mr. Hatch asked the contractor doing the repair on the outlet works to fill the area and left Mr. Horsburgh to supervise that operation.





At about 6 p.m. Mr. Horsburgh reported to Mr. Hatch that the seepage had increased considerably and that the small front-end loader, which was the only equipment which could get to the site at the time, was unable to handle the material to fill the eroding area. Mr. Hatch went to the site immediately and observed that the seepage had increased significantly to an estimated 5 c.f.s. The erosion had worked headward into the downstream face of the dam about 50 feet from the 10 a.m. seepage point at a location about 50 feet east of the east spillway wall.

Mr. Hatch immediately returned to the office and tried to reach Mr. Fred Walker of the Denver office by telephone. He was unable to contact Mr. Walker but did reach Mr. Dick Larsen of the Denver office and reported the situation to him. Mr. Larsen instructed him to watch the leak and report back if it approached 20 to 25 c.f.s. He then returned to the dam where he observed that the leakage had increased to an estimated flow of 10 to 15 c.f.s. and that the erosion was progressing rapidly and had reached back an additional 20 feet from the 6 p.m. location.

Mr. Hatch returned to the office, called Mr. Larsen again, and told him he would alert the city of Green River, Wyoming, for possible evacuation, in the event of failure of the dam, and make arrangements for clearing the area along the Green River Valley of fishermen and residents who might be in danger.

He then tried to reach Regional Director Clinton and Assistant Regional Director Rippon but was unable to do so. He did reach W. F. Peterson, Regional



Engineer, and advised him of the situation and that he was going to alert the Valley.

Sometime between 7:30 and 7:45 p.m., Mr. Hatch called the Sweetwater County Sheriff, George Nimmo, advised him that there was a serious leak in the Fontenelle Dam, and arranged that the entire area in the Green River Valley below Fontenelle Dam should be alerted for evacuation in the event that the dam should fail. Mr. Hatch arranged with Sheriff Nimmo that the Bureau would send personnel down the Green River between the dam and the Thoman Ranch (about 23 river miles) to advise all ranchers and campers to leave the area immediately. Mr. Hatch also sent George Clark and Dick Horsburgh to the dam to maintain close observation of the leak and to keep him advised.

Messengers were dispatched to the Seedskaadee Development Farm and the Thoman Ranch to notify them of the dangerous situation and other Bureau personnel combed the Green River Valley notifying campers and the contractor's personnel at his trailer area.

Mr. Hatch notified Lincoln County Commissioner Brady and the Search and Rescue Group at Kemmerer, Wyoming. They promptly dispatched personnel to the area, bringing equipment to blockade all roads crossing the river and to assist in notifying campers in the area. The Lincoln County Sheriff provided radio-equipped automobiles to stand by at the Fontenelle Dam and at the Fontenelle Bureau of Reclamation office so they could promptly notify all concerned in event of failure of the dam.



At 9:30 p.m., W. F. Peterson reached Mr. Rippon and reported on the leak situation as he knew it from Mr. Hatch's earlier telephone call. Mr. Rippon in turn reported to Mr. Bellport. Both Mr. Rippon and Mr. Bellport contacted Mr. Hatch for a report. Mr. Rippon and Mr. Bellport then agreed to meet at Fontenelle Dam early the next morning.

Numerous telephone calls were received by Mr. Hatch from Colonel Elrod of the Wyoming Civil Defense organization in Cheyenne, from Mr. Willis Heikes of the Civil Defense organization in Green River, Wyoming, and from all the news media serving the area. In response to all calls, Mr. Hatch advised that the leak was serious and preparation should be made to evacuate all downstream areas immediately should the dam fail and word be received by them through the radio communications which had been established.

Mr. Hatch was in frequent telephone contact with Sheriff Nimmo, whom he kept fully advised, and who proved to be a steadying influence among the inhabitants downstream throughout the entire emergency period.

By no later than 10 p.m., the leak was judged to have stabilized at a flow estimated as someplace in the range of 15 to 20 c.f.s. This observation was reported to Chief Engineer Bellport during Hatch's telephone call to him at about 10 p.m.

#### Saturday, September 4

Chief Engineer Bellport, with Oscar Rice, Harold Arthur, and Richard Whinnerah, arrived at Fontenelle about 9:30 a.m. Immediate on-the-ground

inspection was undertaken. Assistant Regional Director Rippon and W. F. Peterson arrived at the dam about 10 a.m.

In the meantime, Mr. Simison in Salt Lake City contacted the newly appointed Regional Director, David L. Crandall, at Burley, Idaho. Mr. Crandall arranged for a charter airplane and flew to Fontenelle, Wyoming, arriving at the dam about 12 noon. Mr. Simison also made the first telephone report of the situation to Washington office personnel. He reached Assistant Commissioner G. G. Stamm at 9:50 a.m. He also reached Mr. Ottis Peterson at 10 a.m., who in turn said he would get in touch with Assistant Commissioner Bennett as soon as possible and advise him fully of the serious situation.

By midday, the cavity eroded by the 15-20 c.f.s. leak was 50 feet deep and 40 feet wide. (See Photograph 2.)

A number of decisions were made and actions subsequently taken following the inspection by Chief Engineer Bellport and the others who were present. These are as follows:

1. At about noon the contractor who had been doing the outlet works repair was instructed to remove his pumps, pipe, and all other equipment from that area and to breach the cofferdam as quickly as possible. He proceeded in accordance with those instructions.

2. The contractor's equipment was removed and the outlet works gates were opened at 3 p.m. to discharge 14,500 c.f.s. This was roughly equivalent to the 15,000 c.f.s. peak flow experienced on the Green River







below Fontenelle Dam during the peak spring runoff. The initial release of 14,500 c.f.s. was made to limit flows to the Green River channel capacity in order to "condition it" prior to increasing the release to the maximum possible and to allow downstream residents to prepare for higher overbank flows. (See Figure 2.)

3. In order to prevent further erosion of the dam embankment, a decision was made to place large rock (riprap that had been stored for future use) in the eroded area. The intended plan was to carefully place the rock by crane in order to provide a porous fill through which the water could escape and at the same time provide support for the embankment and prevent further retrogression. The crane operation was judged to be too slow by on-site engineers, and they decided to dump rock on the edge of the roadway and push it into the eroded area with a bulldozer. Hauling and dumping of rock was started in the afternoon and continued during the night.

4. As early as possible the headgates of the East and West Canal diversions would be opened to permit the maximum practicable releases. Before those headgates could be opened, escape channels across the natural terrain had to be prepared to handle the flows which would be released.

5. Notice was given downstream along the entire Green River Valley regarding the increased releases at Fontenelle Dam so that they could be prepared for an abrupt rise in water surface.



6. The first formal press release on the situation was issued at about 5 p.m. In this release the Chief Engineer characterized the situation as "serious but not critical." This conclusion was based principally on the conclusion of everyone concerned that the water was entering bedrock at some point beneath the water surface of the reservoir, traveling through bedrock, and emerging in the earthfill where it was eroding along the contact between the bedrock and the embankment. The fact that the leak flow had not appeared to increase during the day supported this conclusion. If the estimated 15 to 20 c.f.s. were leaking directly through the fill, the dam unquestionably would have failed by this time. In this press release and all subsequent releases, until the first measurement of the leak flow on Monday, September 6, a figure of 20 c.f.s. was used for the estimated volume of the leak flow.

The Chief Engineer and his party returned to Denver, leaving the dam at about 5 p.m.

Throughout the evening, numerous telephone contacts and reports were made to Washington, Denver, officials of the State of Wyoming, and the Sheriffs' offices of both Sweetwater and Lincoln Counties, and to news media who called frequently during the night. A 24-hour watch was established and the alert to possible evacuation maintained.

#### Sunday, September 5

Early in the morning of September 5, the leak flow was observed to be



unchanged in volume, and the placement of rock in the eroded area continued. No further erosion was taking place. At 8 a.m. the outlet gates were opened to full capacity of 17,000 c.f.s. (See Figure 2 and Photograph 3.) The 14,500-c.f.s. releases had prevailed for about 15 hours so that the channel downstream should have been conditioned and the residents downstream prepared for higher flows. It was realized that higher releases would result in some overbank flooding, but this was considered a circumstance necessary to accomplish the most rapid evacuation of the reservoir.

Preparation work necessary to opening of the canal headgates was completed and the West Canal gates were partially opened at 3 p.m. and increased to wide open at 6 p.m. to release about 1,200 c.f.s. (See Photograph 4.) The East Canal gates were opened at 6 p.m. to release about 400 c.f.s. Thus, the total releases at Fontenelle Dam at 6 p.m., September 5, were estimated to be about 18,500 c.f.s. This was the maximum possible release, and subsequent releases would begin to diminish slowly as the reservoir level receded.

The dumping of rockfill in the eroded area was effective in arresting further erosion of the embankment. The rock contained considerable fine material, and when mixed with additional fine material that was eroded from the embankment as the rock slid down the face, the mixture of riprap and fine material rendered the rockfill relatively impervious to the leak flow. As this material covered the opening in the embankment from which the leak was emerging (see Photographs 5 and 6), it caused the leak flow to emerge at a somewhat higher elevation which caused some further erosion of the embankment above and upstream from the leak.



At about 3 p.m. the flow of water from the leak began a series of rather violent surges. During each surge of flow, the volume of discharge increased significantly and the emerging flow was much more heavily laden with suspended materials. (See Photograph 7.) Following each surge, the leak flow dropped off to a very small amount, giving the appearance that the flows were momentarily stopped. It was the consensus that the rockfill was damming the emerging leak flows, causing and accelerating the erosion and internal caving of the embankment.

The reservoir water surface at the time of the surges was about elevation 6,504 feet, or 46 feet higher than elevation 6,458 feet where the leak flow was emerging. Also, the minimum effective thickness of the original embankment of the dam from the water line to the eroded cavity was about 85 feet, of which about 20 feet was Zone 1 material. (See Figures 3 and 4--note that sink hole did not occur until the next day.) For these reasons, breaching of the dam was considered a possibility. The placement of additional rockfill was discontinued. The conditions observed in connection with the surging flows were reported to Mr. Bellport and he concurred in the decision to stop placement of the rockfill. Some 2,300 cubic yards of rock had been placed in the leak area, and this material stopped further deepening and downstream erosion. The surging flows were variously reported by observers as stopping as early as 4 p.m. and as late as 8 to 9 p.m., and the leak flow again stabilized at the estimated 15 to 20 c.f.s.

Sunday night found rather heavy thunder showers prevailing in the area. Rains were not continuous, but heavy, prolonged, rainfall was experienced followed by short periods of little or no rain. The principal effect of the occurrence





of this rain was the increase in inflow to the reservoir, thus retarding drawdown of the reservoir and causing some concern over the increase of the Green River flows downstream from Fontenelle Dam.

During the day, Chief Photographer Stan Rasmussen undertook a photographic effort which was to continue several days. He not only photographed the situation involving the surging flows and other significant photographs at the Fontenelle Dam, but also made a photographic survey of Green River flows and the overbank flooding which was taking place from the Fontenelle Dam downstream through Green River, Wyoming. In this connection, a fixed-wing aircraft (Cessna 182) was utilized in the photo flights and in moving personnel as necessary between Green River and Fontenelle, Wyoming. The plane was able to land on a section of county road adjacent to Fontenelle, Wyoming, and at the Green River airstrip.

Also, arrangements were made with Mr. Benson, Project Power Manager, Montrose Power Operations Center, for the use of the Bureau of Reclamation helicopter so that it would be available for use in alerting isolated people in the Green River Valley downstream in event of failure of the dam.

L. E. Holmes, Chief, Division of River Control, Region 4, arrived at Green River, Wyoming, at 11 a.m., Sunday, September 5, where he was stationed throughout the emergency to advise and assist State and local officials in preparing for the high flows which would result from releases at Fontenelle Dam and for evacuation of vulnerable areas should Fontenelle Dam fail. John Georges, Supervisory Civil Engineer, Fontenelle Dam, arrived at Green River the afternoon of the 5th and assisted Roy Holmes.



Immediately on arrival, Mr. Holmes met with Sweetwater County Sheriff George M. Nimmo and Mayor William Luzmoor, and with them made a field inspection of the areas which would be subject to overbank flooding in the town of Green River. The river bank sections which would need additional protective work in view of the anticipated high flows were identified. He also advised them regarding the serious situation occasioned by the leak in Fontenelle Dam. He reassured them to the extent that the magnitude of the leak flow was remaining constant and that the leak was coming through the abutment rock and not through the fill. He emphasized that the Bureau of Reclamation was hopeful that the reservoir level could be drawn down before there would be any breaching of the dam. Later that evening, Sweetwater County, upon the order of County Commissioner and Civil Defense Coordinator Willis Heikes, arranged for heavy equipment to begin reinforcing dikes in the vulnerable area behind the rodeo grounds.

At about 10 p.m. Holmes and Georges met with Mr. Willis Heikes and Sheriff Nimmo to discuss the preparations for possible emergency evacuation. These Sweetwater County officials advised Mr. Holmes that if word of failure of Fontenelle Dam was received, the following steps would be taken immediately:

1. Send all police vehicles to stop all traffic into the town of Green River.
2. Evacuate four ambulance cases from the south side of Green River.
3. Sound the fire siren in town and send police cars through the town with bull horns, awakening and ordering people to evacuate homes.



4. Dispatch buses to both sides of the river to transport people to public buildings on high ground on both sides of the river.

5. Have company personnel of Mountain Fuel Supply Company and the power company cut off gas and electricity in the town.

6. Make a house-to-house search of the south end of town to ascertain that occupants had departed.

Detailed plans to furnish food, water, and bedding had not been made, but these contingencies could be handled if the emergency developed. In the event of failure, immediate word would be received at Green River by radio from the Lincoln County Sheriff who had personnel stationed with a radio-equipped car at Fontenelle Dam on a round-the-clock basis. Sheriff Nimmo had notified all ranchers and industries between the town of Green River and Fontenelle Dam to evacuate their homes immediately. Some of the ranchers decided not to move but to take the chance that the dam would not fail.

Telephone reports, which became a daily procedure, were made to appropriate Federal, State, and local officials to keep them completely and accurately informed.

Constant contact was maintained by telephone with the local and regional news outlets, particularly the Associated Press and United Press International in Cheyenne, Wyoming. Through these wire services radio and television stations were kept fully and currently informed of the situation at Fontenelle Dam.



A number of representatives of news outlets were on hand. These included representatives of three Salt Lake and one Casper television stations, a Lander radio station, and the Salt Lake Tribune.

Throughout the emergency, the public was permitted to view the leak area from a high, safe point on the right abutment. Many came during the Labor Day weekend. (See Photograph 8.)

Two-way radios were provided by Mr. Rudy Mecca of Kemmerer, Wyoming, on a volunteer basis so that Bureau of Reclamation personnel at the dam and in the Fontenelle office had direct and continuous means of communication.

#### Monday, September 6

The flow of the leak seemed to remain steady in magnitude. Heavy releases continued from Fontenelle Reservoir with water being discharged from the river outlet works and from the East and West Canal headworks to the maximum which was considered safe. The West Canal was operated at maximum capacity, but the East Canal discharge was limited because its erosion channel tended to swerve back toward the toe of the dam.

Rainfall continued as moderate thunder storm precipitation throughout September 6, although not as heavy as was experienced during the previous night. This rainfall increased the inflow to the Fontenelle Reservoir as indicated by the inflow reading of 1700 c.f.s. on Saturday, September 4, at the time heavy releases were initiated from the reservoir as compared with the September 7 noon measurement of 2,890 c.f.s.

The releases from Fontenelle Reservoir were decreasing slightly from the 18,500 c.f.s. measured the day before. Mr. Holmes reported from Green River, Wyoming, that the river was rising steadily with a measured discharge of 16,500 c.f.s. late in the day. (See Figure 2 for gage readings below Fontenelle Dam and at Green River, Wyoming.)

As shown in the photographs taken prior to this time (see Photograph 9), the leak flows were entirely or partially discharging over the east spillway wall into the toe of the spillway chute. On the morning of September 6, equipment was moved into the area below the leak and the leak flows channelled parallel to the east wall of the spillway. A 4-foot weir was installed adjacent to the lower end of the spillway wall with the leak flows directed over the weir. The first measurement of the leak flow was made by the United States Geological Survey early on the afternoon of September 6. They measured the flow as 5.7 c.f.s. (See Figure 5 for subsequent leak flow measurements as the reservoir was drawn down.)

At about 4:45 p.m. a sudden and alarming incident occurred. A 15' x 20' area on the upstream half of the crest road on the dam adjacent to the spillway bridge suddenly and completely collapsed. (See Photograph 10.) This collapsed area was referred to as the "sink hole." Immediate inspection of the sink hole was made by Project Construction Engineer Hatch and his men. (See Photograph 11.) By measurement it was determined to be 30 feet deep and was observed to bell out or widen to the east and to the south. The widening to the south was in







the direction of the eroded leak cavity. Mr. Hatch was able to see bedrock on the west side of the cavity and to observe some water coming out of the bedrock at that location and percolating down through the material forming the bottom of the sink hole. It was decided to fill the cavity immediately by bulldozer which simply pushed nearby riprap from the face of the dam into the sink hole. (See Photographs 12 and 13.) The purpose in filling the hole was to stabilize that area and to prevent further collapse.

The danger at this time was that further collapsing could bring about the beginning of a breach in the dam, since the water surface level at that time was about 11 feet higher than the bottom of the 30-foot sink hole, and only 45 feet of undisturbed embankment (of which only 15 feet was Zone 1 fill) stood between the sink hole and the water surface of the reservoir. (See Figures 3 and 4.) As far as could be observed, the collapsing, which formed the sink hole, did not affect the discharge from the leak.

The newspapermen at the site were fully informed on our appraisal of the cause of the sink hole and its significance. Also, the facts concerning the sink hole were fully reported by telephone to the wire services and other news media. Reports were made immediately to the Bureau of Reclamation offices in Washington and Denver and to Wyoming State offices.

A 24-hour watch was maintained with continuing downstream alert to the still possible failure of the dam. The personnel of the Saguaro Construction Company, the contractor for the river outlet repairs, remained stationed at the dam in



the event of the need for further effort on their part in connection with any situation which might develop.

On Monday, September 6, at Green River, Wyoming, Mr. Holmes inspected the dikes that were being raised in the town of Green River and was of the opinion that the dikes would be adequate to contain the rise in the river which would result from maximum discharge in the river outlets and two canal headings at Fontenelle Dam.

Mr. Holmes met with Brigadier General Robert Outsen, the Wyoming State Adjutant General and head of the Wyoming State Civil Defense organization. He gave General Outsen the complete details on the situation at the dam and on the emergency preparations which had been made for evacuation of the town of Green River, should it become necessary. General Outsen agreed that all had been done that could be done to protect the lives of the people in the Green River Valley below Fontenelle Dam.

John Georges returned to Fontenelle to assist with matters at the dam.

#### Tuesday, September 7

Drawdown of Fontenelle Reservoir continued at the rate of about 4 feet per day. The rain of the two previous days ceased with clearing weather. The leak flows diminished slightly which seemed to be a response to the decreasing head as the reservoir was lowered. (See Figures 1 and 5.)

Chief Engineer Bellport, Harold Arthur, Ralph Gullett, and Fred Lippold arrived at the site on the morning of the 7th. Discussions were held with Mr.



Harrison of the Saguaro Construction Company. Mr. Bellport's assessment of the situation was that it "remained serious but was improving rapidly" as the reservoir level was drawn down. The reasoning behind this conclusion was the fact that the leak was slowly diminishing combined with the gain of a 3-foot width of earth embankment for every one foot of drawdown in the lake level. Furthermore, the drawdown of the lake would soon reach a much thicker section of Zone 1 material below elevation 6,494 feet--the top of a wedge-shaped, Zone 1 berm or terrace, adjacent to the right abutment rock. (See Figure 6.)

The riprap fill in the sink hole continued to slowly subside, but this was not of particular concern since subsidence of the material reflected consolidation of the riprap and continued removal of fine material at the base of the hole by the leak flows.

General Robert Outsen, Acting Adjutant of the State of Wyoming, visited the dam and was given a complete tour of the dam and explanation of the situation by Regional Director Crandall. Arrangements were made for aerial mapping of Fontenelle Dam and vicinity and of the Green River from the dam to the head of Lake Powell. A flood damage survey including aerial and oblique photographs, as well as on-the-ground investigations, was begun by the representatives of the Region 4 office.

Mr. Holmes had been maintaining careful and continuous observations of stream flow gage heights and discharges at Green River, Wyoming. He recorded the peak flow at Green River as 16,900 c.f.s. at 9:10 a.m. (See Figure 2.) In this connection, the U. S. Geological Survey recorded the flow at the gates below Fontenelle Dam that morning as 17,350 c.f.s.





Wednesday, September 8

On the morning of September 8 the reservoir level fell below the important Zone 1 berm at elevation 6,494 feet. (See Figure 6.) For the first time a feeling of moving out of a serious situation began to be felt. The placement of this Zone 1 berm was a change made during construction of the dam to better cover the rock of the right abutment. The realization of the significance of the conservative approach to earth dam design, as evidenced by the presence of this Zone 1 berm adjacent to the troublesome right abutment rock, was accentuated as this berm level was reached.

Continuing contact was had with the press, although all of the reporters who had been at the dam had left. Regular telephone contact was maintained with news outlets in which the simple facts were related and the continuing explanation given that the situation remained serious but was improving.

Messrs. Crandall and Holmes, at a dinner meeting in Green River, met with Governor Hansen, Sheriff Nimmo, Mayor Luzmoor, City Councilman Pershin, Green River Star publisher Adrian Reynolds, County Commissioners Ferrero and Heikes, and the Green River Chief of Police, Glen Butcher. Mr. Crandall explained fully the situation at the dam, including the size and location of the leak, our opinion as to the cause of the leak, the chance of failure of the dam, and the latest reservoir levels and quantity of water evacuated from the reservoir. Mayor Luzmoor and Sheriff Nimmo briefed the Governor on evacuation plans. Holmes explained that the Bureau's best judgment of what would happen should the dam



break was that a rise in the river level at Green River would be experienced within two hours but that the peak flow would arrive in about 16 hours and would total 120,000 c.f.s. The crest of that peak discharge would be about 40 feet above the river level prevailing at that time, and the peak would probably inundate all of the portion of the city of Green River located south of U. S. Highway 30. Estimated hydrographs of the flow of the Green River at Fontenelle Dam and at Green River, Wyoming, assuming failure of the dam, are attached. (See Figures 7 and 8.)

Thursday, September 9

The situation remained stable on September 9 with the continued drawdown of the lake level at about 4 feet per day. The early evening measurement of the leak flow indicated that it had decreased to 4 c.f.s., a reflection of the decreasing head produced by the lowering of the lake level.

Governor Hansen, accompanied by Sheriff George Nimmo and Green River Star publisher Adrian Reynolds, visited the dam in the morning. Mr. Crandall took him on a complete tour of Fontenelle Dam, on the ground and by helicopter. That afternoon Governor Hansen gave an interview to the Rock Springs Daily Rocket which commented very favorably on the actions of the Bureau of Reclamation in this crisis and which was undoubtedly most reassuring to the local people. A copy of that article is attached.

In the afternoon Mr. Crandall participated in a 45-minute interview on Radio KVRS, Rock Springs, Wyoming. The program, which originated at a coffee counter



in a bakery in Green River, Wyoming, had been advertised by spot announcements all day, so that it undoubtedly had a large audience at the 4 p.m. air time. Reverend Eugene Todd, who handles a regular program called "The Coffee Counter," was a most cooperative interviewer. The regular following of his program numbers 9,000 people, but a larger number probably listened to this special program. The program went according to the script which the Bureau of Reclamation had prepared. Without doubt this was a most reassuring public statement on the part of the Bureau of Reclamation as far as the people of the Green River-Rock Springs area were concerned. A copy of the program transcribed from the tape is attached.

#### Friday, September 10

The situation continued stable with the reservoir drawdown continuing and with a slow decrease in the volume of the leak flow. The sink hole area continued to subside, and as subsidence took place additional material was placed in the sink hole.

Aerial mapping photographs were taken of Fontenelle Dam and vicinity and of the Green River Valley between the dam and Green River, Wyoming.

Interest among the news media showed a significant decrease.

#### Saturday, September 11

The situation remained stable with continued improvement in terms of drawdown and diminishing leak flow. It became evident that the reservoir drawdown would soon reach the Zone 2 berm at elevation 6,480 feet. (See Figure 4.) Consideration w



given to the desirability of lifting the alert status, since the effective thickness of the embankment between the leak area and water surface would then exceed 200 feet. Mr. Crandall discussed lifting the alert with Mr. Bellport, and it was agreed that Mr. Crandall would call Mr. Bellport at 9 a.m. on Sunday morning with regard to lifting the alert.

Sunday, September 12

Mr. Crandall in a telephone conference with Mr. Bellport received approval to lift the alert. A press release was prepared and telephoned to the local and regional news media.

Mr. Crandall and others who had been on duty since the beginning of the emergency left Fontenelle, Wyoming, that afternoon.











PHOTOGRAPH 1

High aerial with identification of the features referred to in the text.

Note: All photographs, except Photograph 2, taken by Stan Rasmussen, Chief Photographer, Bureau of Reclamation. Photograph 2 by Martin Einert, Bureau of Reclamation, Fontenelle, Wyoming.







PHOTOGRAPH 2

First photograph of the leak area. Taken Saturday afternoon, September 4, 1965. Leak flow stabilized at estimated 15-20 c.f.s. with flow emerging at contact of bedrock and embankment.









PHOTOGRAPH 3

17,000 c.f.s. discharge from outlet works when opened fully at 8:00 a.m. Sunday, September 5, with reservoir water surface at 6,505 feet. Note backfill along wall had been removed by contractor prior to the leak.



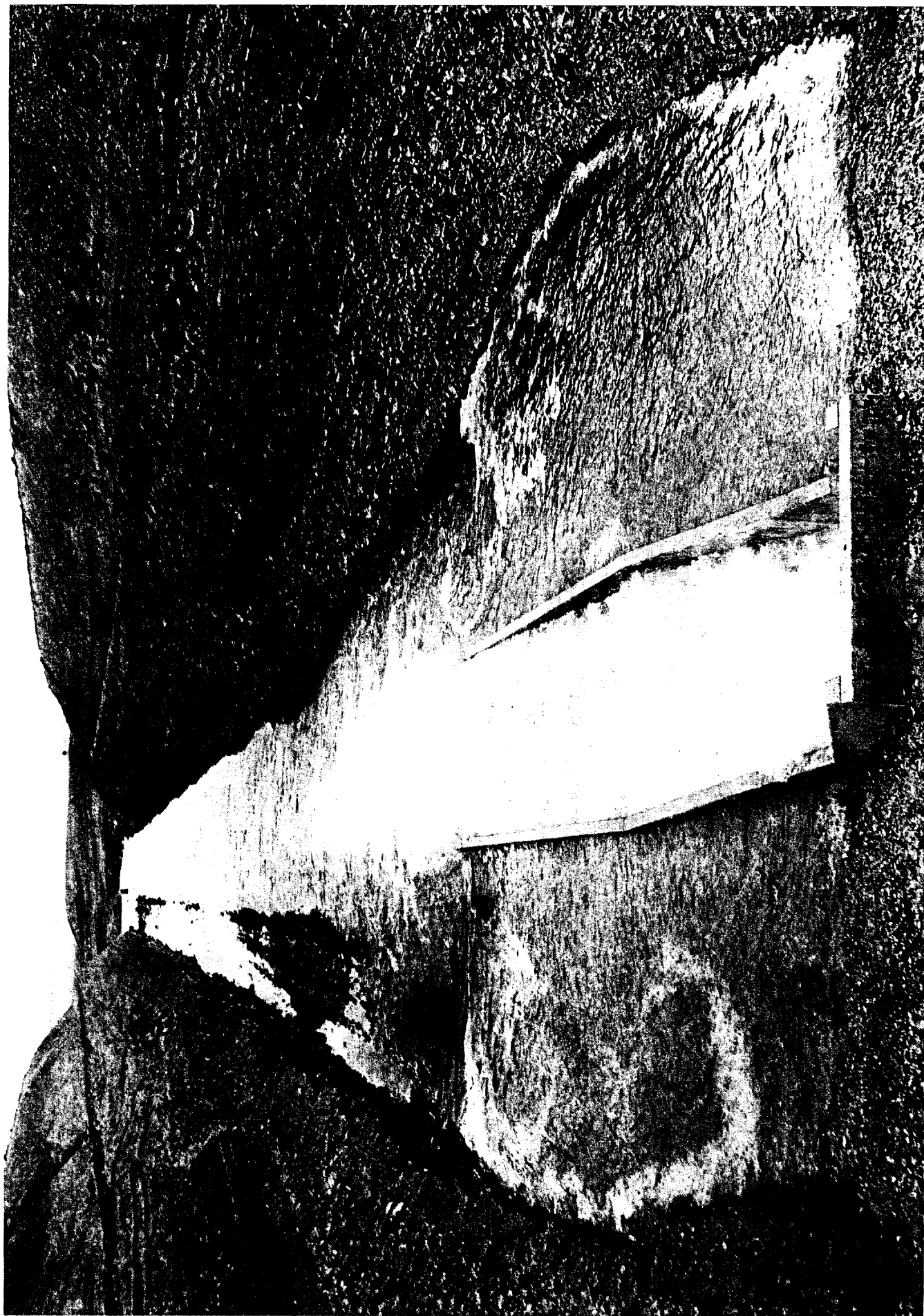




PHOTOGRAPH 4

West Canal discharge 1,200 c.f.s. Opened to full capacity  
at 6:00 p.m., Sunday, September 5.





1995-1996

1994-1995-1996

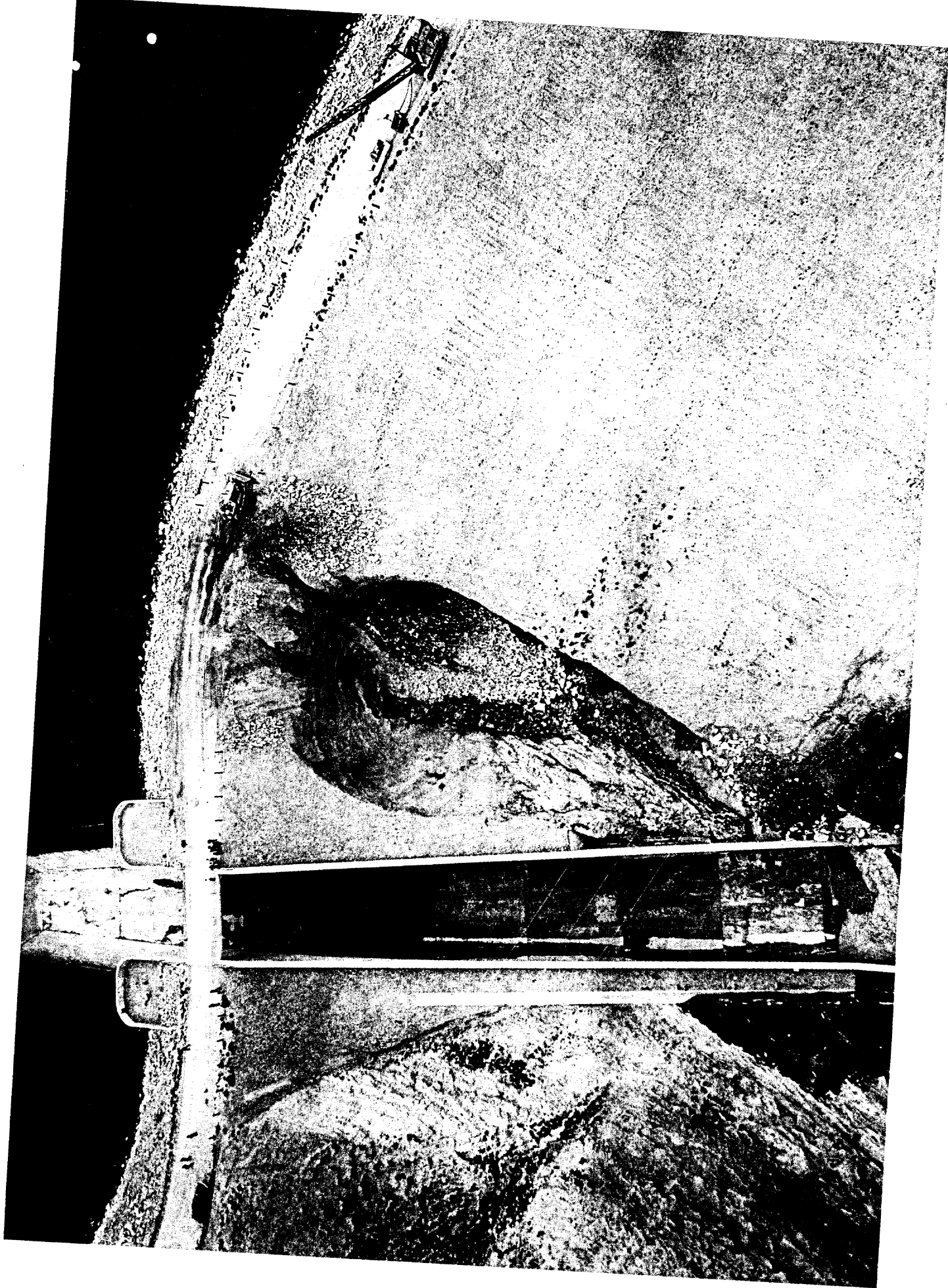
1994-1995-1996  
1994-1995-1996  
1994-1995-1996



PHOTOGRAPH 5

Rock dumped on crest road was pushed over the side to drop into the path of the leak flow. - The leak water tumbles down rocky materials and erosion is arrested below point of emergence.

Sunday September 5.



154-200-1473

320

154-200-1473



PHOTOGRAPH 6

The rock pushed into the cavity piled up in front of the leak opening in the embankment and caused the leak outflow to rise vertically somewhat as the opening became choked. Sunday, September 5.





ORIGINAL PHOTOGRAPH  
SERIALIZED 10/15/68  
INDEXED 10/15/68  
OCT 15 1968  
FBI - MEMPHIS

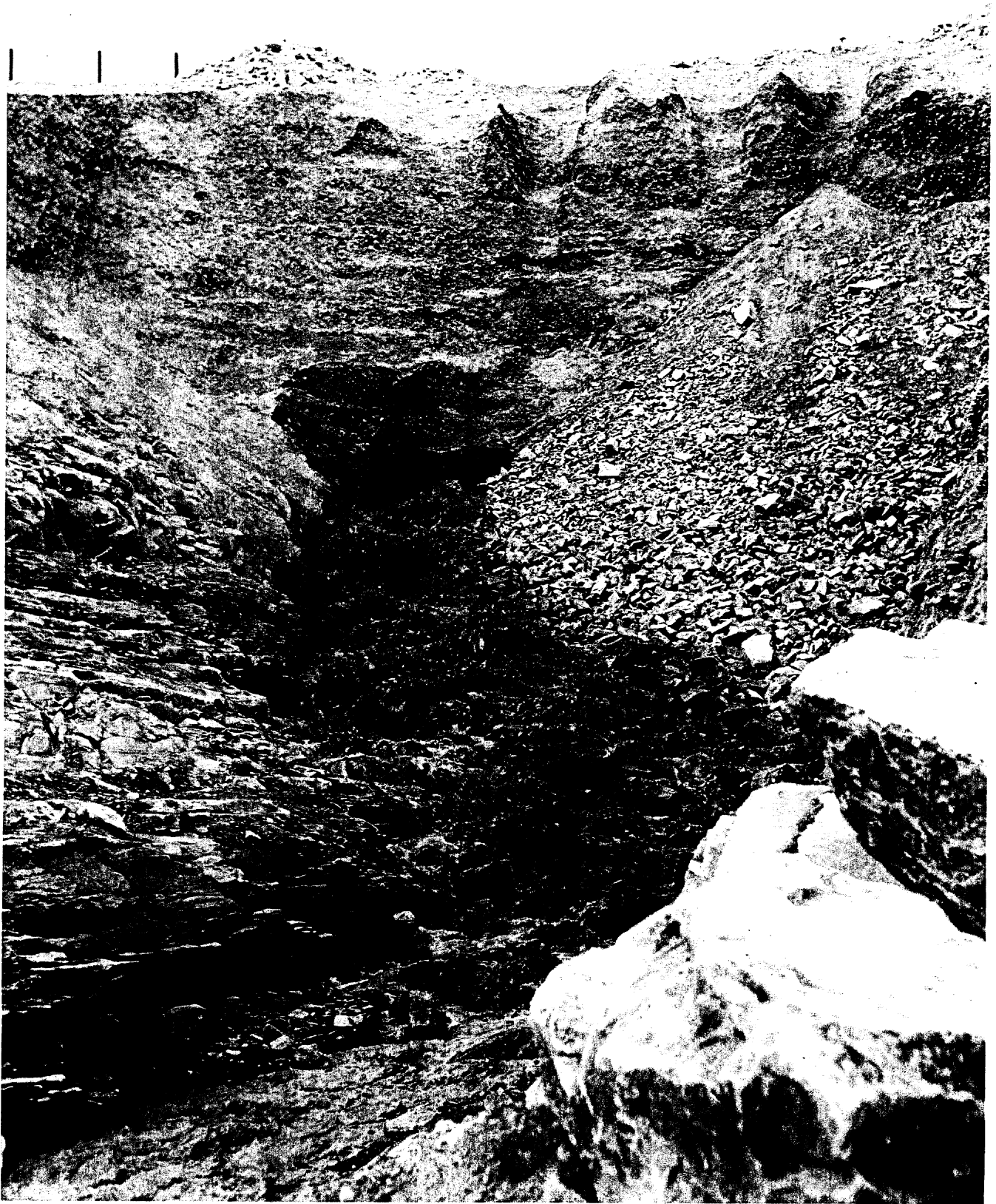
151-100-1420

SEP 1 1968



PHOTOGRAPH 7

At the peak of each surge in leak flow, muddy water gushed from opening in notably increased volume. Surges began before 3 p.m., Sunday, September 5.



RECEIVED  
GENERAL INVESTIGATION  
DIVISION  
FEDERAL BUREAU OF INVESTIGATION  
U. S. DEPARTMENT OF JUSTICE  
WASHINGTON, D. C. 20535

10-1-75 1479

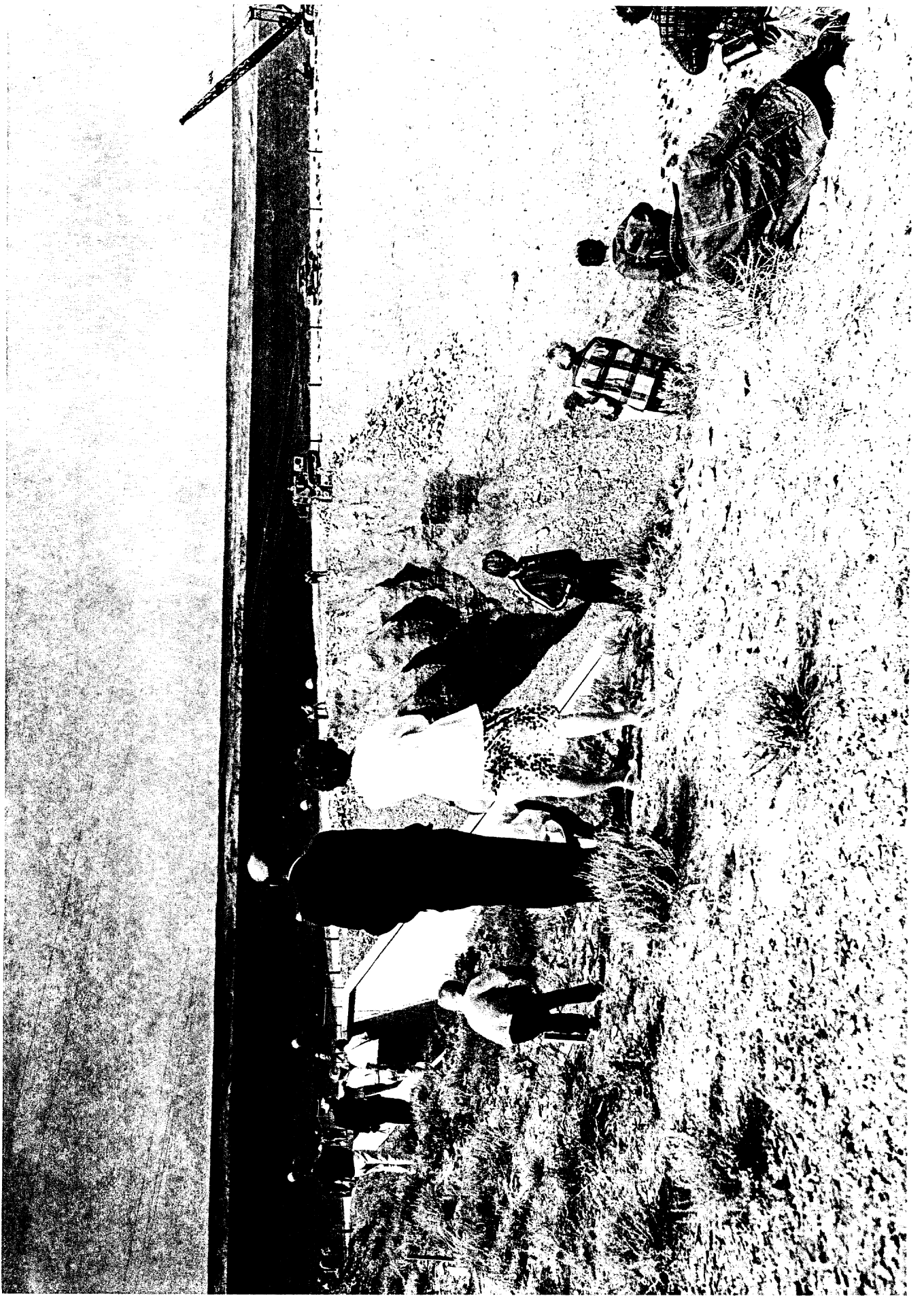
10-1-75



PHOTOGRAPH 8

A large number of people visited Fontenelle Dam during the leak emergency which occurred on the long Labor Day weekend. All were able to view the leak area from a safe high point on the right abutment.





104-10000-1475

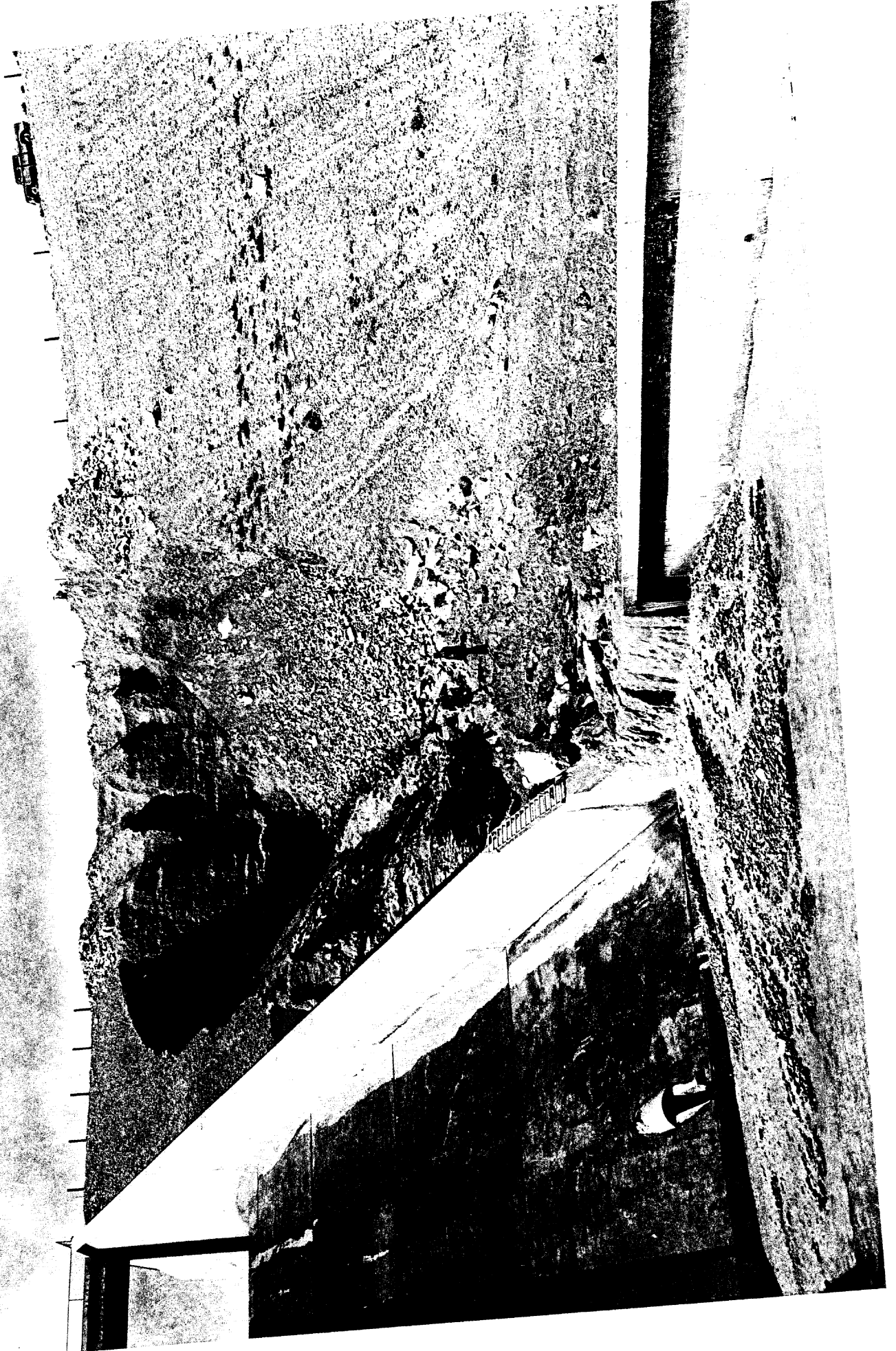
104-10000-1475

104-10000-1475



PHOTOGRAPH 9

Most of the leak flow plunged over the spillway wall into the stilling basin. It was necessary to excavate a channel parallel to the wall and install a weir before the leak flow could be measured. Photograph taken Sunday, September 5; first weir measurement made early afternoon, Monday, September 6.



1918

154 - 100 - 148

1918  
154 - 100 - 148



PHOTOGRAPH 10

The "sink hole" formed by sudden collapse of the upstream half of crest road at 4:45 p.m., Monday, September 6, was critically near the upstream face of leak area cavity.





Handwritten text, possibly a signature or name, enclosed in a rectangular box.

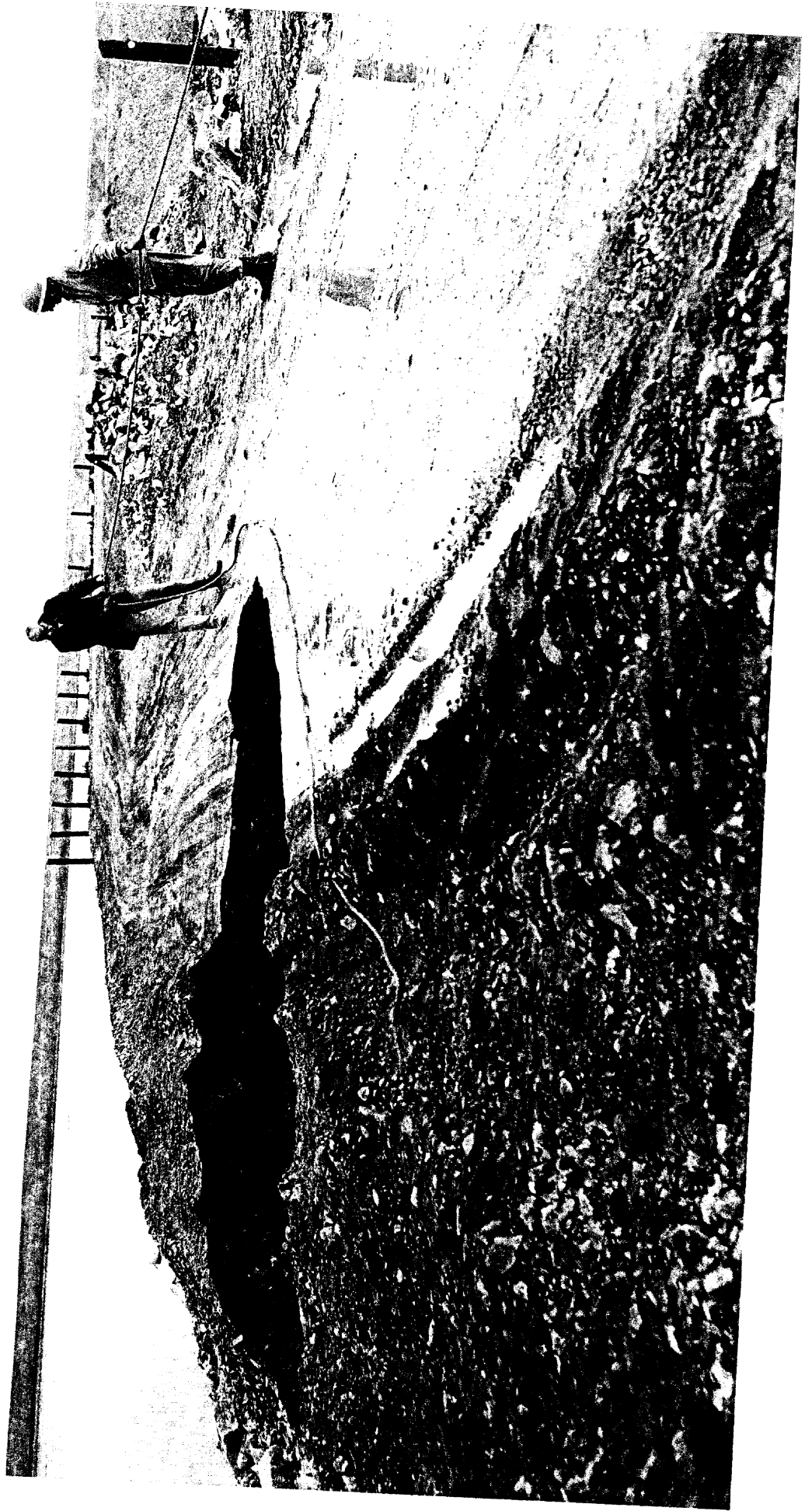
1721 - 1722

1721



PHOTOGRAPH 11

Project Construction Engineer John Hatch and his men immediately measured the depth of sink hole at about 30 feet; observed water flowing from exposed bedrock on the west side of sink hole (nearest camera); and noted that the bottom of the hole belled out to the east and south (toward leak cavity).  
Monday afternoon, September 6.



1840

1840-1849



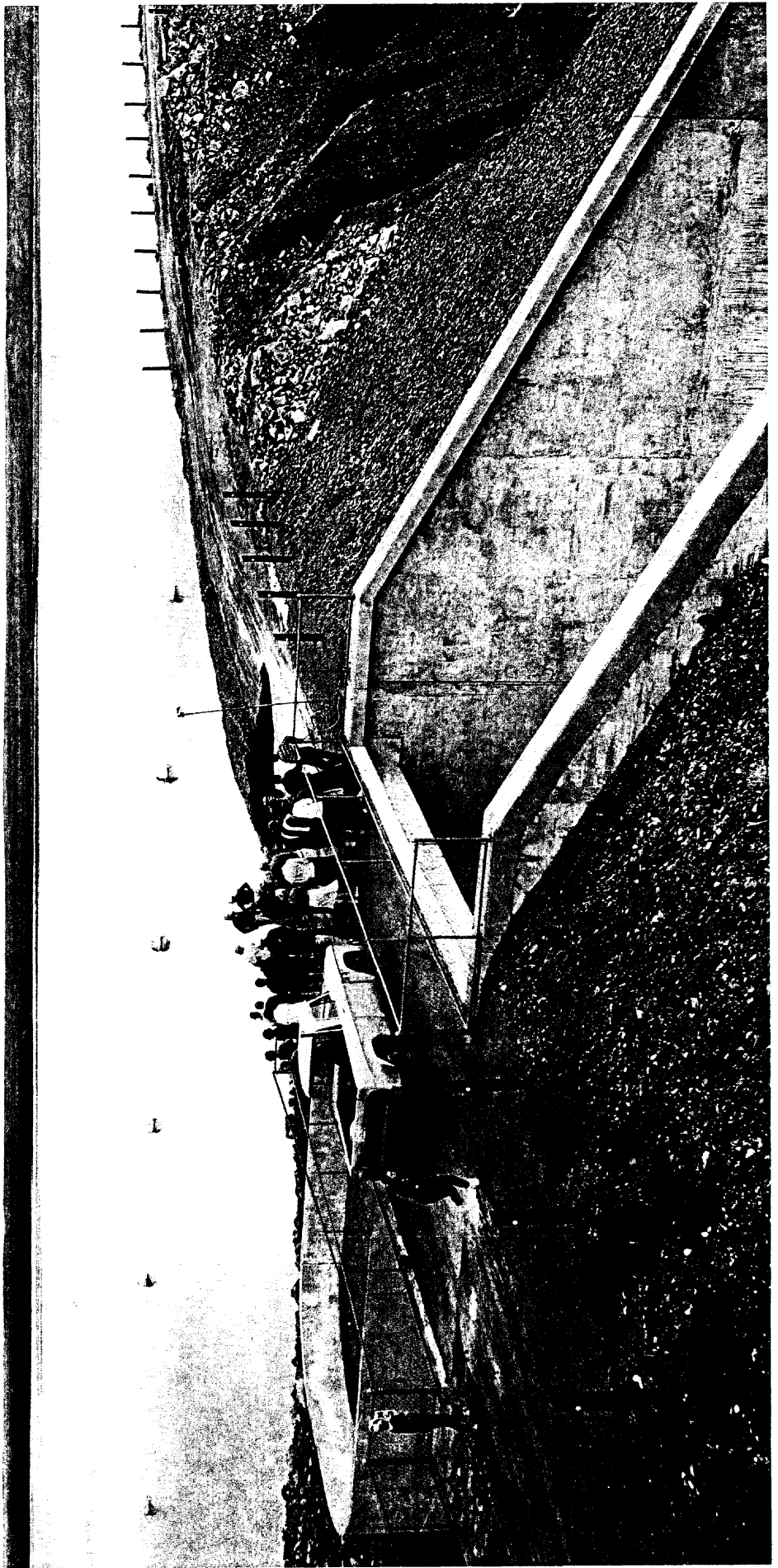


PHOTOGRAPH 12

Immediately following observation of the size and shape of the sink hole, the bulldozer pushed riprap from upstream face of dam into the sink hole to fill and stabilize the collapsed area.

Monday afternoon, September 6.







PH 4-100-1443

PH 4-100-1443



PHOTOGRAPH 13

Looking into sink hole as it is being filled by bulldozer,  
Monday afternoon, September 6.



THE UNIVERSITY OF CHICAGO  
LIBRARY  
1100 EAST 58TH STREET  
CHICAGO, ILL. 60637

1435

1435



PHOTOGRAPH 14

Discharge of 15,780 c.f.s. on Thursday, September 9, fills channels around the Fontenelle Powerplant which sits on bed-rock. Upper left is delta built by discharge from West Canal.





GENERAL INFORMATION  
MAY 11 1964  
15A-440-1512

15A-440-1512

15A-440-1512



PHOTOGRAPH 15

Fontenelle Dam on Thursday, September 9. West Canal discharge and delta in right foreground; East Canal discharge in upper right.







PHOTOGRAPH 16

Erosion by leak flow, measured at about 4 c.f.s. on Thursday, September 9, has been stabilized. Reservoir level had been lowered to about elevation 6,490 feet, with effective thickness of undisturbed embankment at 100 feet in minimum critical dimension.





154-400-1525  
SALT LAKE CITY, UTAH 84143

154-400-1525

REC-10000

PHOTOGRAPH 17

Fontenelle Dam on Thursday, September 9, with reservoir level at about elevation 6,490 feet--drawn down about 17.5 feet from 6,507.40 level at start of evacuation, but still 32 feet above level of emerging leak flow. Rate of drawdown, about 4 feet per day at this time. Each 1 foot of drawdown added 3 feet to width of embankment between waterline and leak cavity.





6021-000-1509

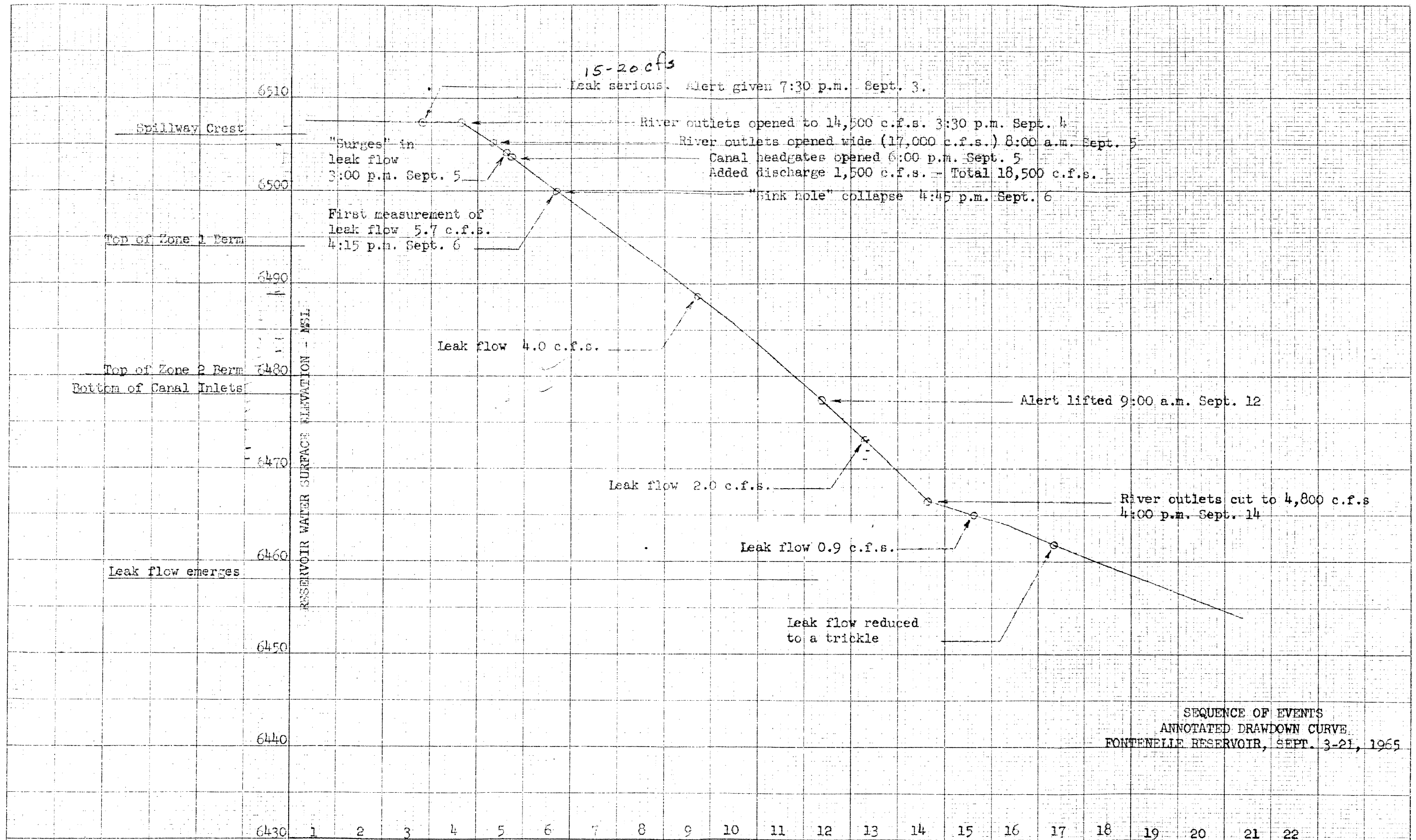
6021-000-1509

6021-000-1509  
6021-000-1509  
6021-000-1509









SEQUENCE OF EVENTS  
 ANNOTATED DRAWDOWN CURVE  
 FONTENELLE RESERVOIR, SEPT. 3-21, 1965

FIGURE 1

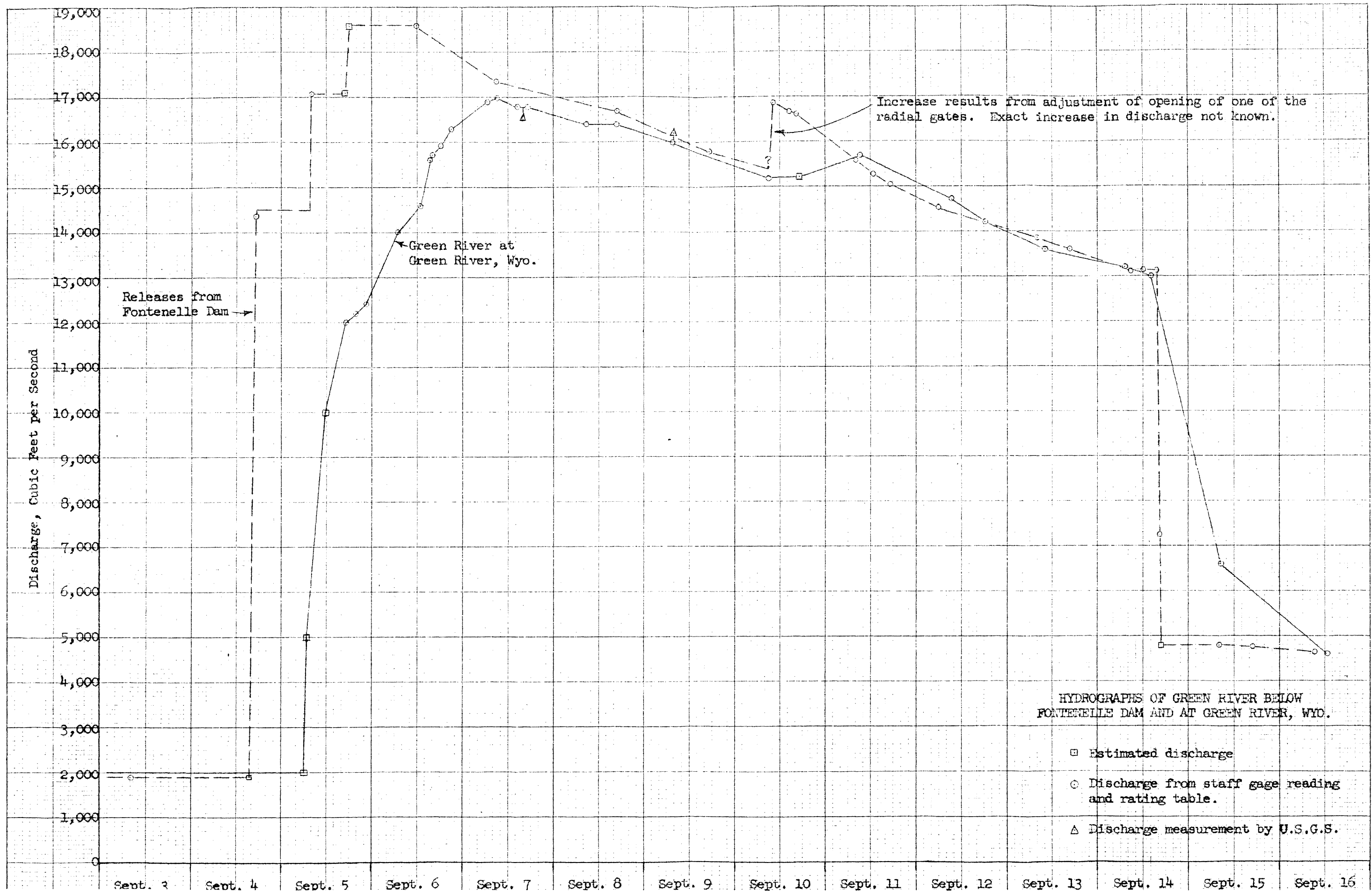
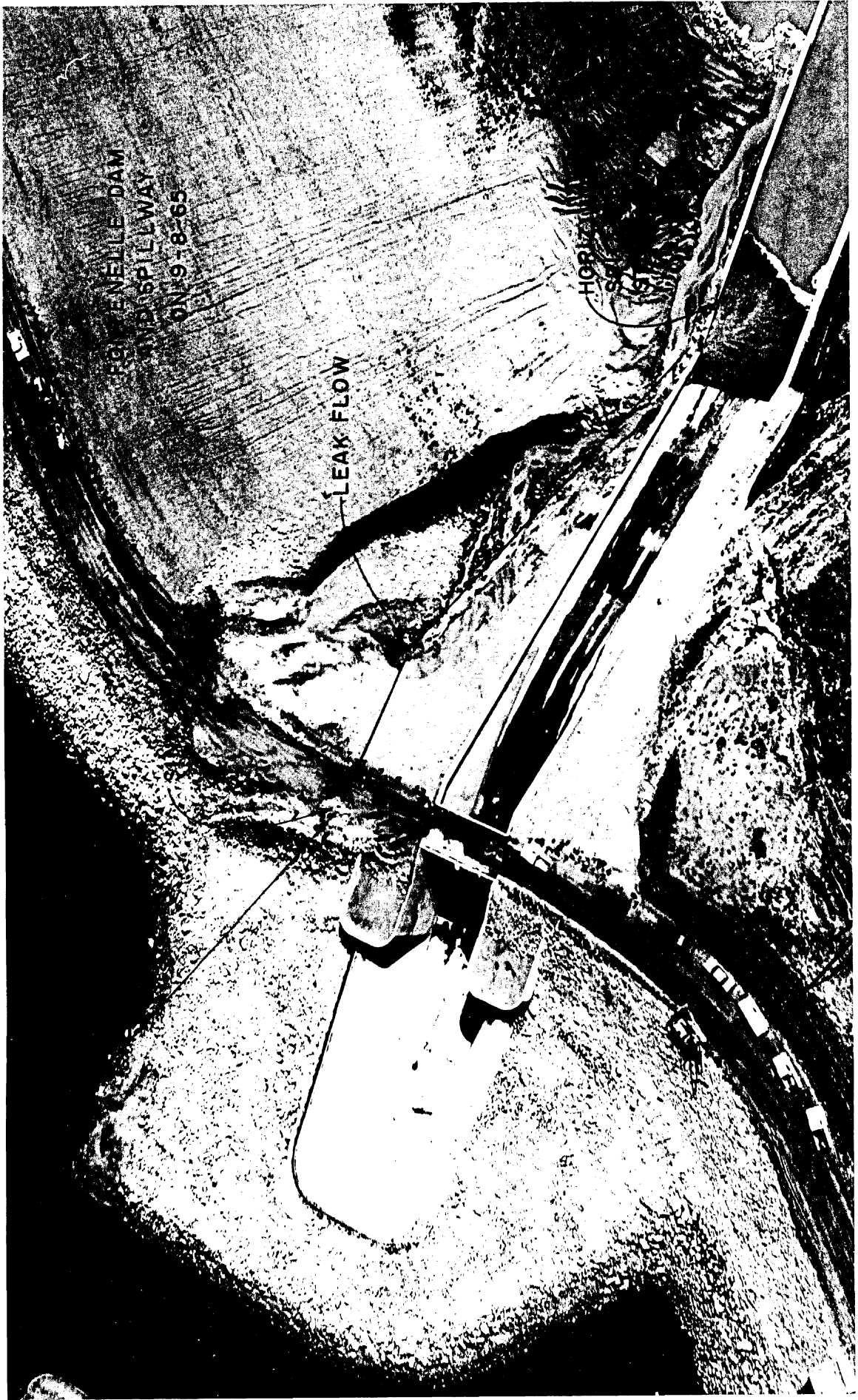




FIGURE 3

Location of Cross Section "A" (see Figure 4).

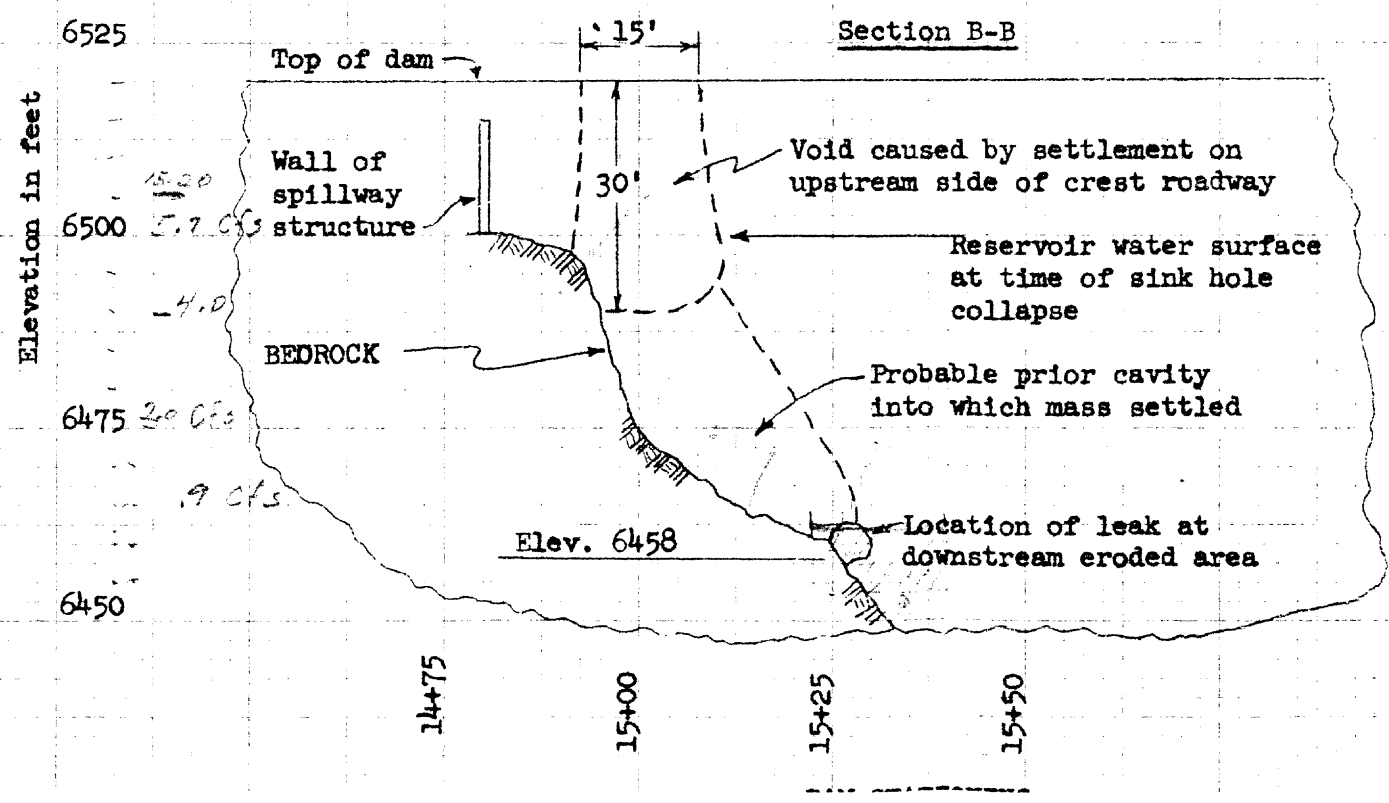
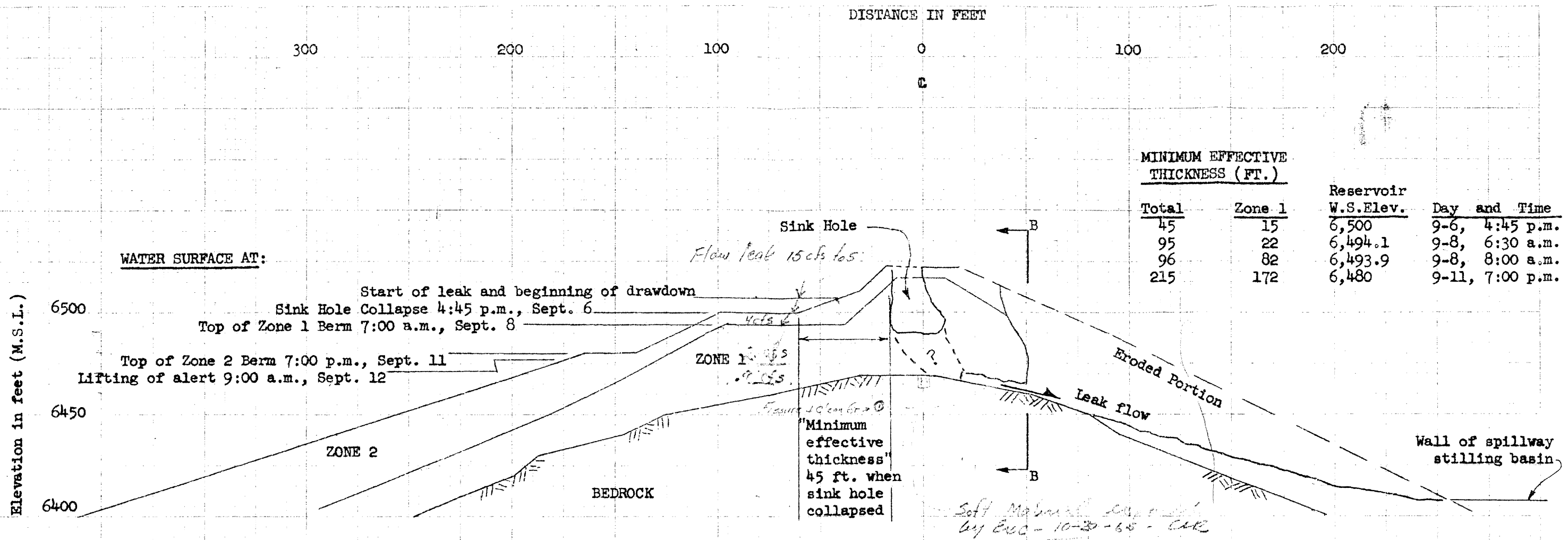


FOUR VENEILLE DAM  
SPILLWAY  
ON 9-8-65

LEAK FLOW

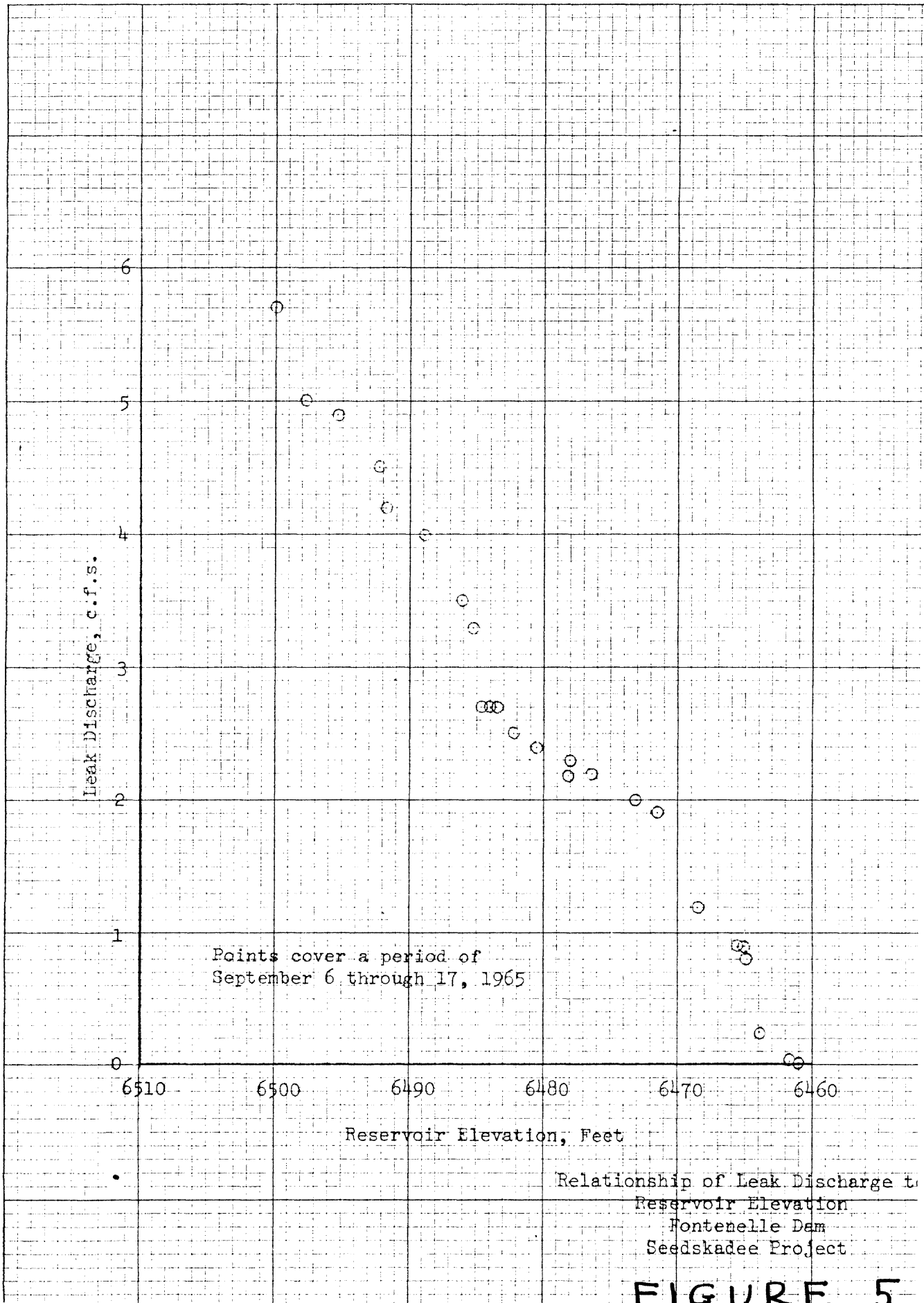
HORIZONTAL  
SPILLWAY





**FONTENELLE DAM**  
 Cross Section "A"  
 showing effective thickness  
 of embankment during  
 emergency drawdown

**FIGURE 4**



**FIGURE 5**





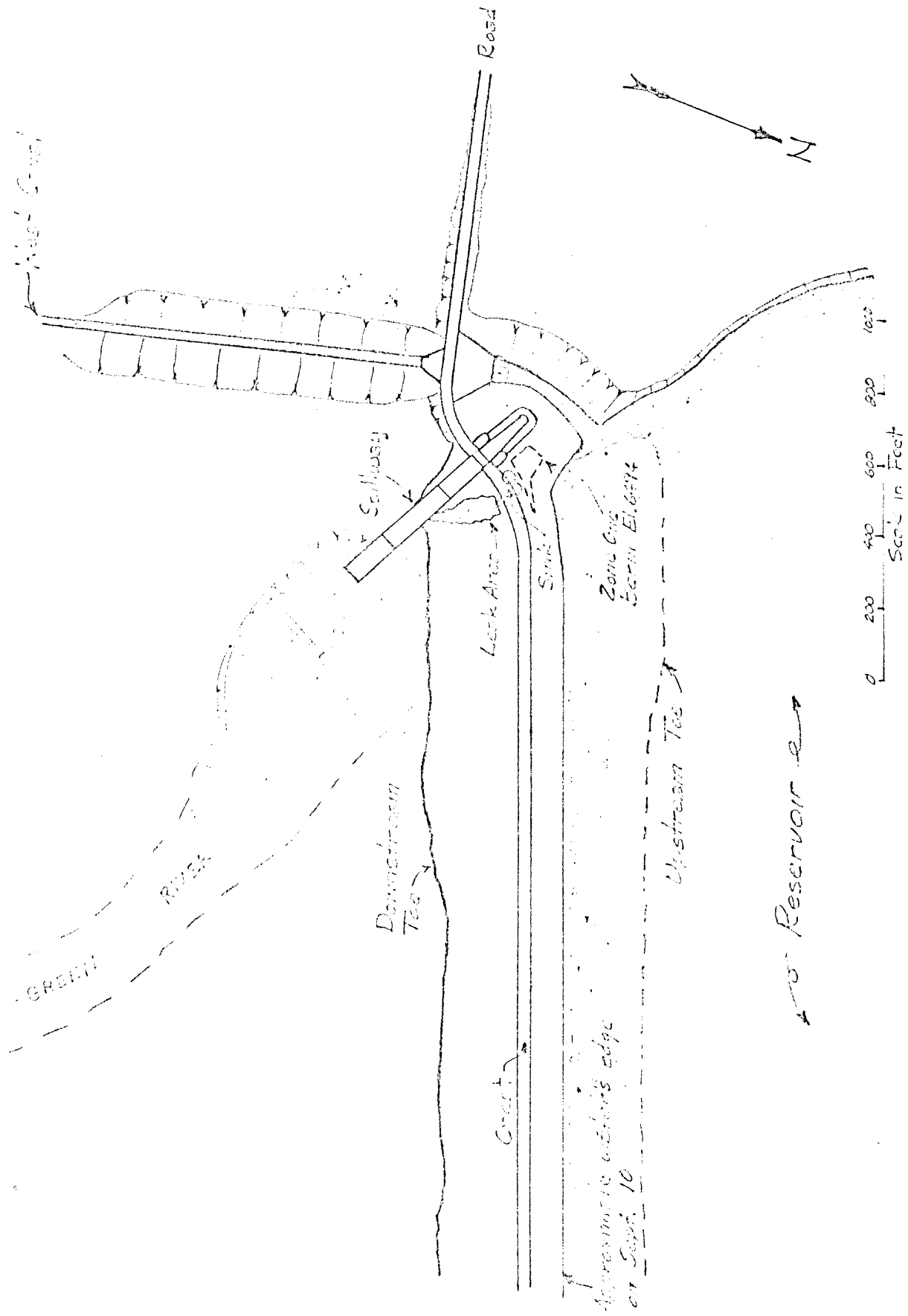


FIGURE 6



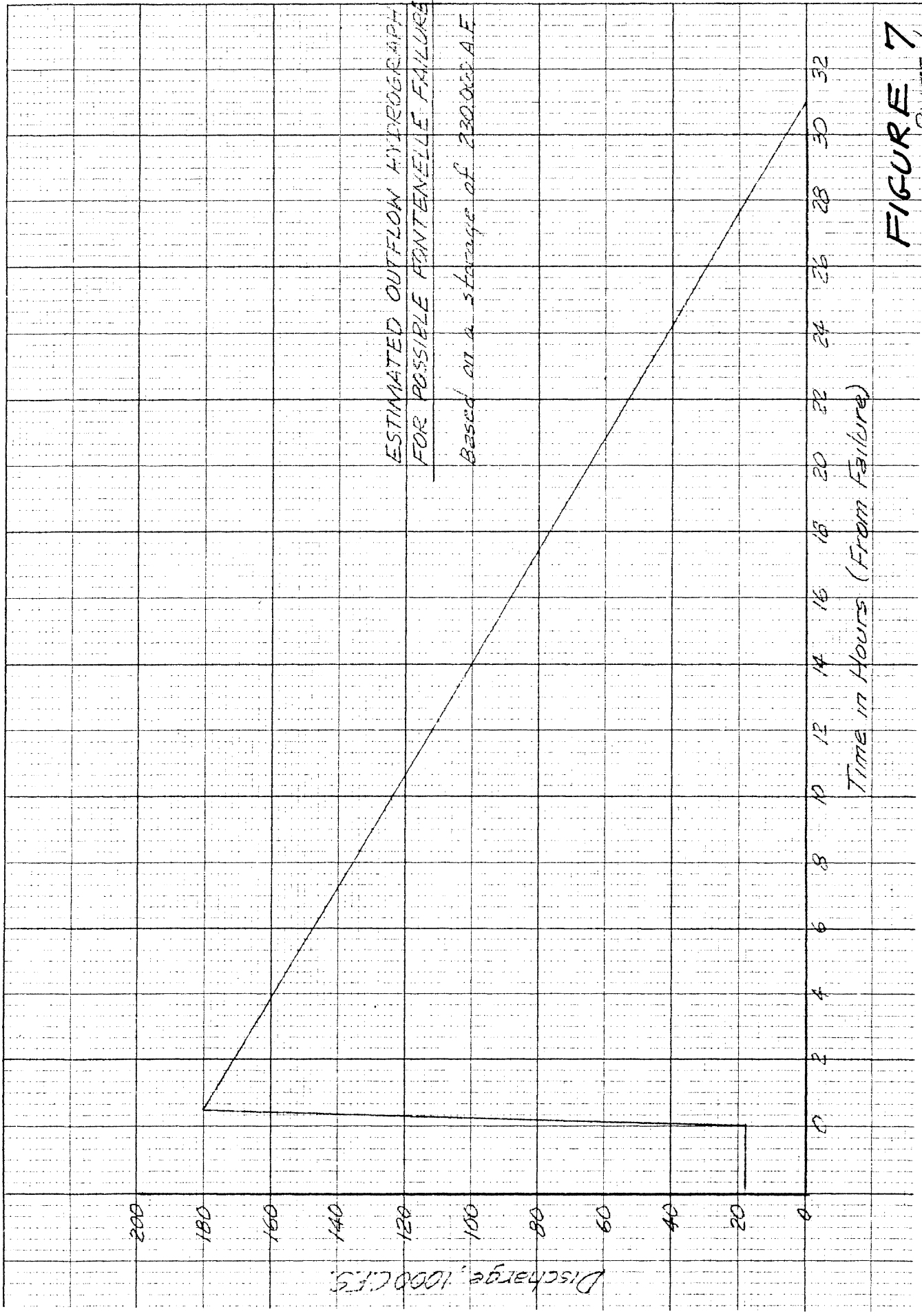
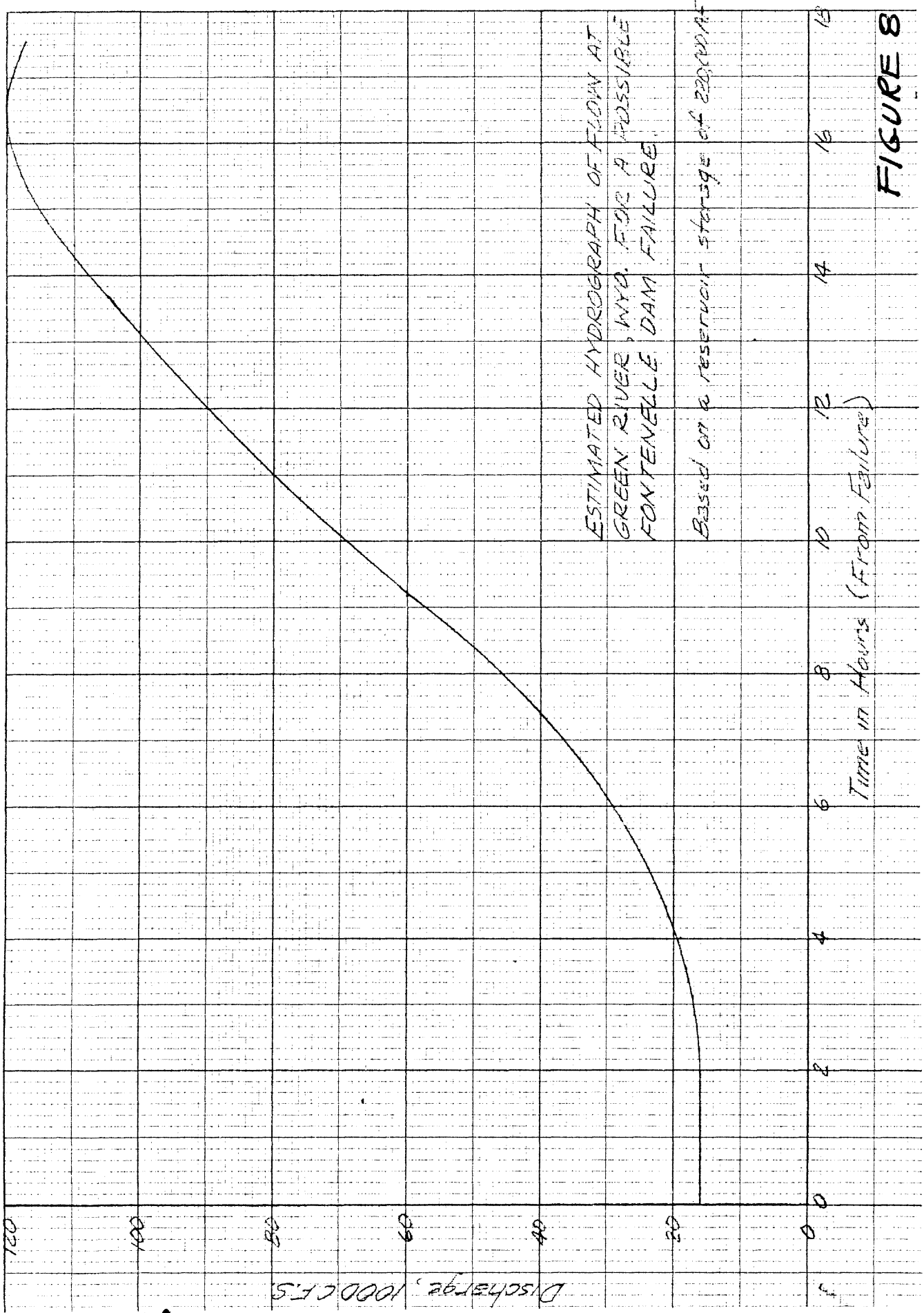


FIGURE 7





ESTIMATED HYDROGRAPH OF FLOW AT  
 GREEN RIVER, WYO. FOR A POSSIBLE  
 FONTENELLE DAM FAILURE.

BASED ON A RESERVOIR STORAGE OF 220,000 A.C.

FIGURE 8









# TABLE 1

## FACT SHEET - FONTENELLE DAM AND SEEDSKADEE PROJECT, WYOMING

### Fontenelle Dam

Prime contractor: Foley Brothers, Inc., & Holland Construction Company,  
St. Paul 1, Minnesota

Fontenelle Dam is a rolled earth and gravel-fill structure.

Height above streambed . . . . .	127 feet
Maximum structural height . . . . .	143 feet
Length of crest . . . . .	5,450 feet
Volume of fill . . . . .	5,300,000 cu.
Volume of concrete in spillway and outlet works . . . . .	45,000 cu.
Capacity of the uncontrolled crest open chute spillway at Elevation 6,512.9 . . . . .	20,000 c.f.
Capacity of the river outlet works at Elevation 6,512.0 . . . . .	17,200 c.f.
Capacity of the West Side outlet works . . . . .	780 c.f.
Capacity of the East Side outlet works . . . . .	530 c.f.
Reservoir area at conservation water surface El. 6,506 . . . . .	8,058 acre
Reservoir area at inactive water surface El. 6,484.9 . . . . .	6,103 acre
Length of reservoir at water surface El. 6,506 approximately . . . . .	12 mile
Length of shoreline at El. 6,506 . . . . .	about 38 mile
Reservoir capacity at conservation water surface . . . . .	345,000 ac.-
Reservoir surcharge capacity to El. 6,512.9 . . . . .	58,000 ac.-
Reservoir active storage capacity . . . . .	150,000 ac.-
Crest of dam . . . . . Elevation . . . . .	6,519
Maximum surcharge water surface . . . Elevation . . . . .	6,512
Top of conservation water surface . . Elevation . . . . .	6,505
Top of inactive water surface . . . . Elevation . . . . .	6,484
Top of dead water surface . . . . . Elevation . . . . .	6,408
Relocation of 6.9 miles U.S. Highway 189 required around reservoir.	
Relocation of 3 miles of new pipeline for the Service Pipe Line Company required around reservoir	

### Power Plant

Installed capacity (KW)	10,000
Transmission line capacity (KV)	69
Distance to hookup with lines of Bridger Valley R.E.A. (miles)	55
Average annual generation (KW hrs.)	51,040,000

### Seedskadee Wildlife Refuge

Total area of 18,000 acres for wildlife refuge.  
4,000 acres for pondage  
2,000 acres for production of feed

### Recreational Facilities

Basic recreation facilities at Fontenelle Reservoir will be provided by the  
National Park Service.

### Irrigation Acreage

Total irrigable acres . . . . . 58,775



# TABLE 2

## FONTENELLE RESERVOIR

Date (1965)	Time (A=a.m.) (P=p.m.)	Reservoir elevation (feet)	Reservoir content (ac.-ft.)	Green River flow		Remarks
				Down- stream from dam (c.f.s.)	At Green River, Wyoming (c.f.s.)	
Sept. 3	8:20 A.	6,507.46	357,260	1,900		
Sept. 4	3:30 P. 5:00 P.	6,507.40	356,770	14,380		Opened ROW gates.
Sept. 5	6:00 A. 6:28 A. 8:00 A. 10:20 A. 11:30 A. 11:50 A. 4:05 P. 5:00 P. 5:15 P. 5:30 P. 6:00 P. 6:40 P. 7:30 P. 8:00 P. 10:30 P.	6,505.46 6,505.28 6,504.78 6,504.53 6,503.92 6,503.73 6,503.48 6,503.24	341,060 339,620 335,640 333,660 328,850 327,350 325,400 323,520	17,075 10,000± 12,000 12,200 12,400	2,000± 5,000±	Radial gates opened to 11.5  Opened west canal outlet.  Opened east canal outlet.
Sept. 6	4:30 A. 5:45 A. 6:50 A. 7:15 A. 9:00 A. 9:50 A. 11:30 A. 12:00 A. 12:15 P. 1:00 P. 3:00 P. 3:10 P. 4:00 P. 6:20 P. 11:00 P.	6,501.87 6,501.67 6,501.46 6,501.14 6,500.69 6,500.55 6,500.18	312,910 311,370 309,760 307,320 303,900 302,830 300,030	18,600 15,600 14,600 15,600 15,700 15,900	14,000	
Sept. 7	1:10 A. 3:00 A. 5:30 A. 6:00 A. 9:00 A. 9:40 A. 1:40 A. 2:00 P.	6,498.63 6,498.37 6,498.00 6,497.64 6,497.05 6,496.69	288,440 286,520 283,790 281,150 276,840 274,230	17,350 16,900		



Date (1965)	Time (A=a.m.) (P=p.m.)	Reservoir elevation (feet)	Reservoir content (ac.-ft.)	Green River flow		Remarks
				Down- stream from dam (c.f.s.)	At Green River, Wyoming (c.f.s.)	
Sept. 7	3:00 P.	6,496.53	273,070		16,800	
(contd.)	5:12 P.	6,496.17	270,470			
	6:50 P.	6,495.95	268,890			
	10:20 P.	6,495.42	265,100			
Sept. 8	12:20 A.	6,495.08	262,680			
	2:00 A.	6,494.82	260,840			
	4:40 A.	6,494.38	257,730			
	6:30 A.	6,494.11	255,830			
	8:00 A.	6,493.89	254,290			
	9:00 A.				16,400	
	10:00 A.	6,493.61	252,330			
	1:40 P.	6,493.06	248,500			
	2:16 P.	6,493.02	248,220			
	4:40 P.	6,492.60	245,310		16,400	
	5:00 P.			16,660		
	7:12 P.	6,492.21	246,620			
	9:25 P.	6,491.90	240,490			
	11:50 P.	6,491.52	237,890			
Sept. 9	1:50 A.	6,491.19	235,640			
	3:50 A.	6,490.92	233,810			
	5:50 A.	6,490.60	231,640			
	7:30 A.				16,000	
	8:30 A.	6,490.18	228,810			
	10:23 A.	6,489.91	227,000			
	2:00 P.	6,489.35	223,270			
	4:00 P.			15,780		One gate low.
	11:10 P.	6,487.83	213,320			
Sept. 10	1:43 A.	6,487.42	210,680			
	4:00 A.	6,487.03	208,190			
	5:40 A.	6,486.74	206,350			
	8:45 A.					One ROW adjusted up ward about 1 foot.
	9:00 A.				15,200	
	10:05 A.			16,830		
	10:30 A.					East canal--1 gate full open.
	11:00 A.	6,485.81	200,520			
	2:30 P.			16,660		
	2:50 P.	6,485.11	196,200			
	4:30 P.			16,580		
	7:05 P.	6,484.33	191,460			
	11:47 P.	6,483.55	186,790			



Date (1965)	Time (A=a.m.) (P=p.m.)	Reservoir elevation (feet)	Reservoir content (ac.-ft.)	Green River flow		Remarks
				Down- stream from dam (c.f.s.)	At Green River, Wyoming (c.f.s.)	
Sept. 11	1:03 A.	6,483.31	185,370			
	2:33 A.	6,483.04	183,780			
	4:02 A.	6,482.78	182,260			
	5:18 A.	6,482.56	180,990			
	8:00 A.	6,482.05	178,050	15,600		
	11:16 A.	6,481.50	174,930			
	1:00 P.				15,290	
	1:45 P.	6,481.08	172,580			
	5:00 P.	6,480.39	168,780			
	5:30 P.				15,040	
Sept. 12	6:15 A.	6,478.04	156,370			
	6:40 A.			14,500		
	6:30 P.				14,200	
Sept. 13	7:40 A.	6,473.15	132,710			
	8:10 A.			13,840		
	10:20 A.				13,600	
	1:00 P.	6,472.10	127,980			
	4:10 P.	6,471.38	124,800			
	4:45 P.			13,600		
	11:38 P.	6,469.89	118,390			
Sept. 14	1:26 A.	6,469.52	116,830			
	3:08 A.	6,469.17	115,370			
	5:21 A.	6,468.74	113,600			
	7:00 A.				13,200	
	8:00 A.	6,468.16	111,230			
	9:00 A.			13,120		
	12:00 A.			13,120		
	2:00 P.				13,000	
	3:30 P.					HP gate closed.
	4:00 P.					#3 Fixed wh. gate closed.
4:15 P.					#1 and #2 radial gates lowered to 6.	
4:30 P.				7,260		
Sept. 15	8:25 A.	6,465.49	100,720			
	8:30 A.				6,620	
	8:50 A.			4,800		
	3:30 P.	6,465.08	99,160			
	4:25 P.			4,760		
	6:30 P.	6,464.91	98,520			





Date (1965)	Time (A=a.m.) (P=p.m.)	Reservoir elevation (feet)	Reservoir content (ac.-ft.)	Green River flow		Remarks
				Down- stream from dam (c.f.s.)	At Green River, Wyoming (c.f.s.)	
Sept. 16	8:35 A.	6,463.97	95,020			
	9:20 A.			4,640		
	10:20 A.	6,463.82	94,460			#1 and #2 radial gates raised to 8.1
	12:30 P.				4,620	
	1:15 P.	6,463.52	93,370			
	4:00 P.			6,280		
	4:30 P.	6,463.20	92,200			
	5:05 P.	6,463.16	92,060			
Sept. 17	8:15 A.			6,050		
	8:35 A.	6,461.73	86,970			
	1:00 P.				6,750	
	1:18 P.					Radial gates set at
	3:50 P.	6,461.11	84,810			
	4:00 P.			5,580		
Sept. 18	8:40 A.	6,459.76	80,220			
	2:45 P.				6,100	
Sept. 19	8:40 A.	6,457.87	74,030			
	P.				5,980	
Sept. 20	8:40 A.	6,455.95	68,000			
	4:00 P.				5,720	
Sept. 21	8:40 A.	6,453.99	62,110			
Sept. 22	8:35 A.	6,452.09	56,630	4,840		







# Hansen Praises Efforts

## Governor Sees Dam, Meets Officials

Gov. Cliff Hansen of Wyoming, inspecting Fontenelle Dam and Green River damage from water and the downstream face of the dam Thursday and meeting with officials in Green River relative to relief measures, praised all those responsible in any way for activities connected with the situation.

"They are doing everything they possibly can to meet the situation," said Hansen, after conferring with Sheriff George Nimmo, representatives of the Bureau of Reclamation, members of Green River City Council, Chief of Police Glenn Butcher and County Commissioners George Stephens, Willis Helke and Dominick Ferrero.

They briefed the governor on what has been done and explained their cooperation with the agencies of the state government and the Civil Defense Department.

Gov. Hansen said he was most impressed by the fine spirit of cooperation which characterizes efforts of all agencies. He toured the Green River area Thursday morning to see what has been done in anticipation of heavy flows of water, including extra levy work and removal of residents to higher, safer ground. He also inspected the city sewage disposal plant, to see how continued high flow could endanger the system.

The governor also went by plane from Green River to the upper end of the Flaming Gorge, inspecting damage, and then flying all the way along the river to Fontenelle.

Taken first by helicopter for an aerial inspection over the dam itself, Gov. Hansen later visited the area on the ground.

"I really am certainly encouraged the dam will hold and that the Bureau of Reclamation will take all steps necessary for repair and to make it absolutely sound. I am impressed with the Bureau personnel and all the effort they have put forth in seeing that the right information is made widely available, and also in seeing how methodical and precise they are to the cause of the problem, although it is not yet fully known," he said.

"We do not know yet what steps are needed, but I am convinced it will be repaired expertly and will be perfectly safe," said Gov. Hansen.

"This is not a failure of structure, but a geologic quirk which caused the leak to develop," he emphasized.

The governor's party also went on up the length of the reservoir after the dam inspection, and noted some subsidence in the road at the upper end, resulting from some settlement. That difficulty, he said, has been called to the attention of the Wyoming Highway Department, with repairs to begin immediately. The Bureau of Reclamation will bring in a geologist, the governor said, for further advice to the highway department on the repair of the roadway.

"I am impressed with the cooperation," Gov. Hansen concluded. "Everyone is working hand-in-hand. It is a wonderful job."



GENE TODD INTERVIEW WITH DAVID L. CRANDALL ON FONTENELLE DAM  
KVRS (RADIO), 4:00 P.M., SEPTEMBER 9, 1965  
ORIGINATING AT LEE'S BAKERY & COFFEE SHOP

MR. TODD: Good afternoon, ladies and gentlemen and everyone listening to our KVRS special public service broadcast this afternoon, as I visit with Mr. David L. Crandall, the Regional Director of Region 4 of the Bureau of Reclamation with his office in Salt Lake City. Naturally everyone in the Green River Valley has been very much concerned about the alert which came our way last weekend with regard to the situation at Fontenelle Dam, and so it was the special interest of KVRS to make sure that Mr. Crandall, the man who really has the answer to the situation, who really understands what the situation really is, could be available to answer my questions this afternoon about the Fontenelle Dam. Just previous to our broadcast this afternoon and just after this morning over the coffee cups, it was my privilege to fly out over the Fontenelle Dam of the Seedskadee project up along the Green River, and, after we arrived at Fontenelle, it was my pleasure to be with Mr. John Hatch, the Construction Engineer, and with Mr. Herb Simison as we went up and looked at the dam, looked at the situation previous to my coming and visiting with Mr. Crandall. So right now, Mr. David L. Crandall is here at the Lee's Bakery in Green River and is prepared to answer some of the questions which I hope to put to him this afternoon about the Fontenelle situation. So first of all, Mr. Crandall, we want you to know how very much we appreciate your taking the time from what must be a horrible schedule you've been keeping up there at Fontenelle to take the time to come into Green River and to talk to the people of Sweetwater County and to the vast radio listening audience this afternoon of KVRS about the situation at the Fontenelle Dam.

MR. CRANDALL: Gene, I appreciate very much your invitation to tell about Fontenelle Dam. We, in the Bureau of Reclamation, have been most concerned about the leak in the dam. We know you and the Green River Valley downstream were too. I also want you to know that we did everything we knew to do to assure your safety. We announced the hazard just as soon as it became apparent, kept your local Civil Defense officials informed, the State Civil Defense people, General Robert Outsen, Adjutant General, Lloyd Bishop, the State Engineer, and many others including your Governor Hansen with whom we were in regular contact. I met with Governor Hansen and others in the Green River area last night, and this morning the Governor and I flew over the area between Green River and the dam and carefully inspected the dam and the adjacent area. Our thanks go to them for their assistance, understanding, and quick response in preparing to meet the threat, and our heartfelt thanks go especially to the people of the Green River Valley and of the town of Green River who were affected by the heavy flows caused by our having to open wide the outlet gates in the dam. The people of Green River prepared well for these flows and helped keep the damage to a minimum.





MR. TODD: Thank you, Mr. Crandall. Well, Mr. Crandall, would you tell us just exactly what it was now that happened at the Fontenelle Dam?

MR. CRANDALL: There had been a small seep area on the lower face of the dam where a leak area developed. A seep is not the same as a leak. It's a damp spot. These are common in a new earth dam. In practically all cases, the seeps dry up as the earthfill settles or seasons, as you might say. But this seep spot on Fontenelle Dam was the exception, a most rare exception, I might add. The seep spot grew into a very dangerous leak. Our Project Construction Engineer, John Hatch, and his men knew of this seep. They were watching it closely, and, like other seep spots, they expected it to dry up. Of course, we now know that it didn't, and there was no way to know that it would grow into a leak. In the daylight hours of Friday, September 4, the seep grew into a small leak. By Friday afternoon there was clearly moving water and earth materials. John Hatch recognized it could be serious and called our Chief Engineer in Denver, Colorado. He also alerted Sheriff Nimmo and the local officials to the hazardous situation that had developed. The next morning, as soon as light permitted, Chief Engineer Bellport, several of his staff, myself, and Assistant Regional Director Rippon arrived to review the situation. As you all know, it was then a serious state of affairs. By that time the cavity eroded to a rather staggering size, and the flow of the leak had grown to what we estimated to be about 20 cubic feet per second. The pear-shaped cavity was about 40 feet across and 50 feet deep. It was perpendicular to the crest of the dam and almost 200 feet long. It lies roughly parallel to the concrete spillway. After inspecting the leak and observing that it was not then increasing, we came to the conclusion that the water was moving through the bedrock that forms the foundation at the right end of the dam and that it was after the water came out of the rock that the erosion of the cavity was taking place. I emphasize that the water was not moving from the reservoir directly through the manmade fill to cause this leak. Our immediate reaction was twofold--first to control the erosion; second to get the water level lowered in the reservoir as rapidly as possible.

MR. TODD: Well, Mr. Crandall, I'd like to make this one insertion. Just this afternoon when I was up there, I was able to see the actual leak itself and to correct in my own mind what I'm sure is misinformation which a lot of people have. Some people seem to think that when you are talking about the size of the cavity, as you say, about 40 feet across and 50 feet deep--a lot of people are thinking that this is a hole in which water is shooting out 40 by 50 feet, and of course this is not the situation at all, is it?

MR. CRANDALL: No it isn't. When the leak, which was at the 20-cubic foot per second level, stabilized, we were sure that it was not increasing. Then we began immediately to dump large rocks into this cavity created by the sloughing of material away to replace that material and to support the steep face of the cavity so that it could not slump further toward the reservoir. This rock was from the stockpiles of riprap at the end of the



dam. Eventually we dropped 2,300 cubic yards into the hole and were successful in stopping any serious further erosion that would make the hole deeper. The cavity did widen by caving in and sloughing from the side area but has not appreciably lengthened toward the reservoir. The second thing that we did was to open the gates of the outlet tunnels through the bottom of the dam. The reservoir was brimful and about 1,700 cubic feet per second were going over the spillway. Obviously we had to lower the reservoir level so that the leak would stop. There was no other way--no other quick, sure way to stop the leak. On Saturday afternoon, the gates were opened to release 14,500 cubic feet per second. This was the downstream channel capacity. The first release was not larger because we felt people had to have a little time to prepare for a greater flow level. Sunday morning we opened the gates wide to discharge 17,000 cubic feet per second.

MR. TODD: Mr. Crandall, may I ask one question at this point. When you talk about "cubic feet per second," for a layman like myself, it is a little hard to understand. To give us some idea, you said Sunday the gates were opened to discharge 17,000 cubic feet. What would this be in comparison to the spring crest that normally comes through here--the high runoff, would this be--how much more than the spring crest?

MR. CRANDALL: Generally, it was comparable to the spring crest. We used the measurement of the spring crest as the basis for the first release. It had been measured at 15,000 cubic feet per second so if they can remember what the peak flow was last spring, then they can relate it to this first level of release. By Sunday afternoon, we opened the headgates to the east and west canals, which are yet to be built, and let the water run across country around the dam and back into the Green River below. Opening these headgates brought releases from the reservoir to something more than 18,000 cubic feet per second. All during this time, we were in continuous contact with Civil Defense officials and Sheriff Nimmo who alerted all the people in the Green River Valley and the town of Green River, Wyoming, to the higher river status. These officials acted very quickly and very effectively I might add. Having arrested the erosion by dumping rock into the cavity and starting the emptying of the reservoir, the situation was then watched on an around-the-clock basis.

MR. TODD: Yes. Well now let me just repeat again just a moment what Mr. Crandall was saying. He told us that the spring crest normally, as it comes through Green River at the peak of the runoff season in the spring, is about 15,000 cubic feet per second, and the initial opening of the drain off of the lake was about this. In the meantime, it has been increased first to 17,000 and now to 18,000 cubic feet per second, so this gives us some idea that there is that much more--3,000 cubic feet per second more water right now in the Green River than there was at the time of the spring crest here during the runoff season. Well, now, I am curious, Mr. Crandall, after you began to release the water, what happened after that?

MR. CRANDALL: Gene, two significant things occurred after the release and the rockfill were under way. First, on Sunday afternoon, water from



the leak surged into much larger flows, then lapsed into smaller flows. After about two hours, the flow of the leak evened out and stabilized the same as before the surges. We now figure that what happened was that the caving in of the channels eroded into the earth in the dam and blocked the flow momentarily. When the blocked flows broke loose, the surges and flow from the lake were observed. After the surging stopped, the flow remained constant.

MR. TODD: Well, now you talked about the surges which began to finally stabilize themselves a little bit. What was the second thing that happened? You said "two things happened." What was the second thing?

MR. CRANDALL: The second event happened suddenly at about 4:45 p.m. on Monday. At that time, a 15x20-foot section of the crest road on the upstream side of the dam suddenly and quickly collapsed. What happened was that an area undermined by the water leaking from the bedrock had simply dropped about 31 feet. We quickly filled it with earth and rock. Up to this moment further unexpected developments had not happened, I might add with relief.

MR. TODD: Well, I am visiting--for some of you who are just now tuning in on your radios, this is Gene Todd, and I am visiting with Mr. David L. Crandall, the Regional Director of the Bureau of Reclamation, a man who is very much in complete charge of the situation at the Fontenelle Dam. I have been asking him questions as to just exactly what happened at the Fontenelle Dam. He very--I think very nicely has been telling us just exactly what did happen, giving us a rundown on the events as they have taken place since last Friday. Well now, I'm sure, Mr. Crandall, that people are now wondering "what does this mean right now? Where do we stand in regard to the Fontenelle Dam?" What's going on right at this moment, for example, at the Fontenelle Dam?

MR. CRANDALL: We are still drawing the reservoir down. We haven't gotten it low enough yet to stop the leak. We have no way of knowing when it will be low enough to stop the leak, because the place where the leaking water goes into the bedrock and emerges to cause the erosion is not yet known. We hope that it will be denied its source of water soon.

MR. TODD: I want to emphasize again a point you made earlier, Mr. Crandall, and that was that this leak is not from water going through from the reservoir through the dam. It's water which is going into bedrock and coming up through the outside of the dam. I think this is an important point which you made very well here just a moment ago. Well now, as the man who is really in charge of the situation up there, Mr. Crandall, would you say that the situation is improving or does it remain the same?

MR. CRANDALL: Well, the situation is improving, and this is the basic reason why. As you know, the dam slopes downstream and it also slopes upstream, so as the water level goes down, the thickness of dam



materials between the eroded area and the water increases. In fact, for every 1 foot the water level goes down, 3 feet of thickness is added.

MR. TODD: May I interrupt for just a moment here, Mr. Crandall, if I may explain this just a bit more. The dam is like an inverted "V" and spreads out. This is the point you are making that for each foot that the water goes down, you actually get 3 more feet in the thickness and dimension of this dam. It is for this reason that you say that for each foot that the water is lowered, we have 3 more feet of safety. Isn't this what you're saying?

MR. CRANDALL: Yes, that is a very good statement of it. At the present time, that thickness is more than 125 feet and increasing at the rate of about 12 feet per day since the reservoir is lowering 4 feet per day.

MR. TODD: May I ask this one question? Just how many feet has the reservoir been lowered since you've begun lowering it?

MR. CRANDALL: At the present time it is down about 16 feet. We expect to, of course, remain on the alert until the contribution of water through the rock to this leak area is stopped by the fact of the lowered reservoir level.

MR. TODD: Mr. Crandall, what is the outlook for the people of the Green River Valley and right here in the town of Green River where some flooding is already taking place where the water--higher crest than it was at the spring runoff--is already lopped over a little bit? What is the future here? I know a lot of people right in Green River are somewhat concerned about this. What would you say to them?

MR. CRANDALL: I am sure that everyone who has been listening understands why we must make the heavy releases of water from Fontenelle Reservoir. We all look forward eagerly to the time when we can reduce the release of water to lower amounts. There is one encouragement for the people who have been suffering from the overbank flows in the Green River. When we started the maximum releases on Sunday, the level of the reservoir was high. In fact, the reservoir was full. At that time, flows released were at the 18,000-cubic foot per second range. As the level of the reservoir is lowered, the pressure, or head as we call it, on the outlet tubes and the irrigation diversions is reduced. Consequently, less water goes through and into the Green River. For example, last night when the reservoir level had been lowered a total of 15 feet by that time, the release at the dam was 17,470 cubic feet per second or more than 1,000 cubic feet per second less than on Saturday. Releases will continue to decrease slowly for this basic physical reason. This reduced flow is already beginning to be perceptible at the gaging station at the town of Green River. It was reported to me today that the river level at town has dropped about 2 inches in the last 24 hours. This decline should continue.





MR. TODD: That is a very good point. May I emphasize that just again, Mr. Crandall. I am sure that something which the people here in Green River want to know, as you have said, is that in the last 24 hours the river level here in the town of Green River has dropped or decreased 2 inches--that is 2 inches lower than it was here 24 hours ago. So you see, we are already beginning to notice this bit of encouragement which you have been telling us about here, Mr. Crandall. You are aware, as we are, that damages have occurred from overbank flooding caused by the large release of water from the reservoir. I know that you are concerned about compensation for such damages.

MR. CRANDALL: There is an administrative procedure whereby claims for damages can be submitted to the Department of the Interior for consideration. If you have suffered physical damage to your property, you should make a detailed inventory which you must have to support your claim. I suggest that you wait until the flood waters recede so that the full extent of the damage can be determined. In this connection representatives of the Bureau of Reclamation will be in Green River next week and be available to talk with people who are concerned on this point.

MR. TODD: Thank you, Mr. Crandall. I think this is good information, and I am sure that a lot of people are concerned about this. As you said, the representatives of the Bureau of Reclamation will be here in Green River next week and available to talk to people who have had damages. I might say, however, from my own observation as we flew over the area this afternoon, that I didn't see very many places where water actually was doing serious damage to any of the places along the Green. It seems to be very well measured, and we talked about this in the airplane--how lucky a lot of the people were who were along the Green River. Well, now here's another question, Mr. Crandall. I don't know how prepared you are to deal with this one, but I am sure a lot of us are asking it. What is the future for Fontenelle Dam? Does this mean that the dam has failed already, or does this mean that there is certainly an unlimited future? How would you answer the question as to the future of the Fontenelle Dam?

MR. CRANDALL: Well, Gene, in this connection I want to say just a little about earth dams in general. Earth dams are good dams. I don't have the latest figures, but I have in hand a report of 1958 which indicates that the Bureau of Reclamation had by that date built 138 earth dams. The Bureau built its first earth dam in the early 1900's. Since 1958 the Bureau has built two very high earth dams. Navajo Dam on the San Juan River in New Mexico is 400 feet high. Trinity Dam on the Trinity River in northern California is 537 feet high.

MR. TODD: May I interrupt for just a moment to get some idea of what these figures mean? Now, Mr. Crandall, you said the Navajo Dam was 405 feet and the Trinity Dam was 537 feet. What is the height of the Fontenelle Dam to give us some idea as to the proportion of these dams?



MR. CRANDALL: Well, Fontenelle Dam is about 127 feet above the original streambed. I might go on to add here that earth dams have been and are being built by many other agencies--both Government and private. The State of California is building Oroville Dam on the Feather River. This dam will reach an unprecedented height of more than 700 feet. You may recall that Hebgen Dam, an older dam, went through and held firm during the very severe Yellowstone earthquake a few years ago. In spite of present difficulties here on Fontenelle, earth dams are good dams.

MR. TODD: That is a good point. I would like to interrupt to emphasize this point which you are making that earth dams are good dams, and you said the height of the Fontenelle Dam was 127 feet, and if you think this is high, you must remember the Navajo Dam is 405 feet, and the Trinity Dam is, as you mentioned, 537 feet, and you mentioned this dam, the Oroville Dam--700 feet. It is amazing. So in contrast our Fontenelle Dam really isn't very high in comparison, and, as you mentioned, earth dams are good dams. Perhaps I could ask you this, Mr. Crandall. When did the Bureau of Reclamation begin building earth dams in this country?

MR. CRANDALL: Well, as I mentioned, Gene, it's in the early 1900's. The leak problem at Fontenelle is not, I can assure you, the result of a technical inadequacy, but when you deal with the forces of nature, you sometimes encounter the unexpected. In this connection, I want to point out that we recognize the presence of the unexpected and design and build dams with considerable safety factor. It is this safety factor or conservative design that has been such a decisive factor in carrying us through this crisis. You may be sure that as we plan and accomplish the remedial or repair work on Fontenelle, the same concept of adequate safety will be guiding our work.

MR. TODD: If I can interrupt here again, Mr. Crandall. I remember just a little while ago when you were standing on the dam, I was talking with Mr. John Hatch and Mr. Herb Simison. Both of them were explaining to me something about this safety factor and the tremendous safety factor which has been built into these Government dams. I think this is a very good point. As they pointed out to me that the Government has gone overboard, you might say, in good safety factors. Here's one time when it has really paid off because, as you mentioned, the safety factor is what is really carrying us through this present crisis. Well, let me put another question to you, Mr. Crandall. Why do you think that the Fontenelle Dam is important? You have been talking about the importance of the dam. Why do you consider it important to the people of this area?

MR. CRANDALL: Well, without it there can be no Seedskafee project. The Seedskafee project which will ultimately supply irrigation water to more than 58,000 acres of farmland will provide a tremendous boost to the economy of the Rock Springs and Green River area. We expect that Fontene



Dam will be able to play its vital role in storing the waters for the Seedskadee project, and, I might say here in conclusion, that you can be certain that the repair is being actively analyzed and worked upon, and that we are looking forward to fully and completely presenting the details of this vital work to the people of this valley in its entirety and to the entire State of Wyoming. We will spare no effort to be sure that what we do, and why we have done it, the knowledge is completely available to everyone.

MR. TODD: Thank you very much, Mr. David Crandall, the Regional Director of the Bureau of Reclamation. We want to thank you for taking the time to fly into Green River here this afternoon and to give us this very important information about the situation at the Fontenelle Dam, and I think I might repeat what you have been telling us that you are standing by, watching every moment. You are being very, very sure that the situation is being watched by technical engineers who really know what they are doing, and you are encouraged with the progress which is being made.

Well, I think this will bring to a close our special broadcast here this afternoon brought to you as a public service feature of KVRS--my interview with Mr. David Crandall. That's all. We go back now to the KVRS studios in Rock Springs, Wyoming.

