

THE PROBLEMS OF  
IMPLEMENTING FLOOD DAMAGE REDUCTION MEASURES  
IN THE VICINITY OF MALHEUR/HARNEY LAKES, OREGON

by

AMIN WAHAB

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Dr. K.W. Muckleston

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**Abstract**

The rise of water level in Malheur Lake in Southeastern Oregon has become a major issue of concern in Harney County, where the lake is located, and on a state-wide level. The concern is due to the extensive damage caused by flood water to agricultural land, highways and roads, a portion of the Burns-Hines and Ontario branch of the Union Pacific Railroad, utilities, homes and other private property, and to the Malheur National Wildlife Refuge. The lake level started rising in 1982 and soon after the US Army Corps of Engineers (Walla Walla, Washington District), undertook a study of the problem. In 1986, the US Army Corps of Engineers, after intensive study, prepared an EIS and recommended flood reduction measures of two kinds, structural and non-structural. A single measure has not been agreed upon yet due to different positions of the interest groups and involved parties on the issue of flooding. An analysis of the situation was chosen as the subject of this research paper.

**I. INTRODUCTION**

The flooding in the vicinity of Malheur Lake in Southeastern Oregon (figure 1), has caused a great concern among individuals affected directly and indirectly by the flood and among varied interests at the county and state levels. The concern is due to the extensive damage caused by the flood water which has risen several feet above the average 4093 feet mean sea level (fmsl), 1247.5 meters mean sea level (mmsl) (NW Economic Associates, 1985). The water level in Malheur Lake started rising in 1982 and eventually

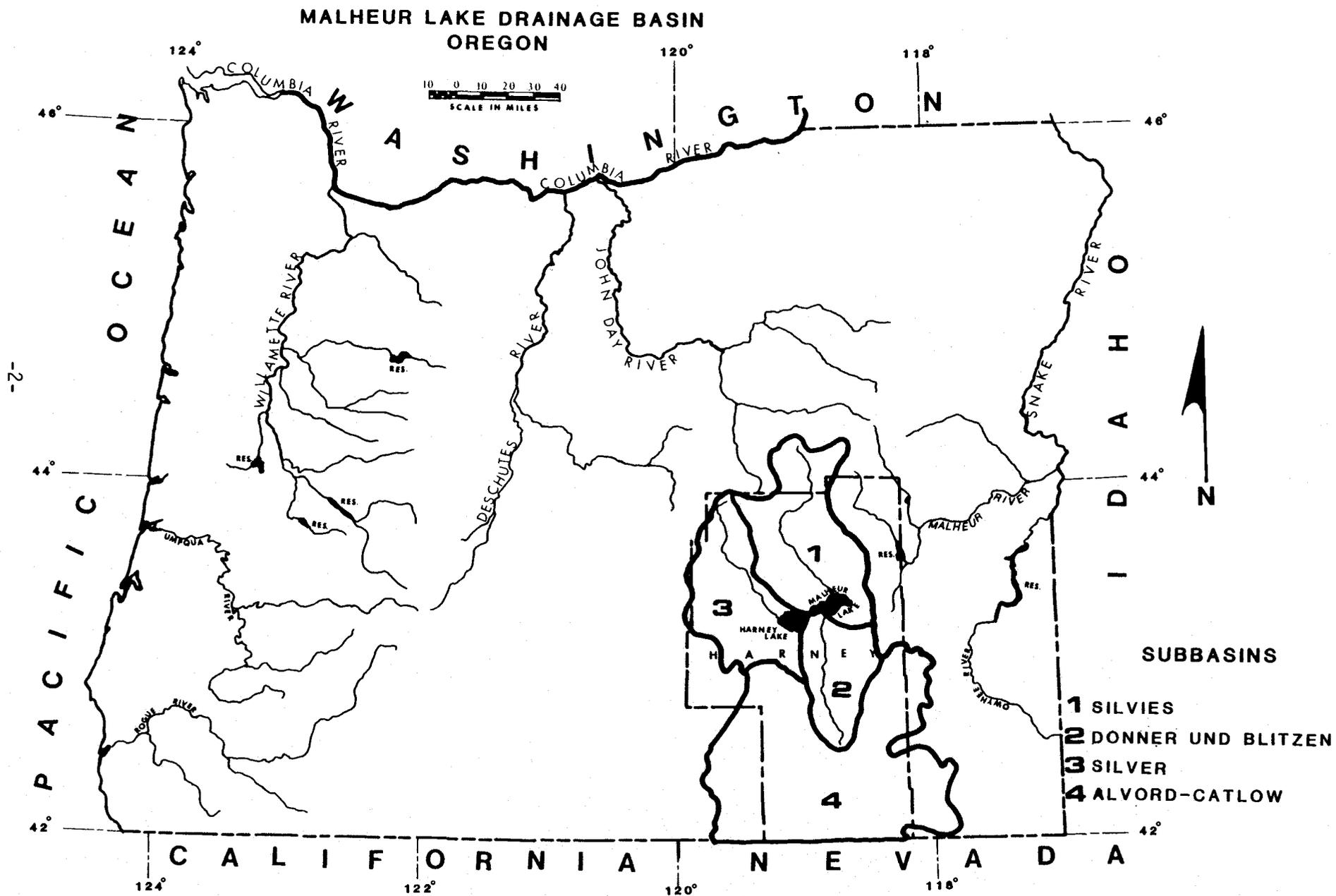


Figure 1

reached a level that caused the overflow of water from Malheur Lake into the adjacent Mud Lake and Harney Lake. The joining of these three lakes has since created one large body of water separated only by State Highway 205 (ibid, 1985). The current situation in the vicinity of Malheur Lake is somehow unusual because it is the continuous flooding of land in a closed drainage basin. The flood problem in the area follows the description of the basin.

Damages and losses that have resulted from flooding are extensive and have affected several sectors of the economy in Harney County. The major concern, however, is over the flooding of farm and ranch land. Since the start of flooding in 1982, over 100,000 acres (40,470.0 hectares) of land has been flooded (The Oregonian, 1987). Flood waters have also damaged state and county transportation facilities, railroad, utilities, homes, improvements, Malheur National Wildlife Refuge and others.

Interests and individuals affected by the flooding have been eager to find a solution to these problems, and have been searching for ways in which they can be mitigated. A solution that is acceptable to all parties has not been reached yet (Hayes, 1987a).

The purpose of this research paper is to discuss the flooding in the area, the proposed structural and non-structural flood reduction measures, and the varying positions on these measures.

## II. A DESCRIPTION OF HARNEY BASIN

### Physical Environment

Harney Basin is located in Harney County in Southeastern Oregon (figure 1). This basin has an area of 5300 square miles (13,727 km<sup>2</sup>) and is a closed drainage basin. The terminus of the surface waters is made up of the three lakes, Malheur, Harney and Mud. Water flow into the lakes is provided by the Silvies and Donner und Blitzen Rivers and Silver Creek (USDA, 1967). The flow period into the lakes usually lasts from late fall through early summer.

The climate of Harney Basin is semi-arid with average annual precipitation of 8 inches (20.3 cm) or less in the low-lands and close to 35 inches (88.9 cm) in the mountainous surroundings (US Army Corps of Engineers, 1986). The growing season in the area also varies with elevation. Areas of relatively low elevation usually have a growing period of between 90 to 120 days while upland areas have a growing period of between 60 and 90 days (USDA, 1967).

In a closed drainage basin, water level is controlled by three means: precipitation, natural evapotranspiration, and by man-made means such as canals. With increased flow of water into the basin's terminus and the lack of natural, and artificial means to reduce the amount of water, the water level would rise. Such has been the case in Harney Basin.

Above normal precipitation in Harney Basin that surpassed

the rate of evapotranspiration, resulted in increased water level in Malheur Lake. Malheur Lake, which is the largest lake in the basin, started to rise above the normal 4093 fmsl (1247.5 mmsl) in 1982 (Wahab, 1987). When water level reaches an elevation of 4093 fmsl (1247.5 mmsl) in Malheur Lake, it flows into the adjacent Mud and Harney Lakes (US Army Corps of Engineers, 1985). Since the prehistoric outlet of Malheur Lake into the Malheur River has been plugged by geologic activities in the area, there is no outlet for excess water to leave the basin (ibid, 1986a). The result has been extensive flooding in the vicinity of Malheur and Harney Lakes.

Other factors that may have contributed to increased water in the lakes are direct precipitation on the lakes and lower summer temperatures (National Weather Service, 1984).

### Natural Resources

As a typical rural area, land and water are two of the most important resources available to the people and other life-forms in Harney Basin. Rivers of the basin such as the Silvies, Donner und Blitzen, and Silver Creek are used extensively for irrigation, recreation and as fish and wildlife habitats (US Army Corps of Engineers, 1985). Even though climatic and soil conditions are harsh in Harney Basin, the agriculturally productive land is extensively used for cattle raising and the growing of forage and limited commercial crops (ibid, 1985).

Land use practices have a direct influence on the yield and quality of water in Harney Basin and as a result, much of the economy of the basin (USDA, 1967). Agricultural productivity in Harney Basin is directly influenced by the use of water. Approaches to water use and management are summarized as follows (USDA, 1967, p.22):

"The major water use in the basin is irrigation of pasture and hay crops. Because the water supply is limited and the nature of the runoff is seasonal, there are many problems involving water use including flooding, erosion, and drainage. In general, the diversion of flood waters early in the spring and wild flooding are the present methods of irrigation water management. Some reservoir storage is available for supplemental irrigation, but this storage is not adequate to provide water for all crop-land developed for irrigation."

Another natural resource available in Harney Basin is the Malheur National Wildlife Refuge. In 1908, an area of 184,000 acres (74,460.0 hectares), including 102,000 acres (41,270.0 hectares) of the surface area of Malheur and Harney Lakes, were set aside as the Malheur National Wildlife Refuge (State Water Resources Board, 1967). This resource plays an important role in providing nesting grounds for the migratory waterfowl.

The management objectives for the refuge include the increased use and production of waterfowl, the conservation of water and provision of habitat during periods of sub-normal water supply (USDI, Fish and Wildlife Service, 1962).

Harney Basin has a large forested area which is con-

sidered a main resource and contributor to the economic well being of Harney County (State Water Resources Board, 1976).

Tourism is also considered to be a resource and economic contributor in Harney Basin and County (US Army Corps of Engineers, 1986a).

The above mentioned resources, and/or economic activities dependent on them, have been affected by the flooding of Malheur Lake in one way or another. Since these resources are vital to the economy of Harney County, mitigation is sought by the residents of the area. This will be addressed in the latter sections of this paper.

#### Economic Background

Harney Basin was settled by the American Indians long before the first Hudson Bay Company trappers went into the area for fur trading purposes in 1826 (Brimlow, 1951). This trapping expedition by Hudson Bay Company trappers was followed by several more expeditions, but 1843 was the first year that cattle herds were driven into the area (ibid, 1951). Cattle production still remains as a prominent economic activity in the basin.

People who settled in Harney Basin after 1843 found the area attractive for stock raising purposes. There were abundant water and wild hay meadows which could easily be utilized for the needs of livestock producers (ibid, 1951). Later, certain developments in diking, drainage improvement, and water spreading were made in order to enhance livestock

production (State Water Resources Board, 1967).

The Homestead Acts of the 1800s and early 1900s, in addition to other legislative acts such as the Desert Land Act of 1877, were the main forces behind encouraging settlers to settle in Harney Basin (ibid, 1967). These settlers, however, realized that dry-land farming was not the most economical way of life. The problem of seasonal dryness initiated the need for the improvement of irrigation methods in the late 1800s (Brimlow, 1951).

The basin has remained mainly a livestock producing area. This includes agriculture which consists mainly of producing forage crops for livestock. Because of the short growing season in the basin, there is little commercial crop production (US Army Corps of Engineers, 1986a).

Harney Basin has approximately 6,377,600 acres (2,580,940.0 hectares) of land which is used for the following purposes (State Board of Water Resources, 1967):

- |                      |                 |                        |
|----------------------|-----------------|------------------------|
| 1. Rangeland         | 5,279,800 acres | (2,136,670.0 hectares) |
| 2. Forests           | 779,400 acres   | (315,410.0 hectares)   |
| 3. Cropland          | 262,700 acres   | (106,310.0 hectares)   |
| 4. Towns, roads etc. | 55,700 acres    | (22,540.0 hectares)    |

### III. THE FLOODING OF MALHEUR LAKE AND DAMAGES CAUSED

The water level started rising over the normal 4093 fmsl (1247.5 mmsl) average in 1982 and eventually reached 4102.56 fmsl (1250.4 mmsl) in May of 1986 (figure 2). This rise of

# Malheur Lake Elevation

1983-1986

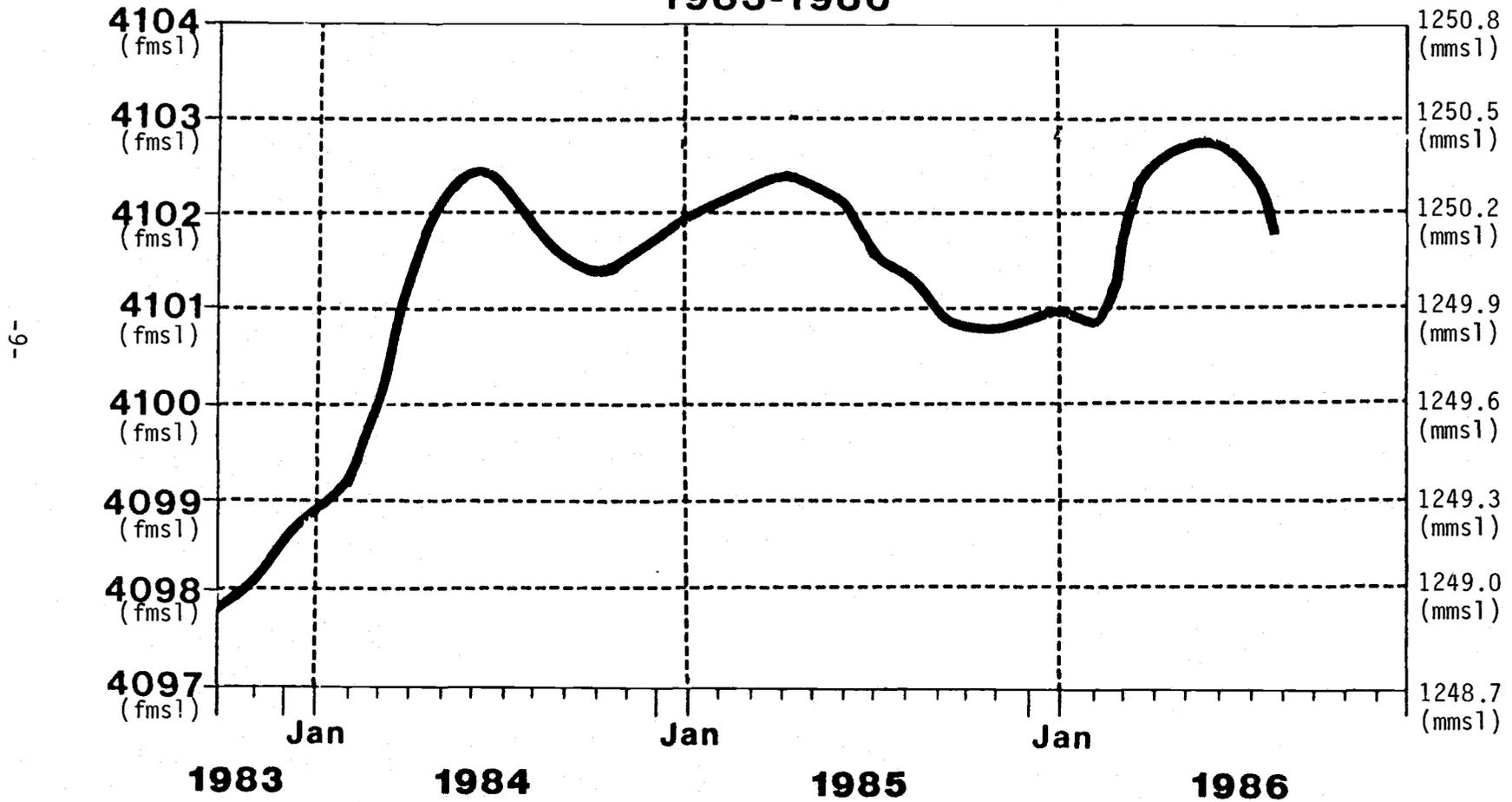


Figure 2

Source: US Army Corps of Engineers, 1986a

9.56 feet (2.9 meters) in water level has caused the flooding of over 100,000 acres (40,470.0 hectares) of land in the vicinity of Malheur and Harney Lakes (figure 3). Even though the water level in the two lakes stabilized in May of 1986 and has been on a decline since then (The Oregonian, 1986b), damages caused by flooding still remain extensive. Water level has dropped from 4102.56 fmsl (1250.4 mmsl) in May of 1986 to 4100.9 fmsl (1249.9 mmsl) in May of 1987 (Anderson, 1987).

Below is a summary of damage categories, estimated through 1985 when Malheur Lake reached an elevation of 4102.4 fmsl (1250.35 mmsl) in May of that year (US Army Corps of Engineers, 1986a):

A. Agricultural Land - The flooding has put out of production about 60,000 acres (24,280.0 hectares) of agricultural land of which 90 percent was in private ownership and the remainder in federal, state, and county ownership. The value of the flooded land has been estimated to be 2,500,000 dollars. The "damming effect" resulting from the flooding of Malheur Lake (particularly to the north of the lake), has caused water logging and reduced productivity on land above the flood elevation. Farmers find it hard to get to their fields in time for spring cultivation due to water logging and roads damaged by flood (NW Economic Associates, 1985).

B. Railroad - A portion of the Burns-Hines and Ontario

# Malheur and Harney Lakes

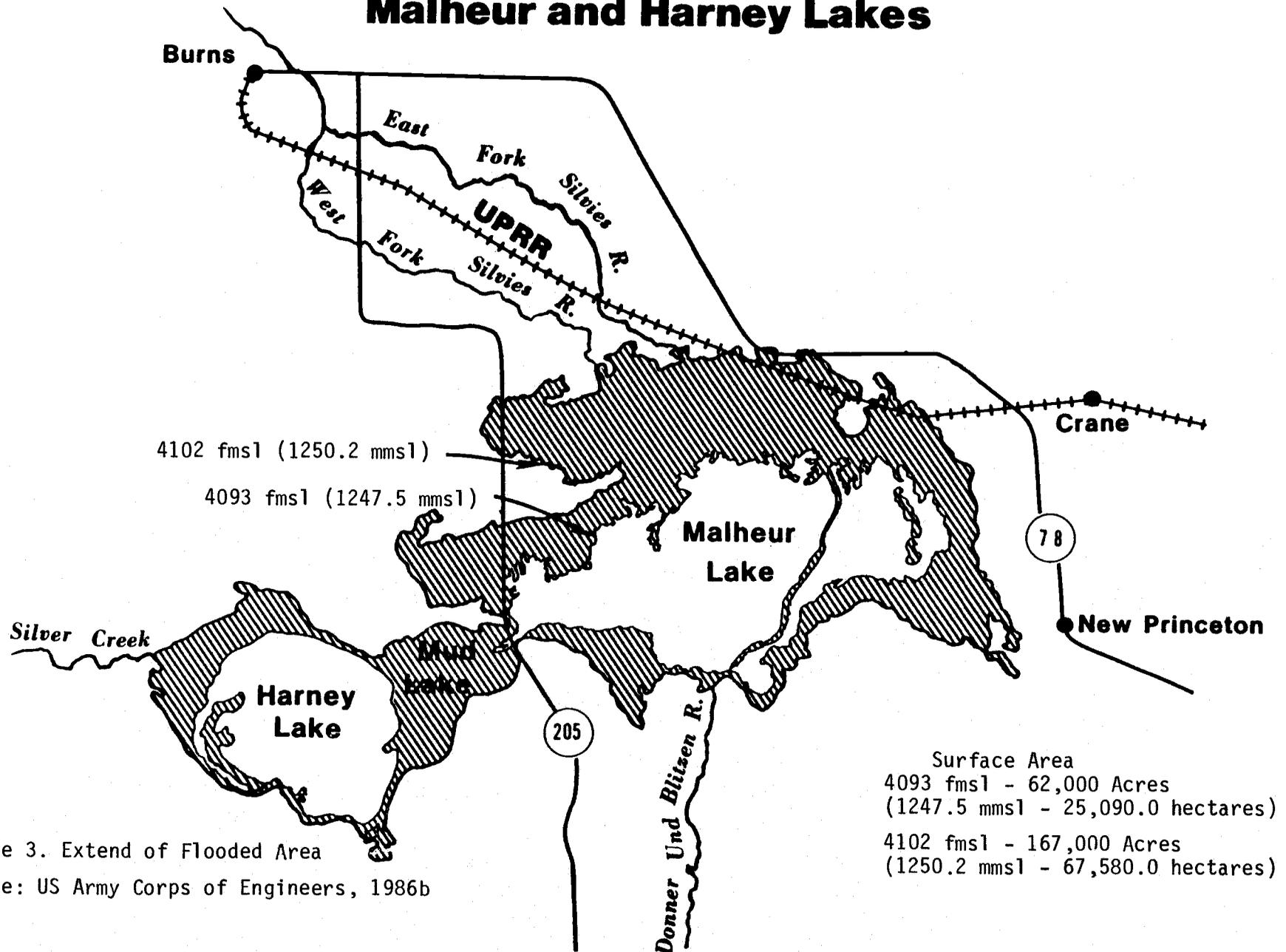


Figure 3. Extend of Flooded Area  
 Source: US Army Corps of Engineers, 1986b

branch of the Union Pacific Railroad has been flooded out and the estimated damage is calculated to be 5,900,000 dollars.

The railroad was being used for the transport of forest products which make a substantial contribution to the economic development of Harney Basin and County.

C. Roads and Highways - An estimated 4,000,000 dollars damage has been caused to State Highways 78, 205 and other county roads. Some of these highways and roads have been raised several times above the flood-line.

D. Utilities - This category includes damage to telephone and electric facilities. The estimated damage is 2,100,000 dollars.

E. Improvements - The flooding has destroyed more than thirty homes and damaged several others, caused damage to wells and septic systems. Damage in dollars is 2,300,000.

F. Other - It is estimated that 200,000 dollars damage has been caused to facilities on Malheur National Wildlife Refuge and another 300,000 dollars have been spent on fighting floods, temporary housing and increased travel costs. While things have gone sour for most farmers and ranchers in the vicinity of Malheur Lake, most fish and wildlife have benefited from the flooding. Certain species that had not been seen in the refuge for many years are making a comeback. The white pelican is one of such species (Savonen, 1985).

The flooding has also contributed to adverse economic conditions and other indirect impacts in Harney County. Employment in retail sales, banking and insurance has dropped in Burns due to reduced income of timber products companies, ranchers and farmers (NW Economic Associates, 1985). In addition, banks have put restrictions on lending money to farmers and ranchers in the basin area; therefore, some farmers see their operations threatened due to weak financial positions (ibid, 1985).

#### IV. INITIATION OF ACTION TO SOLVE THE PROBLEM

Harney Basin was declared a disaster area by Governor Atiyeh in June of 1982 (Obermiller and McLeod, 1984) and the investigation of the damage started soon after. In May of 1983, the Harney County Emergency Board submitted a disaster assessment report to the Oregon State Agricultural Stabilization and Conservation Service (ASCS), in which the extensiveness of damages and concerns of the affected people were reported (USDA, ASCS Harney County, 1983). The report indicated the concerns of the county and stated that the economic impact of the flooding was affecting the entire community and the main economic contributors in Harney County: agriculture, timber industry and tourism.

The Harney County Emergency Board proposed short range and long range solutions to the problem in order to mitigate the affected parties. These solutions were to be

implemented by the state and federal governments (ibid, 1983). In fact some were later included in the Army Corps of Engineers study and some were dropped due to their environmental impacts and/or low benefit cost ratio.

The solutions proposed by the Harney County Emergency Board included the following (ibid, 1983, p.5):

- 1.- Use of refuge and BLM resources by farmers and ranchers until such resources are available
- 2.- Provision of low interest loans through Farm Home Administration to farmers and ranchers so they can refinance their existing loans
- 3.- Implement an emergency feed program which would require the government to provide surplus feed to farmers and ranchers or share the cost of purchased feed
- 4.- Temporary exchange of use between the refuge and the affected ranchers, until the flooding subsided
- 5.- Flood easements to the affected ranchers and farmers inundated by high lake level
- 6.- Permanent land exchanges between public and private lands
- 7.- Guaranteed low interest operating loans for grain and alfalfa farmers

Long term solutions to the flood problem proposed by the Harney County Emergency Board included a drainage canal and upstream storage on the Silvies and Donner und Blitzen Rivers. The drainage canal later became a controversial part of the flood reduction study. The upstream storage proposal on the Silvies and Donner und Blitzen Rivers that would have reduced inflow into Malheur and Harney Lakes was dropped by the Corps of Engineers. The reasons for dropping

the upstream storage proposal were low benefit cost ratio and environmental concerns (US Army Corps of Engineers, 1986a).

Some of the above proposed solutions, plus other alternatives, eventually became part of the study conducted by the Corps of Engineers aimed at reducing the impacts of the flooding.

#### V. FLOOD REDUCTION MEASURES PROPOSED BY THE ARMY CORPS OF ENGINEERS

In order to combat and mitigate flood damage caused by the rising water level in Malheur and Harney Lakes, the US Army Corps of Engineers, Walla Walla District, in their completed Malheur Lake Flood Damage Reduction Study, Harney County, Oregon, Draft Feasibility Report and Environmental Impact Statement, proposed several flood reduction measures.

These measures included:

1. Private and Federal Land Exchange
2. Purchase of Flooded Land by the Federal Government
3. Railroad Relocation
4. Virginia Valley Canal
5. Combination of Alternatives
6. No Action

The first alternative (land exchange) was dropped from further study because it was not seen as a viable solution. Joshua Warburton, the BLM district manager in Burns, in a

letter to the Corps of Engineers, gave the following reasons for the rejection of the land exchange measure (US Army Corps of Engineers, 1985, p. D-3):

- "a. The BLM did not have comparable subirrigated lands.
- b. The BLM sagebrush land was very limited in acreage, was over 45 miles (72.4 km) away from the affected by flood area and was composed of isolated scattered tracts.
- c. Development costs on federal lands would be exorbitant and not easily affordable by the affected ranchers.
- d. Appraisals would require that much more private land be traded for than federal land received due to the flooded condition and the low values of the offered private land."

The Corps of Engineers grouped the rest of the flood reduction measures into two groups, non-structural and structural.

#### Non-Structural Measures

The non-structural approach to flood reduction in Harney Basin includes two alternatives and the combination of those two. These alternatives are (US Army Corps of Engineers, 1986a):

1. Land Purchase - The implementation of this measure includes the purchase of the flooded land by the Federal Government. There are three options in this measure and they are: the purchase of land to 4102 fmsl (1250.2 mmsl), 4099 fmsl (1249.3 mmsl) and 4095 fmsl (1248.1 mmsl).

Figure 4 indicates the above levels. The purchased land would then be added to the the Malheur National Wildlife Refuge. Since the purchased land would become Federally owned, it would be the responsibility of the Federal Government to pay the total price for the land.

2. Railroad Relocation - A portion of the Union Pacific Railroad has been put out of service by flood waters. Since the railroad is vital to the timber economy of the area, the relocation of the railroad onto a higher elevation has been proposed. Three elevations, 4110 fmsl (1252.7 mmsl), 4105 fmsl (1251.1 mmsl) and 4100 fmsl (1249.6 mmsl) have been considered (figure 5). The implementation of this alternative would not benefit the farmers and ranchers who have lost their land to the flood waters. The implementation of this measure would require a non-federal sponsor to provide 25 percent of the total costs.

3. Combination of the above two Alternatives - This involves the purchase of the flooded land up to the 4095 fmsl (1248.1 mmsl) elevation and the relocation of the railroad onto a higher ground. This approach has been favored by the state of Oregon (State of Oregon, 1986). Cost sharing for the implementation of this measure would follow the patterns of the first two alternatives.

# Land Purchase Alternative

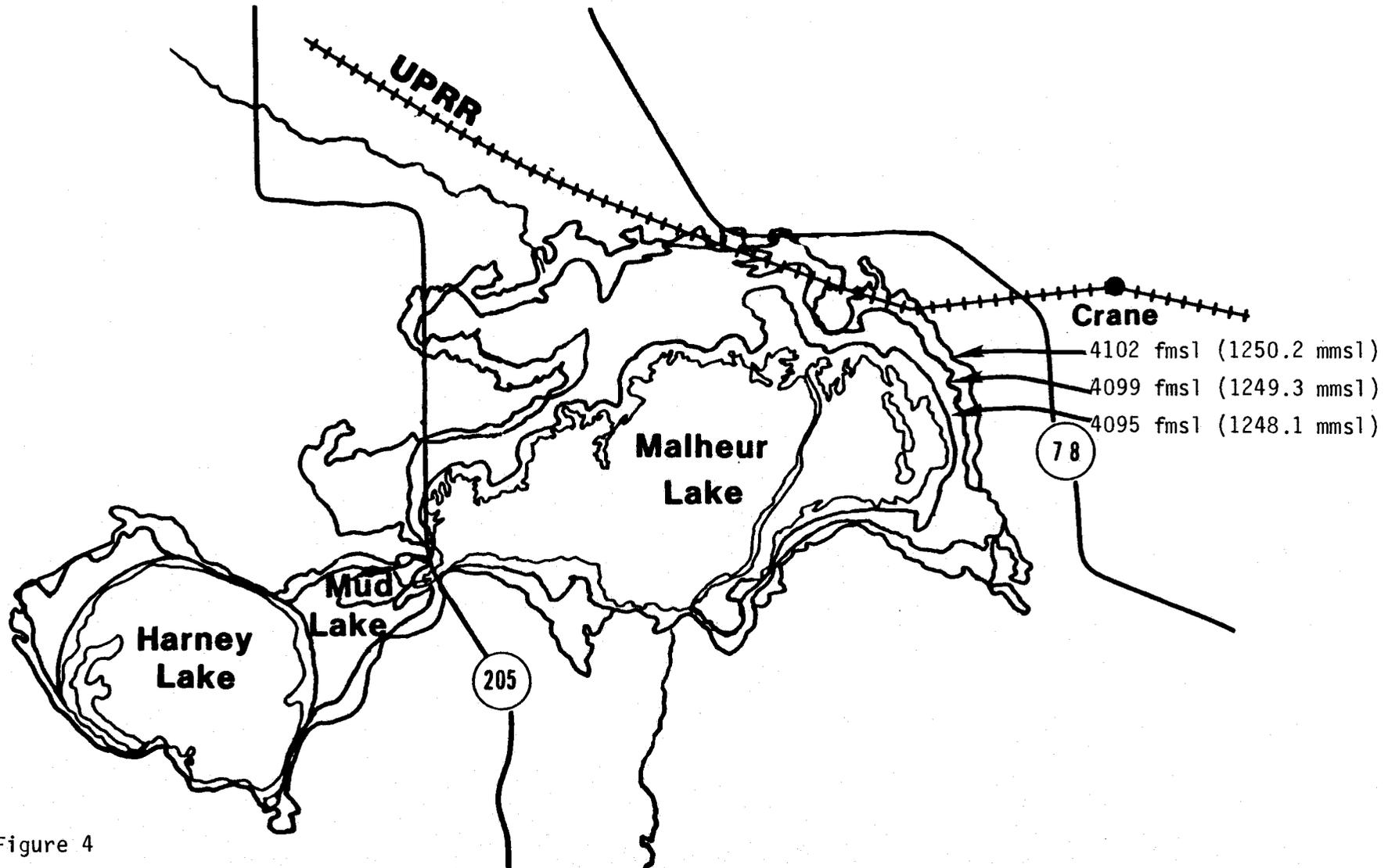


Figure 4

Source: US Army Corps of Engineers, 1986b

# Railroad Relocation Alternative

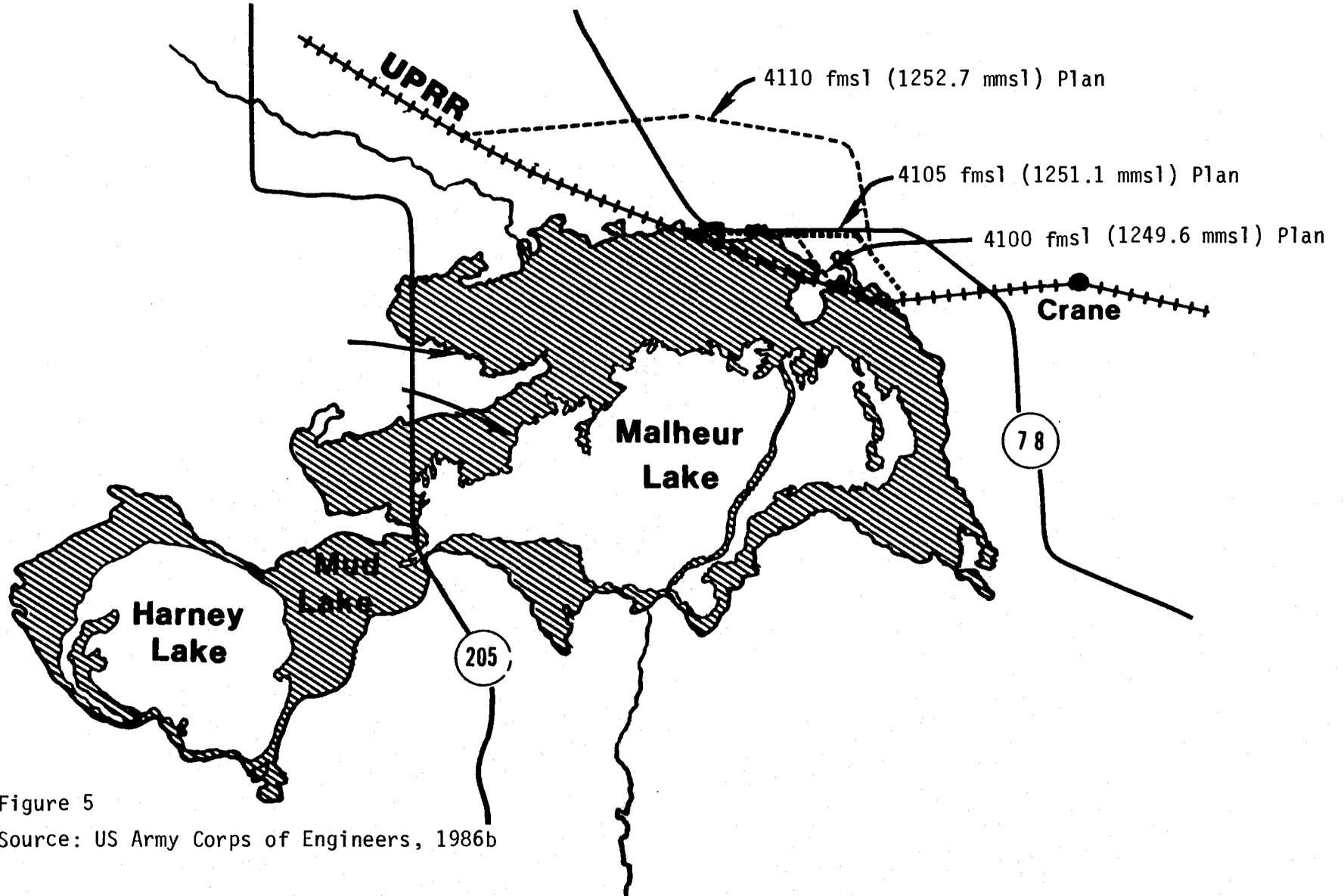


Figure 5  
Source: US Army Corps of Engineers, 1986b

### Structural Measures

The structural measure involves the controversial 15 mile (24.1 km) long, 21 million dollar Virginia Valley Canal (figure 6). The Virginia Valley Canal would divert excess water from Malheur Lake into the Malheur River, a tributary of the Snake River. The diversion of excess water would cause the lake level to drop and eventually the flooded land could be reclaimed (US Army Corps of Engineers, 1986a). The implementation of this measure requires a non-federal entity to share 25 percent of the costs.

The no action alternative is included in the preparation of the feasibility study for formalities (ibid, 1986c&d).

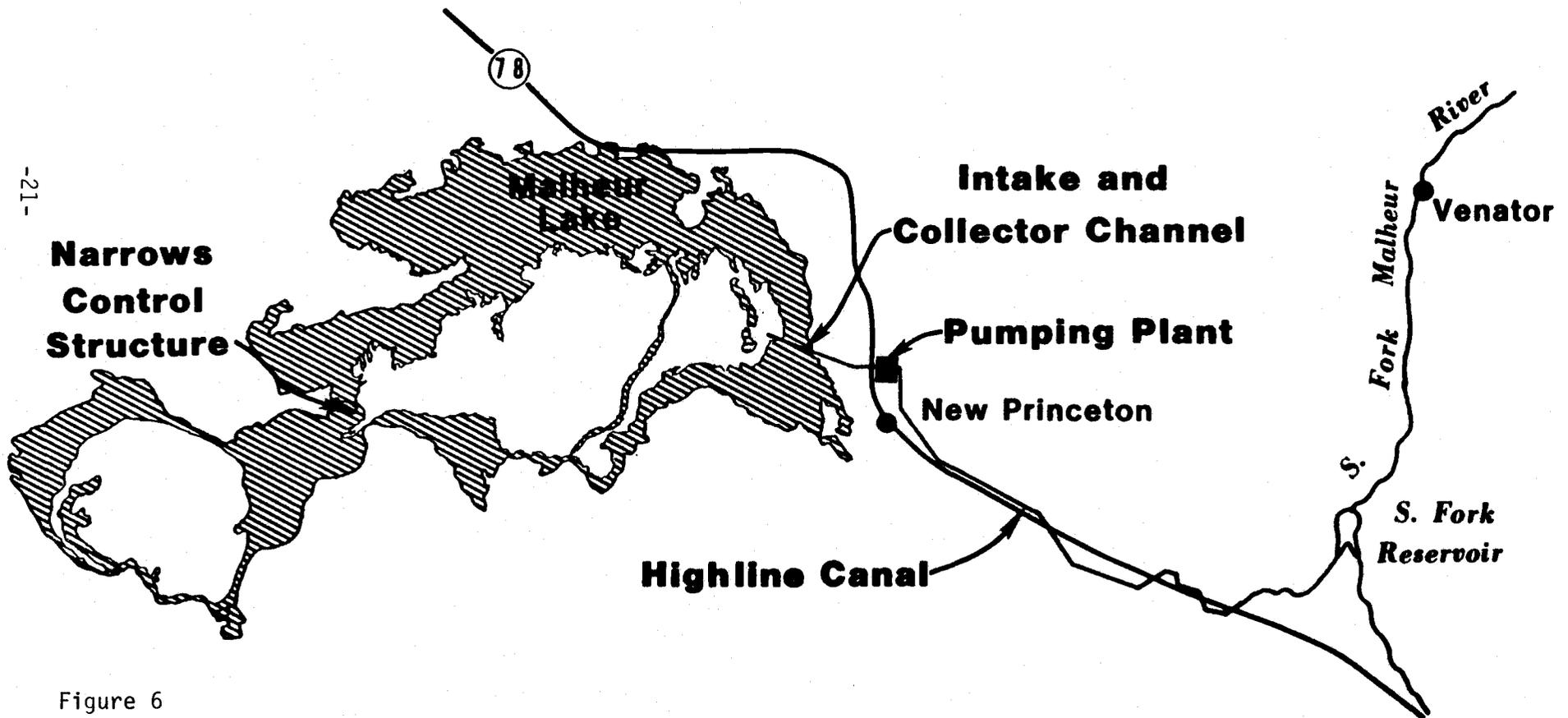
## VI. VARYING POSITIONS ON FLOOD REDUCTION MEASURES

Due to divergent positions on a single flood reduction measure, no agreement has been reached on the implementation of the proposed measures. Each of the non-structural and structural measures have been rejected and/or dropped by various groups.

### Farmers and Ranchers

Farmers and ranchers strongly support the Virginia Valley Canal alternative (Cockle, 1987). Farmers and ranchers believe that after the lake level is brought back to its normal 4093 fmsl (1247.5 mmsl) elevation, they could reclaim

# Virginia Valley Canal Alternative



-21-

Figure 6

Source: US Army Corps of Engineers, 1986b

their lands and continue normal operations. They also believe that without the building of the canal, "their land value would be ruined forever" (ibid, 1987). Farmers and ranchers have been the most adversely affected of all groups by the flood water and would like an immediate solution to the problem; however, the solution they favor is expensive and requires a non-federal agency to share the costs; therefore, the situation is complicated.

The issue of implementing a flood reduction measure has become a complex one. Harney County, state and federal actors, other citizen groups of the state of Oregon and environmental groups have strong interests in the issue. The non-agreement between these parties has forced the farmers and ranchers to still wait for a solution to the problem.

### Harney County

Harney County has rejected the land purchase alternative. The alternative was rejected by the county commissioner on the grounds that the purchase of the flooded land by the Federal Government would result in the loss of tax revenues generated from the land (Hayes, 1987b). The Federal Government already owns 76 percent of the land area in in Harney county according to the commissioner (ibid, 1987b).

It should be mentioned, however, that Harney County receives 25 percent of timber receipts from the sale of

timber products from the National Forests in the county (Obermiller, 1986). Due to reduced timber products sales from these forests, payments in lieu of taxes received by Harney County may have declined from 1,900,000 dollars before flooding to 1,425,000 dollars after flooding (ibid, 1986).

According to Chuck Hoyt, a BLM officer in Portland, Harney County also receives federal payments in lieu of taxes from the BLM lands in that county. In 1984 Harney County received 314,267 dollars in Pell payments, 470,168 dollars from mineral leases and 990 dollars from grazing leases from the Federal Government (Hoyt, 1987).

Harney County favors the railroad relocation and the lease of the flooded land by the federal government (Cockle, 1987). The relocation of the railroad would insure the operation of the Burns-Hines and Ontario branch of the Union Pacific Railroad. This operation is seen as vital to the timber economy of the area.

The leasing of the flooded land would leave the land in the ownership of the farmers and ranchers and on the Harney County tax roll (ibid, 1987). The land would resume production when the lake level drops to its pre-flood level.

Harney County also favors the construction of the Virginia Valley Canal in order to reduce flooding (Cockle, 1987). While Harney County would benefit from the canal, the neighboring Malheur County has opposed the construction of the canal. The downstream impacts of the Malheur Lake

water on the Malheur River system would be harmful to Malheur County according to the officials of the county. Malheur Lake water would cause bed and bank erosion in Malheur River, downstream sedimentation, damage to trout fisheries in Malheur River and would cause degradation of irrigation water withdrawn from Malheur River.

The solutions desired by the farmers, ranchers and Harney County would require millions of dollars of State and/or Federal funds. Harney County, however, seems to be unwilling to provide any funds for the implementation of any of the alternatives.

#### Actors at the State Level

The position of the state government on the three alternatives was expressed in a letter that Governor Atiyeh sent to the Corps of Engineers district office in Walla Walla. Atiyeh opposed the construction of the Virginia Valley Canal and added that, "Public testimony strongly opposed the structural alternative because of the high construction costs, uncertainty of the proposed relief, the amount of time needed to build the canal and the potential environmental damage to the natural resources in the area" (State of Oregon, 1986). The position of the state on opposing the canal was supported by the State Department of Natural Resources and Department of Fish and Wildlife (The Oregonian. 1986a).

State level support was indicated for the non-structural

alternative involving the purchase of the flooded land by the Federal Government up to the 4095 fmsl (1248.1 mmsl) elevation and the relocation of the Union Pacific Railroad onto a higher ground (Hayes, 1986).

The State of Oregon also supported the lease of land by the federal government. However, it was indicated by the Governor that the 25 percent expense money to be provided by a non-federal agency was not available from the state (State of Oregon, 1986).

#### Actors at the Federal Level

The US Army Corps of Engineers finally concluded their studies in December of 1986. The Corps of Engineers, who did extensive study of the flood problem, finally dropped the plan for building the Virginia Valley Canal in December of 1986 (Hayes, 1987a). The canal option was dropped due to a low benefit/cost ratio and opposition from environmentalists, private citizens, fish and wildlife officials at both State and Federal levels, Malheur County and the State of Oregon (ibid, 1987a).

In January of 1987, Col. James Royce, chief engineer for the Corps of Engineers, Walla Walla District, indicated that Federal Government participation in implementing the flood reduction measures would not be recommended (ibid, 1987b). Royce was quoted as saying, "It is not appropriate to recommend federal involvement in railroad relocation, as the railroad is a singly owned property and relocation could

effectively be accomplished through individually implemented action without federal participation." In another interview, Royce indicated that the situation in Harney Basin could be an exception, but the policy adopted by the Corps of Engineers prohibits the Corps from using emergency flood control funds for projects that would benefit a single owner such as the Union Pacific (ibid, 1987a).

The idea of the flooded land purchase by the Federal Government was also rejected by the Corps of Engineers. The reason given was that no non-federal actor had agreed to pay the 25 percent share of the expenses (ibid, 1987b).

### Other

The positions of the three governments on the flood reduction measures in the vicinity of Malheur and Harney Lakes, have been strongly influenced by the public and environmental groups. In two public information meetings held by the Corps of Engineers in Salem on April 16 and October 30 of 1986, it became obvious that the structural approach to flood reduction was overwhelmingly opposed by most citizens who testified and by representatives of environmental groups. Position letters were sent to the Corps of Engineers district office in Walla Walla and were published in the Corps of Engineers feasibility study which came out in the Fall of 1986.

Environmental groups such as the Audubon Societies of Blue Mountain and Portland, US and Oregon Departments of

Fish and Wildlife, Oregon Department of Natural Resources, Malheur County, Vale Oregon Irrigation District and several other interests opposed the structural approach (US Army Corps of Engineers, 1986a,c&d). Opposition to the draining of Malheur Lake, via the Virginia Valley Canal, was based on the predicted severe negative impacts of the lake water on the Malheur River System, downstream irrigation, fish, wildlife and others (ibid, 1986).

The above groups did, however, agree with the implementation of the non-structural measures in order to mitigate losses by the farmers, ranchers and other affected parties.

#### VII. REASONS FOR NO ACTION

The defeat of the Virginia Valley Canal seems to have led to a situation where no other alternative is seen as a viable solution by those impacted by the flooding in the vicinity of Malheur and Harney Lakes. They think this situation of no decision has resulted from the Army Corps of Engineers' withdrawal from the flood issue. With the withdrawal of the Army Corps of Engineers and the unwillingness of non-federal agencies to provide the 25 percent non-federal share of the expenses for implementing a flood reduction measure, the Federal Government seems to show little interest in providing funding for the implementation of any of the alternatives. The question here is whether the taxpayers should be responsible for

providing 100 percent funding for the implementation of an alternative that would benefit a few.

The state of Oregon also seems reluctant to provide the 25 percent non-federal share of the expenses for implementing a flood reduction measure. It was indicated by Governor Atiyeh that state money was not available for providing the 25 percent non-federal share (State of Oregon 1986). The argument here could also be based on the idea whether the state taxpayers should be responsible for the implementation of a measure that would benefit a few.

The above situation still seems to hold true. In a telephone interview on May 14, 1987, Witt Anderson, Corps of Engineers Project Manager for Malheur Lake, said that state funds were still unavailable for the project. Anderson also indicated that there was no federal interest in the Malheur Lake flood project.

With a decision still months away (Cockle, 1987), the situation seems desperate for those impacted the most by flood waters: farmers and ranchers. They state that it is the responsibility of the government to apply a flood damage reduction measure to the problem.

Many lumber companies in Harney County have faced economic difficulties partially due to increased transportation costs and part of their difficulties result from a severe slump of the timber markets. They would, therefor, like to see the relocation of the flooded railroad. The railroad situation does not seem to be the

cause of all the problems facing the timber economy of Harney County. Jack Graham, special projects coordinator for the Oregon Department of Transportation, in a letter to the Corps of Engineers indicated that lumber shipment by truck to Ontario would be a desirable method should the railroad remain flooded out.

#### VIII. CONCLUSIONS AND THE FUTURE OF THE AREA

The flooding problem in the vicinity of Malheur and Harney Lakes is characteristic of areas with closed drainage. Malheur Lake flooding, unlike flash flooding or tidal flat flooding that have a very short duration, has remained for several years. Several climatic factors have contributed to this long duration of flooding in Harney Basin.

Even though Malheur Lake has fluctuated greatly in its size throughout time, the latest flooding seems to have taken the general public by surprise. It has changed from complete dryness in 1934 to a record large size of 180,000 acres (72,840.0 hectares) in 1985 (Savonen, 1985).

The flooding problem that started in Harney Basin in 1982 still remains without a solution. The flooding is costing the state and local governments, residents of the area and those affected directly and indirectly, millions of dollars. These parties, however, seem to be unwilling to pay the 25 percent non-federal share of the expenses required for

implementing the most expensive flood reduction measures. A solution is needed which would be long range and which would guide future planning in the area for the conservation, proper development and management of water and land, the two most important resources of the area.

Agreement upon such a solution would depend on the willingness of the different interest groups and various agencies and governments to bear their share of the responsibility. This lack of willingness seems to be the major obstacle in the way of achieving a solution.

From the examination of the flood situation in the vicinity of Malheur and Harney lakes one point is obvious, and that is the desirability for a non-structural solution to the problem except for the farmers, ranchers, timber and railroad companies and Harney County who favor the structural solution. It is suggested that the solution to the flooding problem in the area that seems the most logical would be one that would benefit the affected farmers, ranchers, timber companies and Harney County. This proposed solution would also be acceptable to most citizen groups and environmental groups in other parts of the State of Oregon. The proposed solution, however, requires participation and cost sharing by all involved parties. This solution would include the purchase of the flooded land to the 4095 fmsl (1248.1 mmsl) elevation, leasing of the remaining flooded land by the Federal Government and the relocation of the flooded railroad onto a higher elevation.

The above solution would have several positive and desired results. First, it would be environmentally sound and would prevent negative downstream impacts from occurring in Malheur River Basin by not constructing the Virginia Valley Canal. The second positive result would be the mitigation of losses suffered by the affected farmers and ranchers and other interests in the area. Third, by the purchase of land up to the 4095 fmsl (1248.1 mmsl) elevation, Malheur lake would have more area for fluctuation without posing a threat to developments in the future. This would also increase the size of the Malheur National Wildlife Refuge for the benefit of wildlife.

The lease of the remaining flooded land would benefit the farmers, ranchers and Harney County. Flood waters at 4102 fmsl (1250.2 mmsl) have caused a total of 1,239,800 dollars loss in net farm income through 1985 (NW Economic Associates, 1985). By leasing the land, farmers and ranchers could resume their farming and ranching activities once the lake level returns to normal. Harney County would not lose its tax base from the leasing.

Relocating a portion of the Burns-Hines and Ontario Branch of the Pacific Union Railroad onto a higher elevation would benefit the railroad and timber companies in the area. Timber companies could resume transporting wood products using the railroad which would result in increased productivity and employment in Harney County.

The implementation of the above measures would eliminate

the need for the Virginia Valley Canal, which does not have the support of many interests. The proposed non-structural flood reduction measure (which is the combination of three alternatives) would ensure a long term solution to the flooding problem that has caused distress in Harney County. It should be stressed that the costs for implementing the proposed measure would have to be shared by federal and non-federal entities.

A situation of no-decision, which exists today, would remain as a financial drain on the resources of the area and on the economic well being of the residents of Harney County.

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