

Assessment Report

**American Fork – Dry Creek Watershed
Tibble Fork Dam
Utah County, Utah**



**Natural Resources Conservation Service
Salt Lake City, Utah**

September 10, 2004

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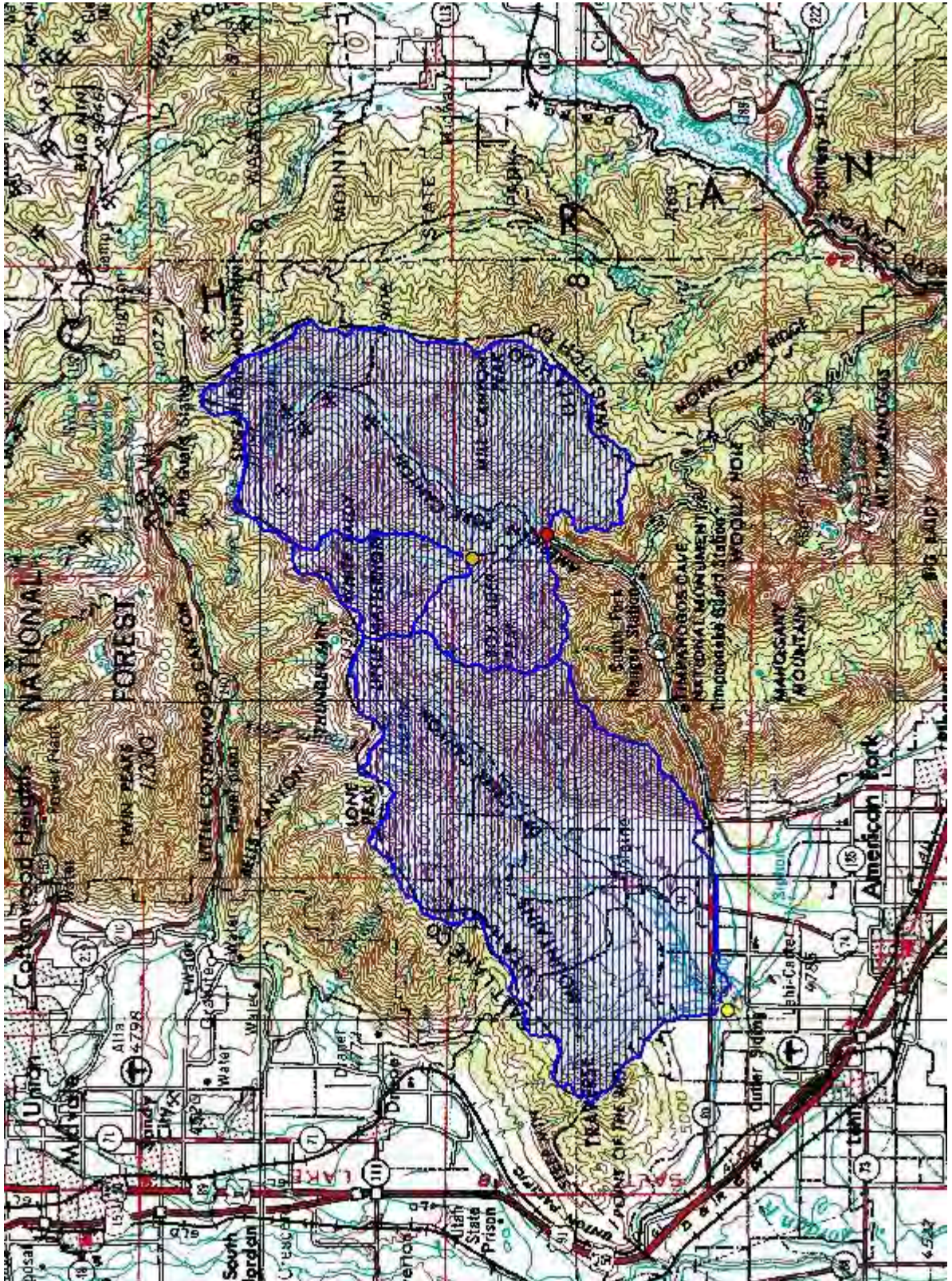
Abstract

The Small Watershed Rehabilitation Amendments, PL 106-472, authorized funding and technical assistance to rehabilitate aging flood control dams built under the USDA Small Watershed Program. Sponsors of these project dams can apply for rehabilitation assistance to extend the service life of their dams 50 to 100 years and ensure that the dams meet applicable safety and performance standards. The policy established by the Natural Resources Conservation Service (NRCS) allows sponsors of dams to request an assessment of their site. This assessment by NRCS will provide the sponsor with information to help them decide if they should pursue the rehabilitation of their aging dam. On June 24, 2004, Mr. Van Burgess, President of the North Utah County Water Conservancy District, requested an assessment of the American Fork – Dry Creek Watershed Project Tibble Fork dam. Teams of NRCS specialists completed field assessments of the site on July 19 and 20, 2004. NRCS field personnel also conducted additional support work in gathering data for this assessment.

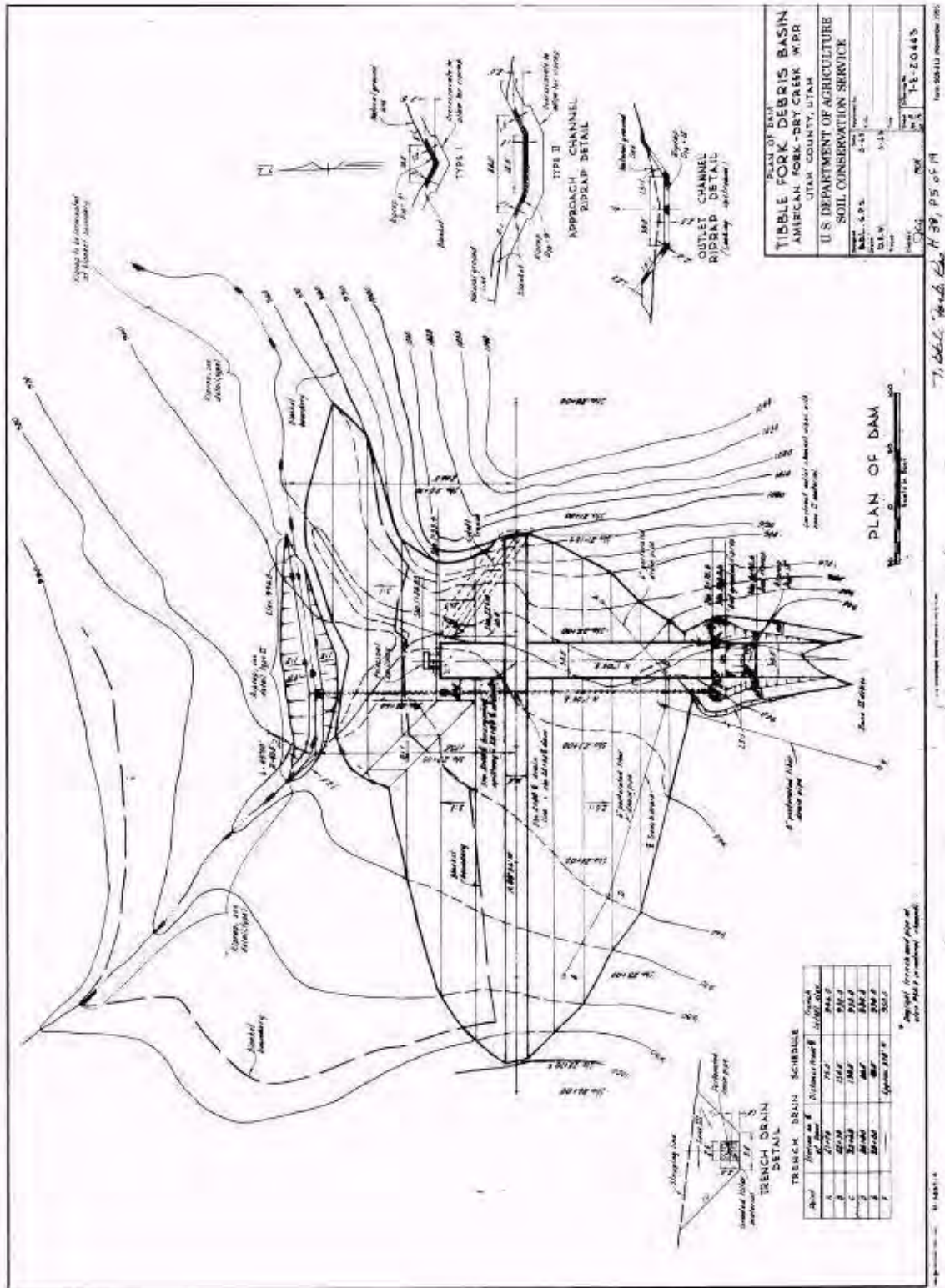
Tibble Fork dam was built within the American Fork – Dry Creek Watershed under the Small Watersheds Program (PL 83-566). The construction of Tibble Fork dam was completed in 1966, and the dam was planned, designed, funded, and constructed for the purposes of sediment containment and flood prevention. The sponsors requested an assessment on the basis of their concern that due to possible sediment accumulation in the reservoir, the reservoir may no longer be capable of serving its original intended flood control purposes. The use of the reservoir was changed in the late 1970's to include fish and recreation, which coincided with a change in dam operations to enable permanent water storage in the reservoir pool. Current records do not indicate that any structural modifications were made to the dam in order to accommodate the change in purposes.

There are also concerns that the dam was not constructed so as to sufficiently handle potential maximum flows given existing hydrologic conditions. The unplanned water storage further exacerbates the concern with respect to the flood prevention capacity of the dam. It is important to note that Silver Lake Flat and Tibble Fork dams exist in series within the American Fork watershed. Should either dam fail, visitors and campers in American Fork Canyon – including the Timpanogos National Monument Visitors Center and multiple Forest Service campgrounds – and occupants of the cities of Highland, American Fork, and Lehi, which sit in the inundation path of the dam, would be in imminent danger. Canyon visitors, in particular, are at significant risk. Dams with downstream hazards have more stringent design criteria than sites without downstream hazards. Because of the current downstream hazard, Tibble Fork dam does not meet current safety and performance standards. This assessment addresses the options available to the sponsors of rehabilitation for Tibble Fork dam.

Project Map



Plan View of Tibble Fork Dam



Description of Tibble Fork Dam

Tibble Fork dam is a 48-ft. tall earthen embankment with a drainage area of 31 square miles. The dam is 455-feet long and is located on the North Fork of the American Fork River at an elevation of 6,380 feet. This dam is in series with Silver Lake Dam, which is approximately 4 miles upstream. The watershed is in the Uinta National Forest with the watershed divide at 10,200 feet MSL. This area was historically a silver mining area. The reservoir is designed to store 234 ac.ft. At the spillway crest elevation the site has the capability to store 166 ac-ft. of sediment with a surface area of 11.5 acres and 68 ac.ft. of water for a surface area of 13.9 acres.. The principal spillway system consists of a 30 in. diameter reinforce concrete pipe passing through the dam with a concrete intake structure in the pool area of the reservoir.

This system controls the release of floodwater. The pipe discharges into a reinforced concrete outlet works. Potential seepage alongside the pipe system is controlled with 25-ft x 30-ft concrete anti-seep collars surrounding the principal spillway pipe. Foundation seepage control measures include an 8-ft wide slurry trench, located 220-ft upstream from centerline of dam and a cutoff trench with 30-ft bottom width with 1:1 sideslopes, also upstream from centerline of dam. Embankment seepage control includes a zone fill cross section with a downstream chimney drain.

Brief History and Existing Condition of Tibble Fork Dam

Tibble Fork dam was designed prior to 1966 and construction on the site was completed in 1966. The site was designed and constructed as a Class “c” (high) hazard site, meaning there was a high probability of loss-of-life if the dam should fail. The dam was planned and built with flood control and sedimentation retention being the primary purposes of the structure. All other uses are for secondary purposes. It was designed to have a 100-year economic life and a 50 year sediment storage life.

Landslides occurred upstream of the reservoir during 1983 increasing the sediment load to the reservoir. One landslide movement blocked the inlet channel about one mile upstream of the pool area. This landslide has been cleared and the valley floor reshaped leaving a narrow stream channel with high embankments. The channel is armored.

Seepage has been observed downstream of the dam embankment in the past. The drought has reduced the quantity of seepage and its indication by vegetation. This would indicate that the seepage is not related to the embankment but it is not definitive.

Original Sponsors of Tibble Fork Dam

North Utah County Water Conservancy District
Lehi Irrigation Company
American Fork Irrigation Company
Alpine Irrigation Company
Alpine Soil Conservation District
Pleasant Grove Irrigation Company

Lehi City
Alpine City
Pleasant Grove City
American Fork City
Utah County
Utah State Department of Fish and Game
Soil Conservation Service (NRCS)

Other sponsors may be added during the rehabilitation process if added purposes or uses of the site are desired and the site conditions are suitable.

Existing Beneficiaries

The benefited area for the Tibble Fork dam is shown on the Project Map. The dam provides flood prevention or reduction benefits on the recreational, agricultural, residential, and business areas downstream. Landowners downstream of the dam benefit from the reduction of flooding occurrences, reduced periods of denied access to their property, and reduction in sedimentation of their property. The local and state highway departments and the general public benefit from the reduction of flooding occurrences and potential damage to road and bridge crossings downstream of the dam. The watershed work plan estimated that the value of average annual damage reduction from construction of the Tibble Fork dam was estimated at an amount of \$17,825. The American Fork – Dry Creek Watershed Project as a whole, including both structural and land treatment measures, was projected to result in an 84% reduction in flood, sediment, and other damages within the project area. The estimated downstream benefits were numerated in approximate 1958 dollars based on the then-existing downstream infrastructure and population. Significant development has occurred in the flood inundation area, drastically increasing the average annual value of flood-prevention benefits that accrue as a result of completion of the watershed project. In order to accurately quantify these benefits in 2004 dollars, a detailed economic study would be necessary. A study at this level of detail is not required under the provisions of the NRCS Watershed Rehabilitation Program.

Seismic Dam Safety

The dam was constructed before seismic criteria were developed. An NRCS seismic evaluation is in progress and will be available for the rehabilitation design work.

Sediment Yield

This structure has a sediment pool storage capacity for a 50 year period. The design sediment storage capacity is 166 acre-feet. US Forest Service work in rehabilitating previously mined sites, recreation trails and upland watershed has been very successful in controlling erosion and sediment yield.

Sedimentation from the watershed was nominal and probably within original estimates until 1983-1984 water years. A landslide impacted the main channel a few miles upstream of the reservoir. This event yielded a large amount of sediment into the reservoir. Since that time,

runoff from the landslide area continues to yield fine grained black sediment to the reservoir. There is minor bank instability in the main channels in the reach between the landslide and the reservoir. The channel and landslide area continue to annually yield sediment.

There is a possibility that the landslide materials are causing some of the heavy metal water quality problems. Testing is being conducted to determine if there is a relationship.

There was a draft reservoir sediment survey report done in 2002. The sediment volume was estimated to be less than 108 ac.ft. This volume is about 65% of the design volume of 166 ac.ft. This survey was based on assumptions and field data; it is not definitive. No detailed sediment volume study has been conducted since completion of the dam. Because of the 1983-1984 landslide event and consequent high sediment yield there is a need for a detailed sediment volume study to determine if the current sediment load exceeds design criteria for the 50 year design life of the reservoir.

Water Quality

There are problems with heavy metals in the water. This has resulted in fish consumption warnings. Studies are currently being conducted to determine the extent and sources of the metals.

There are references in gold panning literature of a small settlement and a tram station at the location of Tibble fork dam and reservoir. It is unknown what treatment these items were given during construction in 1966. These uses of the land could be a contributing cause of heavy metals. There is also a mention of a previous dam in the same area. It is also unknown what treatment these items were given during construction in 1966.

Hydrology

The dam and reservoir were designed prior to 1966. A Dam Failure Inundation Study was completed in 1992 for both Silver Lake Flat and Tibble Fork dams. The conclusion of this report was that the emergency spillways of both dams meet agency criteria. The hydrologic design conditions used for sizing the principal spillway and auxiliary (emergency) spillway need to be re-evaluated with regards to current hydrological design criteria. Therefore, it is recommended that an updated hydrologic study be completed.

Hazard Classification

The current hazard classification for Tibble Fork dam is Class "c" (high) hazard meaning that if the dam should fail for any reason there is a high probability that loss-of-life will occur. The potential losses exist due to the hazards associated with the recreation areas, homes, businesses, and schools that are downstream of the site and within the flood zone if the dam should ever fail. The downstream floodplain is in a rapidly developing area. Growth and construction continue within the flood zone.

Eligibility of the Dam for PL-566 Rehabilitation Funds

Based on the information available to NRCS today, Tibble Fork dam is currently being operated for purposes different from the original watershed work plan. The original plan of work, the design, and the construction of Tibble Fork dam were for the purposes of debris containment and flood prevention. It appears that during the 1970's, outlet structures originally intended to remain open were closed off with the intent of raising the water level and water storage capacities of the reservoir. At this time, NRCS does not have any record of having authorized this change in operations. As of 1980, the purpose of the structure had been expanded to include fish and recreation, purposes not included in the original work plan, design, or construction of the dam. This violation of the design of the dam and the accompanying permanent storage of water in the reservoir significantly decrease the flood-prevention characteristics of the structure and reservoir. Because the use of the dam was changed from its original purposes, Tibble Fork dam is not eligible for the Rehabilitation provisions of the Watershed Program. Funding for rehabilitation may be available through other channels; NRCS PL-566 Rehabilitation (PL 106-472) funds, however, cannot be made available for this structure.

While the change in operations affects the potential sources of funding for rehabilitation, it does not affect the basic need for rehabilitation. The current assessment of NRCS is that Tibble Fork dam is in need of rehabilitation, as outlined below.

Rehabilitation Needs of Tibble Fork Dam

Several items need to be addressed in order for Tibble Fork Dam to meet current NRCS criteria associated with a high hazard site and to insure the useful life of the site as stated in the 1958 Work Plan. General rehabilitation work would include:

1. Modify the dam and auxiliary (emergency) spillway to meet the modern criteria required of a Class "c" (high) hazard dam.
2. Extend the principal spillway system if the dam is raised.
3. Sediment removal, if the sediment volume exceeds design criteria.
4. Investigate the ground water conditions in the right downstream areas of the dam and modify dam as needed.
5. Meet current NRCS and Utah Dam Safety standards and criteria for hydrology, seismicity, design, environment laws, cultural preservation laws and other items as needed.
6. Evaluate impacts on dam safety of augmenting the purposes of the dam to include fish and recreation. Investigate whether structural modifications are needed in order to prevent a dam failure from occurring as a result of using the dam for unintended purposes.

Adequacy of O&M for the Dam

The site has been generally well maintained. Minor rilling was seen on the embankment.

Potential for Addressing Other Resource Needs

Beyond bringing the dam up to current standards, there do not appear to be any additional resource needs that could be met through dam rehabilitation.

The following are rehabilitation needs for this site:

- 1. Extend the Useful Life of the Structure by upgrading the site to current NRCS criteria for a Class “c” (high) hazard dam by raising the top of the dam.** This alternative would involve some or all of the following actions: Raising the auxiliary (emergency) spillway, providing adequate auxiliary (emergency) spillway capacity, raising the top of the dam, upgrading the monitoring system, repairing or replacing components of the water conveyance system.
 - a. Estimated Total Project Cost: \$6,500,000
 - b. The costs do not include landrights costs.
- 2. Other possible alternatives would include either removal of the dam or removal of the downstream hazards.** Due to the economic and social value of downstream developments, these alternatives are not considered practical or desirable.

Sponsor Action Needed for Rehabilitation of Tibble Fork Dam

In order to pursue the rehabilitation of Tibble Fork Dam, the sponsors must explore possible sources of funding for the project.

**Pictures of Existing Conditions at American Fork – Dry Creek
Watershed Tibble Fork Dam**

