Appendix A

Authority to Regulate Safety of Dams on National Forest System Lands

The authorities through which the U.S. Forest Service regulates safety of dams on National Forest lands are as follows:

National Dam Safety and Security Act of 2002 (P.L. 107-310)
National Dam Safety Program Act of 1996 (P.L. 104-303)
FSM 7500 Forest Service Engineering Requirements for Water Storage and Transmission Projects, August 1993
FSH 7509.11 Forest Service Dams Management Handbook, August 1993
Water Resources Development Act of 1992 (33 US.C. 2201)
Presidential Memorandum of October 1979 and Federal Guidelines for Dam Safety, published June 1979, reprinted by FEMA April 2004.
Federal Dam Inspection Act of 1972 (P.L. 92-367)
Departmental Regulations 1043-18 (USDA)
Title 36, Code of Federal Regulations, Part 251 and FSM 2700
Title 18, Code of Federal Regulations, Part 4
Title 33, Code of Federal Regulations, Part 208

Memorandum of Understanding between the State of Montana, Department of Natural Resources and Conservation, and USDA Forest Service, Northern Region, Mar. 2000

Responsibility for Dam Safety

Mill Creek Irrigation District, through their engineering representative, is responsible for the design, plans and specifications for this project. The Forest Service is responsible for ensuring compliance with current dam safety laws and regulations on National Forest System Lands. Both parties have the responsibility to protect public safety and the environment from an unacceptable risk of catastrophic failure.

After Teton Dam failed in 1976, the direction for dam safety programs changed through an executive order, signed by President Carter that directed Federal agencies to implement the Federal Guidelines for Dam safety (reprinted April 2004), FEMA Publication No. 93, prepared by the Interagency Committee on Dam Safety (ICODS). (PF G-1) The objective is clearly stated under section I.A. Background: "It is the intent of these guidelines to outline management practices that will help to ensure the use of the best current technology in the design, construction and operation of new dams and in the safety evaluation of existing dams." In Section II. Objectives and Scope: "Those charged with administering these guidelines must recognize that the achievement of dam safety is through a continuous, dynamic process in which guidelines, practices, and procedures are examined periodically and updated. Technical procedures need to change with technological advancement, and management should ensure that observed deficient practices are corrected and that successful practices are duplicated."

Appendix B
Condition of Mill Lake Dam, Proposed Repairs and Minimum Requirement Analysis

Condition of Mill Lake Dam and Proposed Repairs

Condition of Mill Lake Dam

Mill Lake Dam is classified as a high hazard dam. This classification is based on the potential consequences if the structure failed, which includes damage to both public and private property, including private residences located downstream. There continues to be ongoing development in the Bitterroot Valley, and housing locations along creeks are increasing. This project will address long term embankment instability issues identified during past inspections and the geotechnical investigation report completed in 2004. The project ensures protection of public safety and private property as well as wilderness and National Forest resources. Mill Creek Irrigation District has requested authorization for sufficient access to accomplish this project.

Mill Lake Dam is an earthfill dam with a steep, stacked rock shell on the downstream side and stores approximately 780 acre-ft of water. The dam is approximately 25 feet high at the outlet pipe and approx. 450 feet long, including a wing dike on the right abutment. East of the right abutment is a 130-foot long saddle dike which leads to the spillway. The proposed modifications are for the purpose of controlling piping and seepage, as well as addressing embankment instability concerns, particularly during high reservoir levels.

The deteriorated low level outlet for Mill Lake Dam was successfully repaired during the slip-lining project in 2005. (The deficient condition of the outlet pipe was explained in Appendix B of the Environmental Assessment for the Mill Lake Dam Project, May 2005). The outlet works replacement in 2005 also included the changing the gate location from the center of the dam to the downstream side of the stacked rock embankment. The purpose of the new gate valve location is to provide improved accessibility and more long-term reliability affecting the operation and maintenance of the headgate. Accessibility to the gate also improves the ability to inspect the gate valve. The proposed work will also complete a last step by constructing a rock berm necessary to protect the gate stem and gate valve from routine avalanche activity at this location. A similar design was successfully implemented at Canyon Lake Dam.

The primary purpose of the proposed project will address embankment stability deficiencies that were identified in past inspections by DJ Engineering, PLLC, the feasibility study submitted to the Montana DNRC, May 2002, and the geotechnical investigation report prepared by Hydrometrics, Inc. and DJ Engineering, PLLC, February 2004. The summary section of the geotechnical report concludes that:

> *"As discussed in Section 2.3, there are no immediate signs that piping is a problem for the dam except around the outlet pipe. There is flowing seepage from just below the toe of the dam in several locations and there is a potential for additional seepage problems to develop at high reservoir levels and mechanically*

from wave action over time (DJ Engineering, 2000). Modifications to the dam to control seepage include addition of an upstream impermeable liner with a heavier armored slope and a downstream seepage filter. The new membrane will prevent much of the embankment from becoming saturated during high reservoir levels and prevent the development of high hydraulic gradients that lead to piping.

An analysis of the existing dam embankment suggests that it may fail if subjected to abnormally high water levels or earthquakes. The modifications proposed in this report address this instability. In addition to the modifications already mentioned, decreasing the downstream slope with rock fill, suitable stability can be assured for the embankment."

MCID's Proposed Repairs to Address Embankment Stability Deficiencies

The decision has been made by Mill Creek Irrigation District, through their engineering representative, to utilize state-of-practice techniques for critical elements of the project, such as the helicopter delivery and installation of the impermeable membrane, and excavation of the trench and backfilling operations necessary to permanently anchor the liner. Other activities, such as the transport and placement of rock, may be accomplished by traditional, or non-motorized/non-mechanized, methods. However, if the work progress falls behind schedule, or unforeseen circumstances develop, such as adverse weather conditions, then the onsite engineering representative may decide to expedite the project completion by mobilization and helicopter transport of additional motorized equipment.

The project is likely to start with the construction of the rock buttress, or stability berm, along the downstream toe. Based on preliminary surveys by MCID's engineering representative, the rock source for the downstream berm is likely to come from some of the rock below the high water mark along the west shoreline, and from the rocky outcrop, or rock island, located within the reservoir area approximately 300 to 400 feet south of the dam crest. Rock sources would be limited to the disturbed area of the active reservoir storage and within the high water mark of the reservoir, which is within the easement boundary.

Mill Creek Irrigation District has requested that the construction schedule provide some flexibility in consideration for their reasonable use and enjoyment of their irrigation water during the earlier part of the irrigation season. Therefore, the start date of the project may be impacted by their water storage use. The borrow sources within the high water mark of the reservoir cannot be accessed until the reservoir pool is drawn down. Some of the loose crest rock from the dam may be used to start the project, then as the reservoir pool is drawn down, the source immediately upstream of the left abutment within the high water mark and the rocky outcrop source will be utilized.

The proposed installation of the geomembrane liner may start in 2007, but it is probably more likely to occur in 2008. The upstream liner will limit saturation of the embankment during high reservoir levels and prevent the development of high hydraulic gradients that lead to piping, which is a potential dam failure mechanism. The liner will also prevent wave action and lake level fluctuations from eroding the embankment soils down the slope between the riprap. Installation of the liner will require the removal and temporary stockpiling of the existing upstream riprap, preparation of the soil bed, placement and welding the liner seams, backfilling the key-in trench for the liner, placement of geotextile fabric above the liner, then the placement of the protective rock armoring, or riprap. The existing amount of riprap on the upstream slope is not adequate to protect the liner, and additional riprap in the appropriate gradation (estimated in the 4 to 18-inch diameter range) will be required. The borrow sources for the additional smaller rock will likely come from the western shoreline, the rocky outcrop or rock island and the east shoreline below the high water mark within the easement boundary. The liner will be anchored in place by a trench (estimated 850 to 900 feet long) along the perimeter. The liner installation will also include backfilling and compacting the anchor trench (approx. 5 feet deep).

Detailed Description of Work and Minimum Requirements Analysis

This analysis includes a detailed break-down of the project into ten steps, or work activities, required to complete the project. The analysis includes the incorporation of traditional skills (non-mechanized, non-motorized means) as well as more conventional state-of-practice methodologies for comparison purposes.

Phase I - Construct Rock Buttress Along Toe of Downstream Face

Because of the avalanche activity that routinely occurs at the dam in the spring, the first priority is to protect the new outlet works gate and gate stem on the downstream side of the dam. A temporary support structure was constructed in October 2006, and the downstream rock buttress will provide a permanent solution to the problem. However, the rock buttress is an important design element in addressing potential stability problems associated with the existing steep rock face and materials comprising the embankment. Rock sources include the unstable rock on the dam crest, rock below the high water mark along the west shoreline near the left abutment (estimated within 150 to 200 feet from the left abutment of the dam). Additional rock will also come from the rocky outcrop, or rock island, located within the reservoir footprint, approximately 300 to 400 feet south of the dam crest. Rock sources would be limited to the disturbed area of the active reservoir storage area and within the high water mark of the reservoir, which is within the 1866 easement boundary. The work and related helicopter transport could start in July 2007.

Step 1 - Stabilizing Dam Crest: The first step involved in the rock buttress work is stabilizing the loose rock along the top of the dam crest before workers can start working under it. Some of the crest rock is unstable because of the steep slope in combination with avalanches forcing some of them loose. Loose rock may be shoved off the downstream crest, probably using Montana Conservation Corps (MCC) crews. Some of the steep stacked rock on the downstream face will also be used. After the loose rock is removed, the downstream face may be covered with galvanized steel rock netting. Other options, such as gabion baskets are likely to be incorporated into the final design along the dam crest. Gabion baskets are typically labor intensive, and some of the dam crest would need to be removed and reshaped to incorporate these baskets into the design. The rock for the gabion baskets will come from the east shoreline below the high water mark. Depending on the amount of gabions and available rock in the appropriate size range, the labor could be extensive. Some of the larger rock would need to be broken down with the boulder buster, and this is a time-consuming process. The other option is to transport additional smaller rock from within the reservoir footprint from sources described above.

Estimated timeframe for completion using non-mechanized/non-motorized means: 12 to 16 weeks breaking up rock up with a boulder buster and transporting the rock by stock and stone boats.

Estimated timeframe for completion using small mechanized equipment: If small mechanized equipment (likely restricted to 3000 lb. airlift capacity) is used to transport the rock and load the gabion baskets, then installation may be reduced to 2 to 4 weeks.

Number of helicopter trips associated with this activity: Helicopter access would be used to transport rolls of rock netting, gabion baskets, and small rock drill and compressor (small equipment transport, which could be utilized to process rock and prepare the grade for the gabion baskets included in step 2 below), Total of 4 to 6 trips.

Step 2 – Constructing Downstream Rock Berm: The second step is transporting the rock from the sources described above to the downstream side of the dam. There are a number of possible options to move the rock, which may include a combination of manual and horse-drawn labor. The possibility of using small mechanized equipment, limited to the size that can be carried with a medium-lift helicopter (approx. 2500 to 3000 lbs.), is also an option. (See the section entitled "Dam Safety and Resource Protection Considerations" below).

The primary source of rock will likely come from the area along the west shoreline below the high water mark and the rock outcrop located within the reservoir footprint, approximately 300 to 400 feet south of the dam crest. The haul distance could vary between 250 to 700 feet when transported to its final location along the toe of the dam, depending on which abutment the material is transported around (see Mill Lake Site Plan on page app.15 below). There is also the possibility of transporting the material along the top of the dam crest and shoving it off the crest. However, this approach may not be acceptable to the design engineer. If some type of hoist or rigging arrangement is set up on the dam crest, lowering the rock into place off the crest may be an option, but the rigging set up would have to be moved along the crest, and this is time consuming if accomplished through non-mechanized means.

Based on the production rates of the Montana Conservation Corps and rigging operations on the Canyon Lake Dam Rehabilitation project in 2003 and 2004 (removal and placement of approximately 350 cy of material -180 cy of rock and 233 cy of soil located primarily on the dam), the placement of the rock buttress alone (not including the labor-intensive preparation work and actual installation of the liner) is likely to require more than one field season.

From preliminary plans, approximately 120 to 140 cubic yards are needed for the rock buttress to stabilize the toe of the embankment. At Canyon Dam, the production rate using the rigging operations to remove and replace the rock from the dam was approximately 2 cubic yards per day. This did not include the haul distances that will be required for additional rock at Mill Dam. The existing quantity of riprap on the upstream side of Mill Dam is not adequate, and there are existing surfaces exposed to wind and wave action. This causes the finer materials to migrate towards the outlet works, and some materials are probably flushed through during higher flow velocities.

Because of the haul distances and additional processing of the over-sized rock (necessary to obtain the required riprap sizing and make it more manageable for the haul) the production rate would decrease. Breaking the rock up with a pionjar and boulder buster is labor intensive and time-consuming. Sorting rock from other materials, including lake deposits, logs and muck in the reservoir bed, is also time-consuming and labor intensive. After processing, the processed rock would be loaded onto the stone boats then transported utilizing stock and stone boats or sleds, approximately 1000 to 1400 feet to the downstream berm location; these steps add more time and effort when compared to the Canyon Dam rehabilitation project. Because the stock cannot walk across the rock berm after the first layer is placed, the rock would then need to be hoisted into place, utilizing rigging methods similar to Canyon Dam. Loading stone sleds could be accomplished by the MCC crews after processing. Based on the Canyon Dam project and consideration of other contingency factors for injuries, resting of crews and adverse weather conditions, construction of the rock buttress alone is likely to extend into a second field season. The work season is typically limited to 2 ½ to 3 months (July through September). Work outside of this window can include snowmelt and runoff conditions in early summer, or snow and freezing work conditions after September at this remote high elevation site.

Mill Creek Irrigation District may want to limit the timeframe of the construction of the rock buttress to one field season because of their irrigation demands, in addition to limiting their risk of exposure associated with postponing the work. For every season the work is not accomplished, there remains the risk of exposure associated with potential failure mechanisms developing within the embankment. Increasing production rates to process and transport the rock within reasonable timeframes is an important factor affecting the overall effort to improve the reliability of the embankment.

Additionally, there needs to be backup plans for both contract and MCC crews working long hours under difficult and potentially hazardous conditions to be relieved in an effort to reduce injuries. Even though the safety of the workers is a priority, and safety programs are emphasized, injuries still occurred on the Canyon Dam Rehabilitation project in 2003 and 2004.

Based on preliminary discussions with the engineering representative for Mill Creek Irrigation District, several options including traditional (non-mechanized/non-motorized) methods, will be considered to process and move the rock from the rock source within the reservoir. However, backup methods utilizing small mechanized equipment (likely restricted by airlift capacity around 3000 lbs.) will need to be incorporated into the emergency response plans in the event that unforeseen problems are encountered and the project needs to be expedited. Breaking the larger rock into the appropriate size could be accomplished more efficiently using small rock drills and air compressors. Options for processing and transporting the rock include utilization of small skid-loaders and mini-excavators, or the possibility of a small yarder typically used in logging operations. The mini-excavator could sort the appropriate size rock from the reservoir deposits, and the loader could transport the rock more efficiently. In all cases, even with the use of small mechanized equipment, there is plenty of opportunity and work utilizing traditional skills (non-motorized/non-mechanized), which includes utilizing MCC crews and stock.

Estimated timeframe for completion using non-mechanized/non-motorized means: 12 to 16 weeks

Estimated timeframe for completion using small mechanized equipment: 3 to 5 weeks

Number of helicopters trips associated with this activity (estimate 2500 to 3000 lbs. lifting capacity at Mill Lake Dam, elevation 6500 feet): One (possibly two) small skid-loaders, and one (possibly two) mini-excavators which would require 8 to 16 trips including mobilization, fuel and demobe.

Phase II – Liner Installation on Upstream Embankment

The proposed design includes the addition of an impermeable membrane or liner on the upstream face of the embankment. This liner addresses several potential problems associated with the stability of the embankment. However, there are a number of labor-intensive activities associated with the installation of the liner that requires both time and skill. This work needs to be accomplished with respect to potential problems that could develop during extreme flood events, such as a significant summer thunderstorm event, which could partially fill the reservoir during a critical time. This work is likely to occur in 2008.

Step 3 Breakup and Removal of Existing Riprap on Upstream Slope: The first step associated with the liner installation is removing the existing riprap across the upstream face and temporarily stockpiling it. The majority of the larger rock on the upstream face will need to be reduced in size to make it more manageable for labor crews and small equipment to handle. Some of this work is likely to be accomplished with a pionjar and boulder buster, which was utilized on the Canyon Dam rehabilitation project. Because Mill Creek Irrigation District is interested in utilizing their storage from the reservoir during some of the irrigation season, the project will begin by removing the rock from the higher elevations near the dam crest. The work will then progress to lower elevations along the upstream face as the reservoir pool is drawn down.

If MCC crews are utilized, the amount of riprap to be removed from the upstream face of Mill Lake Dam in comparison to that removed from Canyon Lake Dam is likely to be considered. An area of approximately 6500 square feet was cleared at Canyon Dam. Approximately 28,000 to 30,000 square feet of upstream slope at Mill Lake Dam will be cleared of rock in preparation for the liner. This is approximately 4 to 5 times the amount of rock that was removed and replaced on the upstream face of Canyon Dam. Not only will the rock at Mill Dam need to be removed, it will also need to be processed – which includes sorting and breakup of the rock into the appropriate gradations.

The more extensive processing of the rock, in addition to the increased quantity of rock as compared to the Canyon Rehabilitation project, will significantly increase the timeframe required to complete the work, especially utilizing non-motorized/non-mechanized methods. Stock could be utilized to remove the rock from the embankment and temporarily stockpile the rock.

If a rock drill, mini-excavator and small loader are used to break up, remove and temporarily stockpile the rock, the work would likely be reduced to five to seven weeks.

Estimated timeframe for completion using extensive labor & stock: 1 ½ to 2 field seasons.

Estimated timeframe for completion using small mechanized equipment: 5 to 7 weeks.

Number of helicopter trips associated with this activity: Because this work is likely to be accomplished in 2008, small equipment would need to be re-mobilized the second season. This equipment is likely to include a small loader and helicopter transport, and the potential for utilizing more than one loader has been included in Step 4 below.

Step 4 – Preparing Protective Soil Layer for Liner: The next step is preparing and reshaping the soil on the upstream face to protect the liner. The slope increases near the dam crest, and this section will be reshaped to a consistent slope (approximately 3:1). This step will require raking through and smoothing/re-contouring approximately 28,000 to 30,000 square feet of soil on the upstream slope of the dam. Some of the soil will already be "in-place" from lake deposits, but additional soil to cushion the liner may be borrowed from areas within the reservoir bed close to the dam (estimated within 100 feet from the dam). Therefore, disturbance should be minimal because this area is already affected by fluctuating water levels within the active storage below the high water mark. In order to protect the liner from puncturing, it is important that the soil bed does not contain any protruding rocks. The soil bed will need to be raked and cleared of any rocks to a depth of at least 6 inches, then an additional 6 inches of soil would be placed. The source for this protective soil layer for the liner would likely come from an area between the right abutment and the spillway channel below the high water mark. Any rock removed from the soil bed is likely to be temporarily stockpiled within the draw-down area of the reservoir, then utilized as riprap in the final stage of the project.

Estimated timeframe for completion using non-mechanized/non-motorized means: Preparing the soil bed for the liner could be accomplished by MCC crews moving the soil in wheel barrows and reshaping with steel rakes, as well as the possibility of utilizing stock and fresnos. This operation is likely to require 20 to 24 weeks.

Estimated timeframe for completion using small mechanized equipment: This work utilizing two small loaders and rock rake attachments is likely to require 6 to 8 weeks. There is an extensive amount of manual labor required with this option also.

Number of helicopter trips associated with this activity: Because this work is likely to be accomplished in 2008, small equipment would need to be re-mobilized the second season, which would require one, possibility two small loaders and appropriate attachments which would require 8 to 16 trips including mobilization, fuel and demobilization.

Step 5 – Excavate Anchor Trench for Liner: This step includes digging a five-foot deep trench around the perimeter of the proposed liner area, which includes the key-in along the top of the dam crest, and along the bottom of the upstream slope within the reservoir bed. The liner will cover the entire upstream surface of the dam embankment. It is important that the liner is keyed into competent material for an effective seal. Based on preliminary estimates, the length of the liner perimeter, or trench length, is approximately 850 to 900 feet.

This work could be accomplished using a mini-excavator, similar to that used on Tin Cup Dam during repairs in September 2003 (see photo 2 on app. page 15 below). If the work is attempted by hand labor using picks and shovels, there is a high probability of encountering water-logged woody debris or rock in the trench. It is important that a backup option be considered in the event that unforeseen problems are encountered, or the work falls significantly behind schedule. After the rock is removed from the upstream embankment, the erosive underlying materials will be exposed, and therefore, the installation of the liner (see step 6) could be accomplished in limited areas across the upstream slope to limit exposure. For example, heavy summer thunderstorms could cause erosion of exposed materials, as well as partially fill the reservoir during a critical time.

Rock was encountered during the excavation operations for the outlet pipe trench on the upstream side of the concrete core wall during the Canyon Dam Rehabilitation, and the trenching operations were switched from the Montana Conservation Corps to a small Bobcat to complete a critical phase under an expedited schedule before winter conditions arrive.

Estimated timeframe for completion using non-mechanized/non-motorized means: 5 to 7 months - The length of time it would take to dig the five foot deep trenches that will key-in the liner is difficult to estimate accurately. Approximately 850 to 900 feet of trench will be required to anchor the liner onto the upstream slope of the embankment. Depending on the amount of rock encountered, it may not even be feasible to accomplish this work by manual means. The use of the boulder buster/pionjar or small rock drills/compressor could be considered, but this work is labor intensive and time-consuming. When utilizing the boulder buster, several attempts are usually required to break up each rock. Another consideration is the safety of the laborers when entering a trench. OSHA has setback slope requirements for the trench wall, depending on the material types. The set back of the side slopes and the problem of water destabilizing the trench sidewalls would considerably add to the amount of soil to be handled and the amount of time to accomplish the work. This portion of the work is also critical in relation to other activities that need to be completed before the end of the season – the placement of the liner and backfilling of the liner edge in the key-in trench.

Estimated timeframe for completion using mechanized equipment: 2 to 3 weeks, depending on amount of rock encountered. Excavation and backfilling the trench to key-in the liner is a critical and time-sensitive activity. A small mini-excavator, similar to that which was air-lifted to Tin Cup Dam in 2003 (approx. 3000 lbs at 6300 feet elevation), could accomplish this activity within the limited field season at this high elevation site.

Potential Problem for both methods (extensive manual labor or mechanized equipment): If large rock, such as a large boulder or rock slab, is encountered during trench excavation, the perimeter of the liner may be re-located around it. This would increase the timeframe, especially for hand labor crews. This scenario would modify the original design, and also potentially increase the amount of liner needed to complete the installation.

Number of helicopters trips associated with this activity (estimate 2500 to 3000 lbs. lifting capacity at Mill Lake Dam, elevation 6500 feet): One, possibly two mini-excavators, and small de-watering pumps, which would require 8 to 16 trips including mobilization, fuel and demobilization.

Step 6 – Installation of the Liner: The next step is the placement and welding of the liner. A roll of 40 mil HDPE liner that is 22 foot wide by 656 foot long (6.7 m x 200 m) weighs approximately 5070 lbs. To accommodate a helicopter with 2500 to 3000 lb. lift capacity, the length of the liners would need to be reduced by half (approx.). However, it is better to minimize the number of seams, or welds, which are basically a weak link in the surface of the liner. Cutting each roll of liner into 7.7 foot wide x 76 foot long pieces to accommodate stock transport is not a reasonable option from a long-term embankment stability standpoint because it would compromise the integrity of the liner. Assuming 28,000 to 30,000 square feet of upstream slope is covered, approximately 4 to 5 rolls of liner would be required. In addition, a welder and generator will be necessary to weld the membrane seams. Small equipment, such as two skid-steers, may also be necessary to lift and position the liner into place.

If the liner installation is completed in smaller sections across the dam, then intermediate steps may be required to temporarily stabilize the leading edge of the liner. This step would likely be accomplished using MCC crews - filling and placing sandbags along the leading liner edge to prevent high winds from lifting and tearing the liner. It is important that the liner is permanently anchored along the perimeter before the end of the field season.

Estimated timeframe for completion using manual labor and stock transport: This option not feasible due to excessive number of seams in the liner, which compromises the integrity and long-term reliability of the liner.

Estimated timeframe for completion using small mechanized equipment: 1 to 2 weeks using specialized crews experienced in this type of installation (does not include backfilling and compacting anchor trench).

Number of helicopter trips associated with this activity: 7 to 10 trips to transport the liner and specialized welding equipment (not including small loaders to support the rolls during placement, which have been accounted for in step 4).

Step 7 – Anchor Trench Completion: Backfilling and compacting the anchor trench to key-in the liner is likely to be accomplished with a small skid steer. A wacker packer, or possibly a small sheepsfoot compactor, such as the one used at Tin Cup Dam in 2003, may be utilized to compact the anchor trench. However, it will be important not to rip or tear the liner during the process.

Estimated timeframe for completion using non-mechanized/non-motorized means: Compaction portion not feasible with non-motorized means, but utilizing MCC crews to backfill with wheelbarrows and shovels may require 4 to 6 weeks.

Estimated timeframe for completion using small mechanized equipment: 1 week

Number of helicopter trips associated with this activity: 2 to 4 for compaction equipment including mobilization, fuel and demobilization.

Step 8 – Placement of Fabric: After the liner is installed, a protective geotextile fabric will be placed over the liner. The fabric will be similar to that which was placed at Canyon Dam by the Montana Conservation Corps, and they will likely be utilized for this step at Mill Lake Dam. The fabric will likely be stitched together, then held in place by the overlying riprap.

Estimated timeframe for completion using manual labor: 2 to 4 days.

Estimated timeframe for completion using small mechanized equipment: Mechanized equipment to support rolls of fabric while unrolling during installation – included in previous steps.

Number of helicopter trips associated with this activity: 1 to 2 trips to transport fabric.

Step 9 – Placement of Riprap on Upstream Slope: After the liner and fabric are placed, the process of placing the stockpiled rock back onto the upstream slope will begin. Additional riprap needed to protect the slope will come from the west shoreline, rock outcrop and east shoreline below the high water mark within the reservoir footprint.

Montana Conservation Corps will likely be utilized to break up larger rock into the appropriate gradation suitable for the riprap protection. This is likely to be accomplished with the boulder buster, which is labor intensive and time consuming. MCC crews and stock could also be utilized to transport and place the riprap using high lines and manual labor. It is important that the rock be carefully placed and interlocked into place to protect the membrane. Work needs to be carefully accomplished without puncturing the fabric and liner.

If the work falls behind schedule, the transport and placement of the rock protection may be expedited – it is critical that the liner and fabric be protected from debris and wave action during the following spring runoff and reservoir filling. Mechanized transport and placement with small equipment (already onsite for other previous steps) may be utilized (see photo 2 on app. page 15 below). The proposed depth of riprap at Mill Dam is approximately 1 ½ to 2 feet, and the surface area is approximately 28,000 square feet.

Estimated timeframe for completion using non-mechanized/non-motorized means: 4 to 5 months (two highlines, stock and manual labor).

Estimated timeframe for completion using small mechanized equipment: 2 to 3 months - Manual labor will be extensive in this option regardless of the possibility of utilizing onsite equipment (see previous steps) – which could be used to sort and transport rock. In this operation, it is critical that the placement on the rock protection be accomplished carefully, and hand-placed riprap may provide the best option to avoid damaging the liner.

Number of helicopter trips associated with this activity: 2 to 4 trips for cables, highline towers and hardware (Note: These trips are associated with the manual labor/ traditional skills option, and therefore, are not included in the total estimate for the conventional equipment option. Helicopter trips for small mechanized equipment have been accounted for in previous steps).

Additional Work that could take place simultaneously with Phase I and II

Step 10 – Spillway Erosion Control: This work involves modifications to the spillway channel to protect it from erosion, and this work may be accomplished simultaneously with either Phase I or Phase II. In the feasibility report provided by Hydrometrics in 2002, the existing spillway capacity is sufficient to route the full probable maximum flood without overtopping the dam. Some work may be done to improve the existing channel. The work is likely to include some regrading and armoring the control section to prevent the crest from eroding. The 70-foot long crest (approx.) would be armored with a masonry wall and buttressed with riprap behind it. There is also an existing headcut at the end of the spillway channel where the elevation drops, and rock armoring is likely to be added for erosion protection. Improvement of the saddle dyke would likely include some material addition from within the reservoir high water mark. All work would be completed within the existing disturbed spillway channel, and all rock or soils would come from the reservoir bed below the high water mark.

Estimated timeframe for completion using non-mechanized/non-motorized means: 7 to 8 weeks

MCID may utilize MCC crews to accomplish minor amount of re-shaping and smoothing of channel – however, if equipment is already in place, this is likely to be accomplished with a skid steer. Depending on the size and the availability of the rock in the correct size range, MCC crews or stock could be utilized.

Estimated timeframe for completion using small mechanized equipment: 3 weeks

Number of helicopter trips associated with this activity: 2 to 3 trips for mortar mixer, sand and cement.

Possibility of Additional Helicopter Flights Considered for Contingencies:

From past experience during Mill Lake Dam Slip-Lining Project in 2005, Canyon Dam Rehabilitation in 2003 and 2004, Tin Cup Repairs in 2003, it became apparent that these projects are typically not accomplished through perfect implementation of a perfect plan. Unknown characteristics of the embankment materials, changed field conditions that lead to modifications of the original design, helicopter availability and coordinating specific tasks and work schedules, human error, injuries, and adverse weather conditions affect implementation of the original plan. These remote, high elevation sites add to the complexity of logistical operations in completing the project within the limited field season.

In addition to contingencies based on engineering and logistical complications, there is another situation that develops during the construction process. Irrigation districts are considered to be local government entities subject to State of Montana statutes regulating contracting requirements, including procurement and competitive bidding procedures. These requirements include public notification or advertisement of the project for a specified timeframe, contractor insurance and bonding requirements, prevailing wage rates and other labor laws. The bottom line is that some of the final details of project implementation and helicopter access will not be known until the contract is awarded and implemented.

The engineering representative for Mill Creek Irrigation District encourages the solicitation of qualified contractors to bid these projects. In an effort to encourage the implementation of the project with traditional tools and skills, both the Forest Service and the engineering representative for Mill Creek Irrigation District discussed ways to accomplish this. In a recent past project (Mill Lake Dam Outlet Slip Lining 2005), the invitation for proposals included evaluation criteria specifically for the purpose of encouraging the use of traditional tools. However, it is difficult to find contractors experienced in the use of traditional tools, as well as having the experience, knowledge, and skills to implement difficult rehabilitation projects in accordance with dam safety laws and regulations. The dam owner, their engineering representative and Forest Service personnel encourage both the use of traditional skills and the implementation of the project that accomplishes the overall goal, which is to ensure that the deficiencies affecting the safety of the dam are corrected within a reasonable timeframe.

Potential contingencies, based on past dam reconstruction projects in wilderness, have been accounted for by adding a factor of 20% to the estimated number of helicopter trips in the summary Appendix table 2 on app. page 19.

Photo 1. Mill Lake Dam site plan

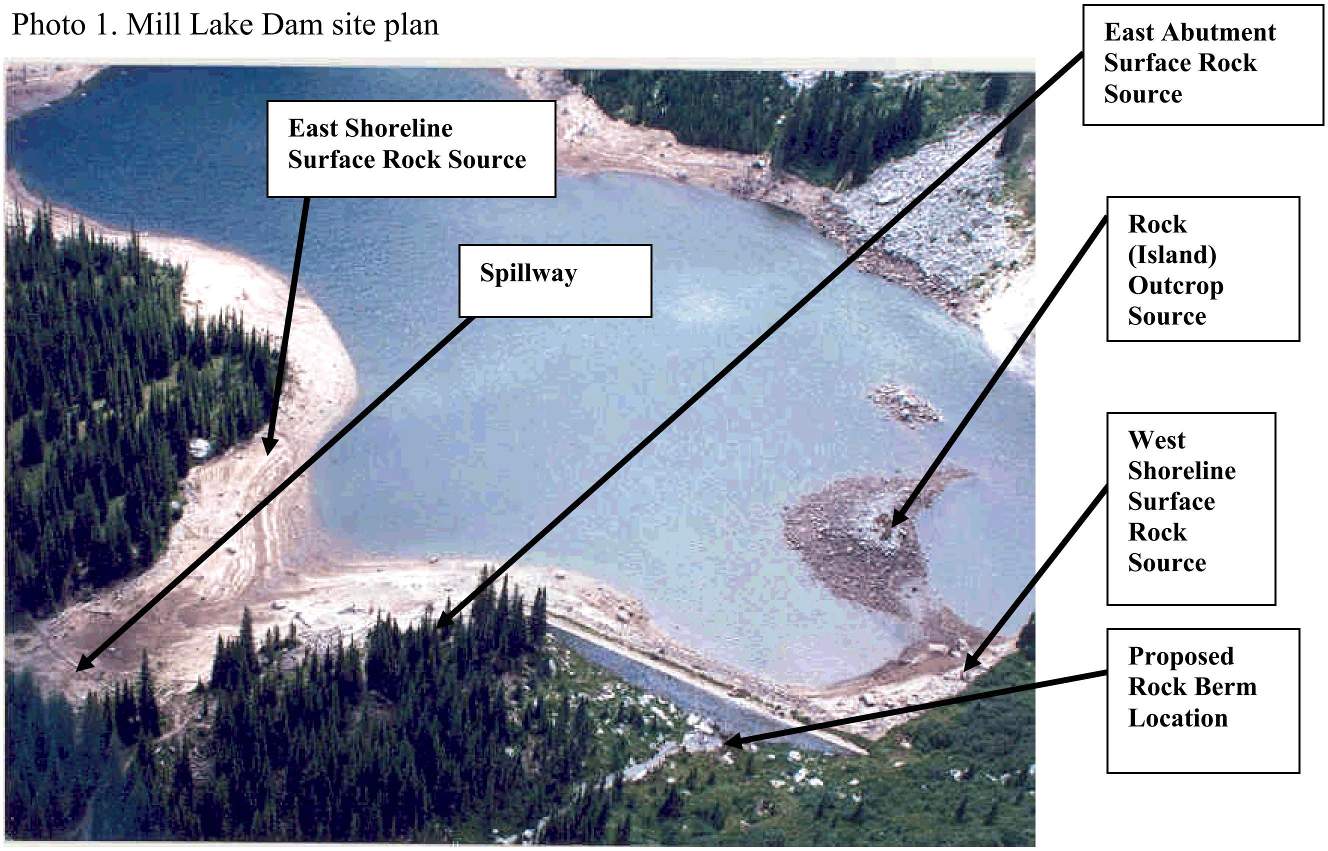

Photo 2. Mini-excavator placing rock protection on upstream slope at Tin Cup Dam 2003

Dam Safety and Resource Protection Considerations

The potential problem facing the dam owner and their engineering representatives is the risk of a large or extreme storm occurring during critical phases of the work. Depending on the intensity and duration of the storm, and the work activities taking place during the event, an increased risk of exposure could occur if the project is not carefully planned and executed with consideration for a response and backup plan. This emergency response plan would likely include onsite mechanized equipment that is available for a quick response time.

In addition, if the work falls behind schedule at this remote site, a backup plan utilizing small mechanized equipment and helicopter transport is likely to be required by the onsite engineering representative in order to prevent the possibility of the dam being left in an exposed, vulnerable state through the following winter and spring snowmelt and runoff season. This would not only be prudent from a dam safety perspective, but also from a resource protection standpoint to respond to any conditions where additional armoring or embankment protection measures may be necessary to prevent erosion and sedimentation.

Safety of Laborers

Despite an emphasis on safety, there were a couple of injuries associated with the work at Canyon Lake Dam in 2003 and 2004. According to the Montana Conservation Corps Regional Supervisor, it is important that crews utilized in this heavy construction work are able to get adequate rest between their two-week hitches. In order to promote safe and healthy working conditions for their employees, the Montana Conservation Crew plans to rotate crews, provide training and possibly reducing the work day from 10 to 8 hours. All these factors affect the duration of the project.

Some activities, such as excavation and fill placement for the anchor trench to key-in the liner (Step 5) are better accomplished using small equipment. It is neither safe nor feasible to excavate the anchor trench by manual labor. To avoid cave-ins and meet OSHA requirements, the slopes would need to be laid back to required slopes, depending on the materials. This would unnecessarily add both time and exposure to work crews to accomplish the work. Laying back the side slopes on the anchor trench would also significantly increase the amount of material disturbance, which is also a resource concern.

Summary for Minimum Requirements Analysis

The range of options presented in this analysis been developed based on past dam rehabilitation projects successfully completed with minimal impacts to wilderness and forest resources. The project addresses stability and internal erosion concerns that were identified from the geotechnical investigation report completed by Hydrometrics, Inc. in February 2004. For every season that the project is delayed, there is an increased risk of exposure, especially to downstream homeowners located within the inundation area of a failure of Mill Lake Dam. Therefore, the responsible parties (Mill Creek Irrigation District and their engineering representative) plan to incorporate an expedited backup plan that increases productivity and provides flexibility in order to complete the project in a reasonable timeframe. The expedited plan would be developed with respect to both public safety as well as Mill Creek Irrigation District's right to use and enjoy their water storage facility. The facility provides irrigation benefits to its members, and the late season irrigation water potentially recharges aquifers serving domestic water wells along the west side of the Bitterroot valley.

In all steps, there is a complex process of balancing the project schedule and deadlines related to the end of the field season, monitoring quality control and assurance of the project in accordance with the engineering plans and specifications, monitoring performance and fatigue of the Montana Conservation Crew labor crews to reduce the number of injuries, minimizing impacts to wilderness and forest resources, and recognizing Mill Creek Irrigation District's water rights and easement for their water storage facilities authorized under the Acts of 1866.

Both Mill Creek Irrigation District and their engineering representative have agreed to minimize the use of helicopter transport and motorized equipment wherever feasible. They have also agreed to utilize stock to transport personnel, food and camp supplies. They plan to utilize the Montana Conservation Corps for movement of embankment materials wherever reasonable and feasible. These efforts will be balanced with consideration for the possibility of expediting the completion of the various project steps with respect to the condition of the dam before the field season ends.

Past rehabilitation projects on Canyon Dam in 2003 and 2004, Mill Dam slip-lining in 2005, as well as a number of emergency repairs, have resulted in the understanding that unknown field conditions, unknown or changing production rates, changes in quantities of materials based on new information found in the field, changes in helicopter schedules during fire season, etc., requires some flexibility in the means and methods of completing the work. Mill Creek Irrigation District and their engineering representative are burdened with the responsibility and liability associated with the implementation of the work, and therefore, their concerns regarding the methodologies for implementation of the project must be addressed in this decision. They plan to complete the work in accordance with professional engineers accountable for complying with statutory and regulatory requirements, in addition to installing and anchoring the membrane in accordance with generally accepted standards, which have been included in this analysis.

It is intended this Minimum Requirements Decision guide and related recommendations serve only as a guide and provide basic parameters for acceptable performance but not become the design and construction plan for the Mill Creek Irrigation District. Further, it is not the intent of this document or the Forest Service to supercede, abridge, modify reduce or in any way assume responsibility for or relieve Mill Creek Irrigation District from requirements to develop and implement a sound plan to repair the dam and meet applicable standards.

Project Schedule

Stabilizing the dam crest and constructing the downstream rock berm are likely to be accomplished in the field season of 2007. The labor-intensive processing of rock, necessary to produce an adequate quantity and size suitable for riprap, is also likely to begin in 2007. The more extensive work related to the liner installation is likely to begin in 2008. The project engineer may require the completion of the liner installation within one field season because of potential risks associated with exposure during extreme precipitation or runoff events. Depending on work progress, which will likely include some traditional skills and the use of MCC crews, work associated with erosion protection of the spillway and finalizing some of the other work may extend into 2009. The estimated project completion schedule is summarized in the Appendix Table 1. below. Appendix Table 2 compares alternatives by year and means of access.

Appendix Table 1. Summary of Estimated Completion Schedule - Proposed Action using Conventional Methods and Non-Mechanized/Non-Motorized Methods (MCC Crews)

	Phase I	**Phase II**
Step	2007	2008-2009
1	2-4 wks	
2	3-5 wks	
3		5-7 wks
4		6-8 wks
5		2-3 wks
6		1-2 wks
7		1 wk
8		2-4 days
9		2-3 months
10		(3 wks –can be completed simultaneously with other work – not added to total)
Total Weeks	5-9 wks	23-33
Total Months	1.25-2.25	5.75-8.25
Total Seasons*	Less than 1	2-3

* Assume three month work season

Appendix Table 2. Year and Means of Access by Alternative

Year and Means of Access	Alternative 1 No Action – Routine Operation and Maintenance	Alternative 2 Proposed Action using Conventional Methods and MCC Crews
2007 # of helicopter trips	0	12-22 (14 to 26)*
2007 # days for Helicopter transport	0	3-5 (4-6)*
2007 Hours of Flight Time Over Wilderness	0	3.0-5.5 (3.6-6.6)*
2007 # stock trips	21 mules 10 horses	76 mule trips 24 horse
2008 # of helicopter trips	0	28-51 (34 to 61)*
2008 # days for Helicopter transport	0	9-12 (11 to 14)*
2008 Hours of Flight Time Over Wilderness	0	7.0-13.0 (8.4-15.6)*
2008 # stock trips	21 mules 10 horses	161 mules 32 horses
2009 # of helicopter trips	0	8-12 (10-14)*
2009 # days for Helicopter transport	0	3 to 4 (4 to 5)*
2009 Hours of Flight Time Over Wilderness	0	2.0-3.0 (2.4-3.6)*
2009 # stock trips	21 mules 10 horses	100 mules 32 horses

*Note: Numbers in parenthesis include 20% contingency factor described on page 14.

Appendix C

Background Information – Other Alternatives Considered but not Given Detailed Study

Alternative 3 – Non-Mechanized Access only and Non-Motorized equipment only
Alternative 3 considers solely non-mechanized access for equipment, supplies and personnel, and use of non-motorized equipment only. This alternative would not meet state of practice techniques for design and construction methods which would jeopardize the long-term performance of the dam and potentially threaten public safety.

Appendix B includes consideration of non-mechanized and non-motorized means for some portions of the work considered to be non-critical elements of the project. Depending on the work progress in relation to the end of the season, these activities are likely to include the transport of the rock from acceptable rock sources (below the high water mark) to the downstream toe of the dam, and the placement of the final riprap protection on the upstream face of the dam after the liner is installed. Both MCID and their engineering representatives have agreed to utilize stock and the Montana Conservation Corps in the proposed action wherever feasible. The engineering representative has also agreed to encourage solicitation of bids for the work using traditional skills and non-mechanized/non-motorized methods. Therefore, the proposed action will incorporate traditional means and skills in those activities that do not compromise the integrity of the overall project.

However, as described in Appendix B, there are some critical elements of the work that are likely to require small mechanized equipment in order to meet the quality control requirements for the project, or to respond to potential emergency situations that could develop as the work is progressing. Other considerations, including the safety of the laborers (explained in Step 5) are factors that must be considered in the work plan. The installation and welding of the liner will be accomplished in accordance with generally accepted industry standards (described in Step 6). Cutting the rolls of liner into smaller pieces to accommodate stock introduces unnecessary risk and potential problems at the increased number and length of welded seams. It is not prudent to introduce risk unnecessarily. Finally, it is important that the work plan include contingency plans to respond to potential extreme hydrological events and delayed work schedules. At the end of each field season, the embankment must be left in a condition that will safely accommodate the following spring snowmelt and runoff.

In addition, the amount of time needed for transport and for work would be extended out to potentially 6 to 8 seasons with this alternative, which is considerably more than alternatives 1 and 2. Extended use of campsites for laborers as well as having 2-8 horses on site continually for the entire length of the work project each season would have impacts to soil and vegetation and accelerate degradation of campsites in an area that already exceeds Forest Plan standards for campsite impacts. There would be increased impacts to Mill Lake trail tread and drainage structures with the estimated 132 mules/62 horse trips in years 2007 and 2008 jumping to 314 mule trips/84 horse trips in years

2008-2010 with a slight decrease of stock and people until 2015. Visitor expectations of naturalness, remoteness and solitude would be impacted by 6 to 8 seasons of work and trail encounters with stock trains. Long term effects to Mill Lake of improved/and or new trails to accommodate stock use and containment would be great and difficult to mitigate.

Based on many factors, including uncertainties and the potential for changes, such as modifications to the design based on new information, or a project schedule that is delayed due to unforeseen circumstances, in addition to the recognition of the rights associated with the use and enjoyment of their easement, it is not reasonable for MCID to pursue a totally non-mechanized/non-motorized alternative.

Appendix E also includes a discussion regarding the risks and unnecessary exposure associated with the exclusive use of primitive or traditional tools for this project.

Alternative 4 – Permanent Breach of Mill Lake Dam

Alternative 4 considers the permanent breach of Mill Lake Dam. Mill Lake Dam is authorized through an easement established by the Act of 1866. As long as valid land use occupancies and water rights exist, the right to maintain and reconstruct these facilities to applicable standards shall be allowed. This option is outside the scope of the decision space of the Forest Service, and the direction for administering easements recognized under the Act of 1866 has been included in Appendix D.

Appendix D

FSM 5500 LANDOWNERSHIP TITLE MANAGEMENT

Ensure consistent and equitable administration of outstanding grants and easements.

5522.1 - Grants for Water Conveyance Facilities

The direction in this section applies to all water conveyance system grants now administered by the Secretary of Agriculture, which were previously authorized and administered by the Secretary of the Interior, including those granted by the Act of July 26, 1866. Additional guidance is found in sections 5522.11 - 5522.13 and in FSH 5509.11, Chapter 60.

1. Administer valid existing easements, which have been shown to exist prior to October 21, 1976, according to the public land law under which the grant was made. The grant is not diminished by defects in a survey or description made many years ago.

2. Administer easements according to the rights conferred under the grant, and Department of Interior regulations at 43 CFR Part 2800, unless otherwise ordered by a court of competent authority. Grants authorize occupancy for particular purposes, and provide for use of the area actually occupied and used, or described in the easement or statute.

3. Allow use of a road when part of an existing right-of-way if it is adjacent to the system and was constructed as part of the system.

4. Allow a holder to perform maintenance and minor improvements within the easement right-of-way. A new authorization is not needed for normal maintenance or minor changes made in the facilities on the right-of-way to maintain capacity of the ditch as it existed on October 21, 1976. Significant changes in location or alignment, significant increases in the area occupied, construction of new access roads, and enlargements and extensions that increase capacity of the system or include new land will require application for, and issuance of, an authorization under FLPMA, as amended.

5. Allow a holder access to the easement on existing roads.

6. Ensure that water conveyance systems on National Forest System lands are operated in a manner that will protect the adjacent Federal lands from damage. Inspect the facilities to identify instances where damage is occurring or is likely to occur and make every attempt to obtain correction by the easement holder. If the holder does not make corrections, consult with the local Office of General Counsel (OGC) about appropriate legal remedies.

7. Although prior authorization is not required for holders to use mineral and vegetative materials, including timber, from National Forest lands for emergency repair work, ensure the holder makes prompt application for the materials used and appropriate

payment for such materials after the emergency has been resolved. Use of materials, on or off the right of way, for purposes other than emergency repair work requires application for, and issuance of, the appropriate permit, and payment in advance for the materials to be used.

5522.11 - 1866 Act Rights-of-Way

Policy in this section applies to rights-of-way for ditches and canals constructed under provisions of section 9 of the Act of July 26, 1866 (14 Stat. 253, 30 U.S.C. 51; 43 U.S.C. 661; sec. 2339, Revised Statutes). General policies in section 5522.1 also apply to these grants.

Rights-of-ways obtained under the 1866 Act were not formally documented and must be individually verified through water decrees, permits, water use records, deeds, ditch location statements, field survey notes filed with the Bureau of Land Management, water rights applications, testimony, court decrees, water administrative records, irrigation records, ditch rider notes, or other historical data. These rights-of-way, when verified, are a valid use of National Forest System land despite the absence of an authorizing document, and the Forest Service has recognized the existence of many such rights-of-ways since the National Forests were established.

1. Administer valid easements in accordance with the above 1866 Act and the various court decisions dealing with facilities constructed under that statute.

2. Treat questions relating to the rights of the United States or the water system owner as a title claim (see FSM 5510). Claims for damages to National Forest System land resulting from the use of the systems will be treated and processed the same as other claims. Work with the owner to ensure maintenance of improvements to prevent or stop damage. Consult the OGC before initiating action to recover damages.

3. Easements are an outstanding property right and are permanent until relinquished or abandoned.

4. Refer questions of abandonment to the Office of General Counsel (OGC) for advice.

Appendix E

Discussion Regarding Use of Primitive Techniques in Critical Elements of Mill Lake Dam

The dam safety profession has evolved beyond trial and error techniques that were utilized around the turn of the last century, and there are construction practices that are much more predictable. Although research and development still continues to improve the design, construction, repair, operation and maintenance of water storage structures, the final decision related to the design still remains with the dam owners and their engineering representative. They are the responsible parties who must be willing to take on the additional liability for potential consequences associated with unproven technology or questionable construction methods, particularly those critical elements affecting the long term structural stability and safe operation of the dam. Dam design must also be an integrated design that takes into account the interaction of the various components of the structure.

Dam safety is achieved by correcting known dam safety deficiencies according to accepted state-of-practice engineering standards in design and construction techniques. Some traditional techniques used to construct or repair these dams in the early 1900's have applications today as was demonstrated on Canyon Lake Dam during the rehabilitation in 2003 and 2004. However, the work accomplished on Canyon Lake Dam using primitive techniques involved the movement of materials exclusively. Primitive techniques were never utilized in the construction of critical elements of the dam, which included the following:

1. Compaction of soils to a required, verifiable and consistent density.
2. Construction and installation of highly reliable mechanical elements.
3. Batching or placement of high quality concrete or grout that meets the design specifications.

Prior to the 1920's, dam design was more trial-and error with little involvement by trained engineers, the consequence of which was a large number of dam failures. Even today, with updated analysis and investigation techniques, materials engineering and quality control, improved construction methods, and lessons learned from dam failure case histories, dam construction and rehabilitation is a relatively high risk endeavor with many pitfalls, including hydrologic, geologic and geotechnical. Technical requirements, guidelines, and engineering standards related to these subject areas affecting dam safety have been published by the US Bureau of Reclamation, US Corps of Engineers, US Natural Resources and Conservation Service, Federal Emergency Management Agency (FEMA), National Dam Safety Review Board, Interagency Committee on Dam Safety (ICODS), Association of State Dam Safety Officials (ASDSO), etc. (PF- G12).

In regards to dams in wilderness, the access issue prohibits importation of large quantities of high quality fill materials for use in the construction of the dam, considerably lowering the reliability of the dam. Given this shortfall, the reliability of various components of the dam must be maximized if the opportunity exists. In the end, reconstructing a dam using highly reliable techniques minimizes impacts to wilderness and the dam owners by minimizing the number of major repairs required to stabilize the dam. This, in turn, minimizes the number of trips required to conduct the repairs over the projected life of the reconstruction.

Engineers, inside and outside of the Forest Service organization, work diligently to implement projects in wilderness areas. The vast majority of projects related to dams are linked directly to the improvement of public safety downstream. With little more than an occasional sheep or cow downstream of the dams in the early 1900's the consequence of a dam failure was relatively minimal. The consequence of failure has increased substantially in 2006 with increased population centers replacing the farms and ranches that once existed.

Owners, consultants, and forest service engineers and regulators entrusted with the safe operation, maintenance, and success of construction projects on the dams face considerable liability should a failure occur. Cases in point are the dam and levee failures which occurred during hurricane Katrina and Hawaii. For additional information, the following websites are recommended:

http://starbulletin.com/2006/04/12/news/story01.html

http://starbulletin.com/2006/08/11/news/story05.html

http://www.tortlaw.net/Katrina.html

Despite the increased risk of using unproven alternative conventional and traditional methods several highly successful projects have occurred on the dams which include,

- 2003 Tincup Dam reconstruction effort
- 2004/2004 Canyon Lake Dam reconstruction effort
- 2005 Mill Creek Dam slip lining project
- 2006 installation of the first web based, satellite linked early warning/monitoring system on a wilderness dam.

The success of these projects is a function of the careful planning prior to implementation. Planning, however, is only part of the picture. In the case of unproven or novel ideas and techniques, many variables exist that are too complex to pencil out on paper. To account for these variables planners often develop contingencies that will substantially increase the likelihood of success for a particular project. Because of their remoteness, access is the primary issue that typically arises as a contingency to ensure success for projects on wilderness dams.

Appendix F

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Appendix G

Types of Actions Analyzed for the Mill Lake Dam 2007 Project

Connected Actions

Connected actions are those actions which are closely related and therefore should be discussed in the same environmental impact statement. Actions are connected if they:

- automatically trigger other actions which may require environmental analysis,
- cannot or will not proceed unless other actions are taken previously or simultaneously, or
- are independent parts of a larger action and depend on the larger actions for their justification.

The proposed action includes those activities necessary to fulfill the identified purpose and need as well as all connected actions identified in the alternatives described in Chapter 2. The proposed action includes the Bitterroot National Forest authorizing sufficient helicopter trips to allow for work to be done at Mill Lake dam and the required terms, conditions and mitigation measures required during access and work periods. Connected actions include work to be done at the dam site, which is described in Appendix B.

Cumulative Actions

Cumulative actions are those actions, which when viewed with past actions, other present actions, and reasonably foreseeable actions, may have cumulatively significant impacts and therefore should be discussed in the same environmental analysis document. Past, present, and reasonably foreseeable actions are activities that have already occurred, are currently occurring, or are likely to occur in the vicinity of the project area and may contribute cumulative effects. The past and present activities and natural events have contributed to creating the existing condition, as described in the Affected Environment in the EA. These activities, as well as reasonably foreseeable activities, may produce environmental effects on issues or resources relevant to the proposal. Therefore, the past, present, and reasonably foreseeable activities have been considered in the cumulative effects analysis for each resource area.

Mill Creek Drainage and Vicinity:

Past Actions inside wilderness only:
Mill Lake Dam - Reservoir Right of Way dam located and used in 1895
Mill Lake Dam - Present dam construction 1907
Mill Lake Dam - Major rehabilitation/maintenance in 1922, 1944, 1959-60-61, 1964 and 1991-1992
Mill Lake Dam - Geophysical Survey – 2001 - use of helicopters and motorized equipment
Mill Lake Dam - Dam Repair – Temporary repair 2001, 2002, use of helicopters and motorized equipment
Mill Lake Dam - Dam Dye tracing test- 2002
Mill Lake Dam - Geotechnical Investigation 2003, use of helicopters, motorized equipment
Construction of dams at Hauf Lake and Sears Lake.
Construction of dam at Lockwood Lake (presently breached)
Mill Lake Dam - Slip lining project- 2005, use of helicopters, motorized equipment

Past Actions that may be inside or outside of wilderness:
Fires – From 1970 to 1997, records of 11 fire starts
Small portion of the Blodgett Campground fire in 2000 was in Mill Creek drainage, creating a mosaic of burn intensities in the lower portion of the drainage
Salvage logging operations to the north of Mill Creek in 2001 and 2002
Post 2000 fire activities Best Management Practices were reviewed , and except for one culvert, were deemed adequate or better.
Construction of trails and road system
Shooting and the use of DDT

Present and Ongoing Actions inside wilderness only
Mill Lake Dam Routine Maintenance – Some motorized equipment, draft horses have been used to move debris
All Dams: Mill Lake, Hauf Lake, Sears Lake
- Dam Operation – water stored and released
- Dam Inspections
- Dam Maintenance

Maintenance and Operation Access – Foot or stock
Mill Lake Dam: Installation of Early Warning System inside wilderness 2002
Sears Lake Dam Maintenance: Motorized equipment 2003, Hand saw 2004

Present and Ongoing Actions that may be inside or outside of wilderness:
Mill Creek trail was realigned in 2003 and 2004 and work will continue into 2005.
Recreation activities including camping at Mill Lake, hiking and stock use
Campground and Trailhead facilities
Fire occurrence
Increased fire suppression resulting in more cover and less forage for wildlife
Increased human access and increased hunting season mortality
Ditch irrigation diversions on National Forest and private lands
Unauthorized ATV trails at the Forest Service and private land boundary
Several private landowners have worked on a channel restoration project
Limited amounts of water reach the Bitterroot River during summer because of diversions on private land
Housing development close to Mill Creek. Currently there are no county setback rules. State requirements are to build outside of the high water mark or get a 310 permit.
Road building, agriculture, channelization and other rural and suburban activities are occurring on private land
Housing development on private lands - 44.2 % ten year rate of growth in population in Ravalli County from 1990 -2000

Reasonably Foreseeable Actions Only in wilderness
Future maintenance on dams
Further repair work on Mill Lake Dam

Reasonably Foreseeable Actions that may be inside or outside of wilderness:
Trail maintenance
Continuing recreation use
Hazardous fuel reduction project near the Forest Service and private land boundary
Prescribed fire
Spraying herbicides along the roads and trails to control noxious weeds