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# Common Issues in NWMC Dam Rehabilitation Plan Reviews January 2008

## Training and Site Visits

NWMC provides direct assistance to states through training and site visits for dam rehabilitation projects. The best time for such assistance is normally very early in the process--when the various options that are available to the SLO (Sponsoring Local Organization) in the No Action Alternative/Future Without Project Plan (NAA/FWOPP) are being explored.

The plan is the product of the SLO and the state NRCS staff. The NWMC fully respects that ownership. The NWMC's intent is to share our experience and to help the staff identify reasonable alternatives, design options, and any project constraints. In a many instances, the NWMC staff can have a positive impact on plan development if involved at an early date in the plan development process. Early involvement by the NWMC allows the staff to better provide consultation throughout the planning process.

## When to Submit Plans for Review

NWMC Dam Rehabilitation reviews are intended to check consistency with agency direction. As time frames allow, it is preferable to submit the draft for review by the NWMC prior to public distribution so appropriate modifications can be made. If consultation is only needed on a particular issue or issues, that should be requested rather than submitting an unfinished document for review. It is not possible to give a defensible review of a plan that is not complete. The NWMC requests that seven copies of the plan be submitted for in-house distribution.

## Watershed Agreements

NWMC reviews watershed agreements to ensure that the template is current and the information is consistent with the plan. The format and content in Figure 504-2 in the NWSM should be followed. The agreement is a new binding document between NRCS and the SLO. States should ensure that that the following items are included in new agreements:

**Authority.** The watershed agreement and the plan should identify the authority under which the document is being prepared. Suggest referencing "Section 14 of the Watershed Protection and Flood Prevention Act (PL-83-566) as enacted by Section 313 of Public Law 106-472, otherwise known as "The Small Watershed Rehabilitation Amendments of 2000".

The watershed agreement and the plan for rehabilitation projects should specify the authority by which the project was originally constructed. Rehabilitation under PL

83-566 as amended by PL-106-472 (Rehabilitation) covers structures built under PL 78-534, PL 83-566, Pilot Watersheds, and RC&D. The proper authorities are listed here for convenience:

- Public Law 83-566 (as amended) - Watershed Protection and Flood Prevention Act of 1954.
- Section 13 of the Act of December 22, 1944 (Public Law 78-534; 58 Stat. 905).
- The pilot watershed program authorized under the heading "Flood Prevention" of the Department of Agriculture Appropriation Act, 1954 (Public Law 156; 67 Stat. 214).
- Subtitle H of title XV of the Agriculture and Food Act of 1981 (16 U.S.C. 3451 et.seq.; commonly known as the Resource Conservation and Development Program).

**Project Term.** The agreement should include the new term of the agreement which is also the design life. A typical statement follows:

“The term of this agreement is for the expected life of the project (    years) and does not commit the NRCS to assistance of any kind beyond the end of the program life unless agreed to by all parties.”

**Cost Share Details.** The agreement should give the specific cost-share details for the project, as specified in the NWSM. For single purpose flood control structures, it is recommend that the cost computation spreadsheet at the following link be utilized: <http://wmc.ar.nrcs.usda.gov/technical/WS/costcomprehab.html>. This information is useful for items 5-8 of figure 504-1 in the NWSM and Table 2 of the plan as well.

**Relocation Participation Rates.** Where applicable, specify rates of participation and authority. A typical statement follows:

"The SLO agrees that they will comply with all of the policies and procedures of the Uniform Relocation Assistance and Real Property Acquisition Policies Act (42 U. S. C. 4601 et. seq. as implemented by 7 C. F. R. Part 21) when acquiring real property interests for this federally assisted project. If the SLO is legally unable to comply with the real property acquisition requirements of the act, it agrees that, before any federal assistance is furnished; it will provide a statement to that effect, supported by an opinion of the chief legal officer of the state containing a full discussion of the facts and law involved. This statement may be accepted as constituting compliance. In any event, the SLO agrees that it will reimburse owners for necessary expenses as specified in 7 C. F. R. 21.1006 (c) and 21.1007."

**Permit Requirements.** The agreement should clearly identify SLO permit requirements. It also should clearly identify those SLO requirements that do not qualify as a part of their cost-share requirement. A typical statement follows:

"The SLO will obtain all necessary federal, state and local permits required by law, ordinance, or regulation for installation of the works of improvement. The costs of such permitting are the responsibility of the SLO and are not cost sharable.

**Federal Flood Plain Management and Flood Insurance Statement.** Even if floodplain regulations (PL 99-662) do not currently exist, this statement should be included. (Refer to item 12 of figure 504-1 of the NWSM.) A typical statement follows:

"The SLO agrees to participate in and comply with applicable Federal flood plain management and flood insurance programs before construction starts."

**Operation and Maintenance Agreement.** The agreement should refer to a new O&M agreement that is consistent with the project life of the rehabilitated project (usually ranging between 50 to 100 years). A typical statement follows:

"The SLO will be responsible for the operation, maintenance and replacement of the works of improvement by actually performing the work or arranging for such work, in accordance with the Operation and Maintenance Agreement. A specific Operation and Maintenance Plan, utilizing the NRCS National Operation and Maintenance Manual, will be prepared before issuing invitations to bid for construction. The term of this new O&M agreement will be for a period of \_\_\_ years, which is the life expectancy of the project."

**Water/Mineral/Resource Rights.** These and other resource rights are also a SLO responsibility and are not eligible cost-share items. A typical statement follows:

"The SLO will be responsible for the costs of water, mineral and other resource rights and will acquire or provide assurance that landowners or resource users have acquired such right pursuant to state law as may be needed in the installation and operation of the works of improvement. The costs associated with the subject rights are the responsibility of the SLO and are not cost sharable."

**Emergency Action Plan.** For high hazard dams, the agreement should include the requirement of the Emergency Action Plan. A typical statement follows:

"The SLO will provide leadership in developing an Emergency Action Plan (EAP) prior to construction and will update the EAP annually with local emergency response officials. NRCS will provide technical assistance in preparation and updating of the EAP. The purpose of the EAP is to outline appropriate actions and to designate parties responsible for those actions in the event of a potential failure of the floodwater retarding structure."

## **Alternatives**

The sections discussing the formulation, description, and comparison of the alternatives are the heart of any plan (refer to NWSM 504.38). A clear, concise, and consistent statement of purpose and need is imperative to set the parameters for alternative analysis (refer to NWSM 504.34 and 504.36).

**Alternatives Considered but Eliminated from Detailed Study.** A section entitled "Alternatives Considered but Eliminated from Detailed Study" should be included, to discuss alternatives that were considered but eliminated from detailed study. Each of

the alternatives not studied in detail needs to be described along with the rationale for why it was found to be unreasonable.

This section can thus show the reader that a wide range of alternatives was considered, and also explain why some apparent alternatives were not developed in detail. Otherwise, all alternatives are to be studied in the same level of detail<sup>1</sup> and displayed in the comparison of alternatives section.

**Decommissioning Alternative.** A decommissioning alternative that meets the stated purpose and need should normally be developed. In order to meet the purpose and need, this alternative often involves a combination of breaching, floodproofing, and or relocation. If the alternative is unreasonable, it can be eliminated from detailed study and included in the “Alternatives Considered but Eliminated from Detailed Study” section.

**No Action Alternative/Future Without Project Plan (NAA/FWOPP).** The NAA/FWOPP is the most likely future condition if none of the Action Alternatives/Future With Project Plans were to be selected. NRCS involvement will vary depending on the option selected. This alternative is required to be studied in detail.

In dam rehabilitation projects, development of the NAA/FWOPP is complicated by the fact that a dam already exists. The SLO has to figure out what to do with it. All the options available to the SLO need to be considered and documented in the development of the NAA/FWOPP. The SLO would be expected to choose their most cost-effective option unless a compelling rationale is presented for doing otherwise.

**Typical Applications.** Typically, dam rehabilitation projects are undertaken under the following circumstances:

- Both NRCS and the state dam safety office agree that the dam is high hazard classification.
- The dam does not meet current safety and performance criteria.
- NRCS, the SLO, and the state dam safety office want to resolve the situation in which the dam poses a threat to human life.
- The state dam safety office is expected to require compliance with applicable state safety and performance criteria.

Typically, in the NAA/FWOPP, the SLO would have the following options:

- ◆ Meet State Criteria for a High Hazard Dam. The SLO could hire a consultant to bring the dam up to minimum state standards. State standards may only identify freeboard requirements and may not include detention storage requirements or extend the useful life of the dam. If the SLO can satisfy the state regulatory agency, the legal mandate is satisfied. It still may not meet current NRCS standards and the useful life may not be extended but

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<sup>1</sup> [S]o that reviewers may evaluate their comparative merits.” (40 CFR 1502.14(b))

the safety issues will be improved. No NRCS rehabilitation funding would be available. As long as the O&M Agreement is not violated, NRCS' future involvement with the dam would not be affected.

◆ **Meet State Criteria for a Low or Significant Hazard Dam.** The SLO could respond to the expected order from the state dam safety agency by reconfiguring the dam to a lower hazard classification. This might involve relocating breach inundation area structures outside the breach inundation area so that a lower hazard classification could be achieved; flood-proofing; constructing dikes or levees downstream to protect property in the breach inundation area; restricting future development in the breach inundation area; downsizing the dam; or some combination of such measures. SLO relocation may be less costly than relocation under federal rules.

◆ **Constructed Breach.** Either the SLO or the state dam safety office could reconfigure the dam so that it would no longer be classified as a dam. Or the dam could be reconfigured as a grade stabilization structure. Since the same rules for dam removal would presumably apply, this document does not distinguish any appreciable difference between the state regulatory agency breaching the dam and the SLO breaching the dam with a constructed breach. This breach would be a minimum size hole in the dam from top of dam down to valley floor, which would eliminate the structure's ability to store water. Costs associated with measures to comply with permitting requirements should be included. Downstream flooding conditions would be similar to those that existed prior to the construction of the dam. This course of action would minimize the SLO dam safety liability but would not eliminate all liability. The quantity and quality and ultimate destination of stored sediment would need to be addressed. This last course of action is not to be confused with "decommissioning" which not only removes the storage function of the dam but also reconnects, restores and stabilizes the stream and floodplain functions. Decommissioning may require the removal of a large part or the entire footprint of the dam.

**Atypical Applications.** In some very unusual cases state dam safety offices have indicated their intention to allow a dam to continue operating indefinitely even though it does not meet applicable state safety and performance criteria. In such unusual cases the analysis process would have to reflect that:

- There is a common understanding of the situation by the SLO, the state dam safety office, and NRCS;
- Public disclosure concerns are addressed;
- The NAA/FWOPP includes any appropriate federal action such as continued federal technical assistance as long as the O&M agreement remains in place.

## **Evaluation Period (Project Life/O&M Agreement Period/Design Life).**

Circular 7 to the NWSM specifies at 508.44(c) a minimum evaluation life for dam rehabilitation projects of 50 years. P&G 1.4.12 specifies a maximum evaluation life for any project of 100 years. Dam rehabilitation projects may therefore have an evaluation life anywhere from 50 to 100 years, inclusive.<sup>2</sup> The evaluation life relies on successful accomplishment of the work specified in the O&M Agreement, including any specified replacements. Replacements include any specified future removal of sediment, for instance. The evaluated life of the rehabilitated dam does not have to be the same as the original dam's evaluated life.

The evaluation life of the project cannot be longer than the physical life of the rehabilitated structure, including necessary replacements. Nor can it be longer than the term of the O & M agreement. The period of analysis is the sum of the implementation period and the evaluation period (NREH 611.0103).

Factors to consider in establishing the evaluation life include “deterioration, obsolescence, changing needs, and improvements in technology” (NREH 611.0100(c)(5)). Within reason, it is within the SLO's prerogative, for instance, to refuse a design life of 100 years (which would bind them to remove sediment at their own expense) in favor of a design life of 50 years without such a provision.

## **Rehabilitation Plan Considerations Related to Engineering**

In addition to regularly required items, the following items require special consideration/discussion in rehabilitation plans:

**Hazard Classification.** This section is normally titled “Breach Analysis and Hazard Classification”. *The only breach analysis required is for the breach related to hazard classification.* A breach analysis based on procedures outlined in Technical Release 60 is required to confirm the NRCS hazard classification. This evaluation needs to be compared with the state classification requirements to determine which criteria are the most restrictive. NRCS requires that rehabilitation projects meet the more restrictive of NRCS or state criteria. The breach analysis to determine NRCS hazard classification on a potential rehabilitation site needs to be done very early in the planning process.

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<sup>2</sup> Strictly speaking, NEPA (40 CFR 1502.14(a)) and P&G (Principle 5(c)) both require that consideration be given to evaluation periods longer and shorter than the 50-100 year period identified. It might be possible, for instance, to save a great deal of money by providing only 43 years of sediment storage. In such a case the necessary information should be generated for the SLO and the Responsible Federal Official to consider. If such an alternative appears reasonable, then it should be developed in detail—explaining that it would vary from the NWSM- or P&G-specified evaluated life. If the alternative did not appear to be reasonable then it would be described in the section of the document entitled “Alternatives Considered but Eliminated from Detailed Study”.

The plan should explain any change in hazard classification and the reasons why the structure fails to meet current safety and performance standards (both State and NRCS). The plan should describe the methodology and assumptions of the breach analysis (e.g. sunny day, water elevations, etc.)

**Consequences of Dam Failure.** This section in the plan should explain what would happen if there were to be a catastrophic failure of the dam. The consequences of dam failure are not intended for incorporation into the economic or other analyses. This is a stand-alone section that logically seems to fit before the “Formulation and Comparison of Alternatives”. This section is intended to provide a sense of why it would be desirable to reduce the threat of a catastrophic dam failure.

In the first paragraph, describe the existing condition of the current dam and the possible modes of failure (stability, hydrologic conditions, seismic conditions, sedimentation, material deterioration etc.). This section should state the risk of dam failure (which may be low, medium or high for any given failure mode).

The second and any subsequent paragraphs should describe the expected consequences of a catastrophic dam failure under the full pool conditions described in paragraph 1. The consequences would describe the human lives and the property at risk in the breach inundation area. The section should describe the potential loss of human life; infrastructure damage (such as roads, bridges, and utilities); likely damage to stream systems, wetlands, and other environmental damages, and long term erosion and sedimentation issues associated with the sediment pool of a catastrophically breached structure. Deciders will be better able to understand the potential loss of human life if some indication can be provided as to the depth and velocity of the floodwaters. Sediment discussions should address both quantity and quality issues. Physical data is to be used where readily available but verbal descriptions of likely consequences based on site observations may be used where other sources of data are not available.

**Sediment Storage.** Sediment issues need to be considered early in the planning process. Component design for dam rehabilitation needs to start at the bottom (sediment storage) and work up through the structural components to the required top of dam elevation. On high hazard dams, there is a tendency to immediately begin with the hydrologic loading requirements with sediment issues sometimes being treated as an afterthought. Some key issues related to sediment storage are as follows:

- ◆ Sediment provision must be included for the entire evaluation period. Normally the sediment pool is designed to hold the entire accumulation expected over the evaluated life. Rehabilitation requires a minimum evaluation period of 50 years. This normally means that the minimum sediment storage interval will also be fifty years. Occasionally projects will provide for sediment by various combinations of storage, pass-through, and removal. The SLO must understand that any provision for sediment not accomplished during the installation period will be entirely at their expense. The cost of future sediment removal and the SLO ability

to pay that future cost must be considered in formulating alternatives. Specific provisions for sediment removal for storage intervals less than 50-years should be included in the Watershed Agreement and O&M Agreement.

- ◆ As discussed earlier, any evaluated life between 50 and 100 years is permissible under rehabilitation. Within these limits, and because of its cost, sediment storage is frequently the determining factor in establishing the evaluation period. The decision process should begin by considering a 100-year design life as being the most desirable interval for both the sponsors and NRCS. If 100-year sediment storage is not reasonably obtainable, a rationale shall be based on a range of potential sediment storage values including consideration of costs, project objectives, site constraints, and other identified concerns. The design process should consider a range of potential sediment storage values based on costs, project objectives, site constraints, and other identified concerns. The required sediment storage volume is normally the most important factor in determining design life but other factors such as state law, expected conduit life or the life of other structural components, and SLO ability to pay, may be more important in any given situation. Problems in plan preparation may also arise when two or more structures in a plan have different design lives.
- ◆ An assessment is needed as to how much sediment has accumulated in the reservoir. Estimates may need adjustment to reflect the volume of borrow material that was excavated to build the reservoir.
- ◆ An estimate of sediment yield for the new project life is needed based on the current and projected land use.
- ◆ An assessment as to the composition of the sediment in the current sediment pool is needed in order to decide whether to remove or leave the current sediment accumulation. It is not necessary to test sediment quality in every rehabilitated site. The first site in any unique area should be tested. Reference sediment quality sites need to be established for any widely different areas within a state. Sediment test results have been unexpectedly good and bad. Sediment sampling takes time and resources, and may constitute a sizable cost component, so begin the assessment early.
- ◆ Because sediment removal is so expensive, plans need to consider other ways to provide needed sediment storage such as raising or replacing risers (with or without replacement of principal spillway conduits).

**Comparison Table of Structural Options.** A comparison table of design options or alternatives has been used effectively in several Rehabilitation Plans. The table itself is not required but a comparison is required and a table is a good way to display the differences. The table is valuable for showing what was evaluated and the relative degree of changes in alternatives or design options. The comparison table can be placed near the beginning or end of the section on “Effects of Alternatives” or in the section entitled “Recommended Plan”. The table should include a comparison of recommended plan elevations and dimensions compared to the current as-built or existing elevations.

The table is usually titled “Comparison of Structural Options (or Alternatives)”. It addresses key structural design features such as 1) principal spillway elevation 2) sediment storage volume in acre-feet 3) principal spillway conduit diameter 4) principal spillway discharge in cfs 5) detention storage volume in acre-feet 6) emergency spillway elevation 7) top of dam elevation. It is usually most effective to have a listing for the current dam as it presently exists with structural rehabilitation options considered such as an earthen spillway or a structural spillway that meets the high hazard criteria. The table can be tailored to meet the design options actually considered in the formulation of a specific plan. This table is not to be identified as Table 3. Tables 1-6 are only to be used for the selected alternative.

## **Checklist**

A rehabilitation plan checklist is posted on the NWMC website at: <http://wmc.ar.nrcs.usda.gov/>.