Kansas Dam Safety Conference 2018

Dam Rehabilitation Planning Alternatives

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Rehabilitation Planning Process

• **Local input**
  – Sponsor determines objectives
  – Public scoping meetings
  – Establish problems and opportunities

• **Detailed planning study**
  – Topographic Surveys
  – Habitat assessments
  – Cultural resources reviews
  – Sediment study
  – Dam safety inspection
  – Engineering analysis of structure and appurtenances
  – Hydrologic and hydraulic modeling
  – Consideration of breach inundation studies
  – Formulate alternatives
  – Benefit/Cost analysis
National Environmental Policy Act (NEPA) Planning

- Water quality
- Human health and safety
- Flood control
- Land use
- Transportation
- Cultural resources
- Endangered and threatened species
- Fish and Wildlife Coordination Act
- Floodplain management
- Migratory birds
- Prime and unique farmlands
- Riparian area
- Clean Water Act
- Wetlands
Alternatives Considered

- No Action/Future without Federal project
- Federal decommissioning with other downstream measures
- Dam rehabilitation
- Acquisition or relocation of at-risk structures
- Floodproofing, floodplain regulation, and other nonstructural alternatives
City of Meadville, PA – Rainbow Dam
Rainbow Dam – Project Setting
Rainbow Dam – Principal Spillway Structure
Rainbow Dam – Downstream Benefit Area
Rainbow Dam – Issues

The Dam does not meet the following criteria:

- NRCS TR-60 criteria for Freeboard Hydrograph (FBH);
- NRCS standard for seismic stability based upon the 10,000-year return earthquake; and
- Pennsylvania standard for seismic stability based upon the 2,500-year return earthquake.
- Dam in series with another High Hazard Class dam that experiences overtopping during FBH Storm event.
Rainbow Dam – Rehabilitation Alternative

- Extend 42' RCP Principal Spillway Conduit by 40' and construct new impact basin.
- New retaining wall between embankment and exit channel.
- Repair auxiliary spillway as needed.
- Work auxiliary spillway control section to 30'.
Rainbow Dam – Rehabilitation Alternative
Hibernia Dam – Chester County, PA
Hibernia Dam – Chester County, PA
Hibernia Dam – Auxiliary Spillway
Hibernia Dam – Chester County, PA
The dam does not meet NRCS TR-60 criteria for Freeboard Hydrograph (FBH).

Embarkment drainage system does not have adequate capacity:

- A “window” in the seepage cutoff causes excess seepage and a high phreatic surface within the dam embankment during high water levels in the reservoir.
Hibernia Dam – Foundation Drain Outlet
Hibernia Dam – Rehabilitation

• Maintain the existing axis of the dam.
• Raise the auxiliary spillway control section.
• Widen the auxiliary spillway.
• Install a concrete cutoff wall in the auxiliary spillway.
• Regrade the downstream stability berm to provide positive surface drainage.
• Install filtered toe between impact basin and existing rock toe.
• Reallocating water supply storage to provide additional sediment storage capacity.
Hibernia Dam – Rehabilitation
Core Creek Dam – Bucks County, PA

[Image of Core Creek Dam and surrounding area]

[Map of Core Creek Park]

[Logo of KLA Environmental Services, Inc.]
Core Creek Dam – Principal Spillway
The Dam does not meet the following criteria:

- NRCS TR-60 criteria for Freeboard Hydrograph (FBH)
- NRCS standard for seismic stability based upon the 10,000-year return earthquake
Core Creek Dam – Rehabilitation

- Maintain existing dam at current location and crest elevation.
- Replace the auxiliary spillway control section with a labyrinth weir.
- Armor the auxiliary spillway downstream of the labyrinth weir with roller-compacted concrete.
- Construct an upstream cutoff wall, downstream scour protection, and a riprap apron.
- Reinforce the downstream face of the embankment with fill at 3.75H:1V slope.
- Extend the existing principal spillway conduit and the existing toe drain conduits.
- Construct a new S.A.F. Basin at the outlet of the principal spillway conduit.
Core Creek Dam – Rehabilitation
Upper Walnut Watershed – Cassoday, KS
Floodwater Retarding Dam 21
Upper Walnut Watershed
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Upper Walnut Watershed
Floodwater Retarding Dam 21 – Issues

- The dam was designed and constructed as a Significant Hazard dam and is currently classified as a High Hazard Class dam. Consequently, the dam does not meet NRCS TR-60 criteria for Freeboard Hydrograph (FBH).

- The current top of dam elevation is above the flowline elevation of the box culvert at Interstate Highway 35, upstream from the dam.
• Maintain dam classification as Significant Hazard Class.
• Remove a single residential property from breach zone.
• Watershed District and Butler County certify that breach area is protected from development through zoning.
• Raise crest elevation of auxiliary spillway to meet current Significant Hazard Class dam criteria.
• Install sand diaphragm around conduit to extend design life 100 years.
Red Lick Creek Watershed – Floodwater Retarding Structure No. 12 – Madison County, KY
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- Floodwater Retarding Structure 12
• The Dam does not meet NRCS TR-60 criteria for Freeboard Hydrograph (FBH).

• 19 of the graves in the Pilot Knob Cemetery are beneath the existing easement.

• 23 additional graves are below the rehabilitated top of dam elevation.
Red Lick Creek Watershed – Floodwater Retarding Structure No. 12 – Madison County, KY
• Raise the crest elevation of the auxiliary spillway.
• Armor the auxiliary spillway surface with articulated concrete block.
• Provide riprap protection for downstream side slopes of new auxiliary spillway.
• Raise the embankment 4.0 feet to provide adequate capacity and freeboard to pass the design storms.
• Replace the end section of the primary spillway conduit, and extend the outlet to a new stilling basin location.
• Slip-line the principal spillway conduit to extend the life to 100 years.
• Receive a waiver from the NRCS requirement for minimum 30-inch diameter principal spillway conduit.
• Relocate 23 graves in Pilot Knob Cemetery.
Red Lick Creek Watershed – Floodwater Retarding Structure No. 12 – Madison County, KY

NOTES:
1. Sketch developed from as-built drawings of Red Lick Creek Watershed Floodwater Retarding Structure No. 12, Madison County, KY.
2. This plan is for reference purposes only and does not represent the actual structure.
3. The information provided is subject to change.

PLAN REFERENCE:
Red Lick Creek Watershed Floodwater Retarding Structure No. 12, Madison County, KY.
Conclusions

• Most Kansas small dams were built from 1964 to 1980 and designed for an expected service life of 50 to 100 years. Nearly 60% of dams in Kansas are now more than 30 years old, and over one-third of all dams (34%) are over 40 years old.


• Each project is unique and the long-term rehabilitation alternative may not be obvious. For federally-funded projects, a multi-disciplinary approach, considering a range of alternatives is required to determine the project alternative that reasonably maximizes net national economic development benefits, consistent with the Federal objective.