



UTAH DAM SAFETY PROGRAM
 Dam Design Review Checklist
 April 24, 2018

Dam Safety standards are defined in Administrative Rules. This checklist is intended to reflect these standards and accepted best practices. It may not be all-inclusive. This document, supporting exhibits and correspondence constitute written review of submitted plans.

Summary Table

General Information	
Dam Number	
Dam Name	
Owner Name	
Agent	
Telephone Number	
Email Address	
Mailing Address	
Designer	
Dam Location (UTM)	
Structural Information	
Dam Type	
Water Use	
Crest Elevation	
Structural Height	
Hydraulic Height	
Crest Width	
Crest Length	
Reservoir Area at Spillway Crest	
Reservoir Capacity at Spillway Crest	
Reservoir Capacity at Dam Crest	
Drainage Basin Area	
Spillway Information	
Principal Spillway Type	
Emergency Spillway Type	
Spillway Crest Length	
Spillway Discharge Capacity	
Breach Flows	
Outlet Information	
Outlet Diameter	
Outlet Length	
Outlet Material	
Outlet Control Location	
Outlet Control Type	
Maximum Outlet Capacity	
Emergency Information	
First Downstream Town	
Distance	

I. DESIGN REPORT - R655-10-6B.E

A. Hydrology and Hydraulics – R655-11-4,7,8 Revision Date _____ Reviewer's Initials _____

- Drainage & Reservoir Basin Hydrology
 - Drainage basin area
 - Reservoir area & capacity curves
 - Drainage basin land use & soil type descriptions
 - Loss method
 - SCS Curve Number
 - Initial and Constant
 - Runoff (transform) method
 - Baseflow method
 - SEF Identified
 - SEF compared to 100yr event on saturated soil with required allowances for freeboard
 - IDF Identified

Storm Events	Precipitation Depth, in	Curve Number or Infiltration Rates	Percent Impervious	Lag time, min	Peak inflow to reservoir, cfs	Maximum water surface at dam while routing peak inflow, ft
USU – 72hr						
USU – 6hr						
100yr – 24hr or 100yr – 6hr						

- Freeboard Analysis
 - Minimum 3 feet
 - Wave height, runup, & reservoir setup considered
- Spillway Design (principal & auxiliary spillways)
 - Spillway rating curve(s)
 - Spillway(s) routes the IDF?
 - No damage to principal spillway while routing the IDF
 - Channel hydraulics addressed
 - Adequate erosion protection and/or energy dissipation
 - Underdrain System Considered
 - Log Boom
- Fuse Plug Design
 - Trigger elevation
 - Breach time
- Dam Breach Analysis and Downstream Routing
 - Trigger elevation
 - Breach time
 - Breach width
 - Peak breach flow
 - Inundation area identified
 - Hazard rating assessed
- Incremental Damage Assessment
 - Threshold flow
 - % SEF routed
- Outlet Design
 - Outlet Rating Curve
 - Pipe size & type (24" minimum diameter)
 - Capable of evacuating 90% of the storage capacity in 30 days
 - Channel hydraulics addressed
 - Adequate energy dissipation

- B. Geologic and Seismic Study –R655-11-5A. Revision Date _____ Reviewer's Initials _____
- Regional geology
 - Site specific geology
 - Bedrock description
 - Alluvial description
 - Geologic cross-sections at maximum section and along the dam axis
 - Faults and faulting history
 - Seismicity - Deterministic and probabilistic
 - Design Earthquake parameters identified. (i.e. Magnitude, PGA, etc.)
 - Landslide potential of reservoir perimeter
 - Other geologic hazards
- C. Geotechnical Report - R655-11.5,6,9. Revision Date _____ Reviewer's Initials _____
- Borings / test pit logs
 - Exploration locations map
 - Total depth (depth > height of dam or 10' into bedrock, with a min. depth of 25' to 30')
 - Stratigraphy with elevations of different formations
 - Depth to groundwater
 - Availability of materials / borrow material analysis
 - Liquefaction or other seismic strength loss potential in embankment and foundation/abutment
 - Dispersive potential in borrow and foundation soils
 - Collapse/Swell potential in the foundation soil
 - Foundation design (seepage cutoff, soil & rock treatment, grouting, etc.)
 - Abutment design (seepage cutoff, soil & rock treatment, grouting, etc.)
 - Cutoff trench/grout curtain - specific design details
 - Embankment design (geometrics, zones, cutoff trench, etc.)
 - Defensive design measures (differential settlement at steep abutment slopes, crack stopper, etc.)
 - Soil/Rock zone properties (including strength parameters)
 - Seepage analysis (with permeability anisotropy ratio ≥ 9)
 - Slope stability analyses
 - End of construction F.S. ≥ 1.3
 - Steady-state F.S. ≥ 1.5
 - Instantaneous drawdown F.S. ≥ 1.2
 - Pseudo-static analysis F.S. ≥ 1.0 for no liquefaction & $p_{ga} \leq 0.2g$ or $\leq 0.35g$ if clay.
 - Post-Earthquake F.S. ≥ 1.2
 - Liquefaction/strength loss & excess pore pressure
 - Deformation analysis F.S. ≥ 2.0 (no liquefaction) or F.S. ≥ 3.0 (liquefaction)
 - Strength loss and excess pore pressure generation considered?
 - Upstream & downstream movement considered in total crest settlement?
 - Internal drainage design
 - Chimney, blanket, & toe drain
 - Outlet conduit filter & drain collar/diaphragm
 - Filter analysis for adjacent zones, foundation, and pipe slots
 - Erosion protection on both upstream and downstream slopes
- D. Structural/Others Revision Date _____ Reviewer's Initials _____
- Reinforced concrete design for appurtenant hydraulic structures (ACI 350)
 - Spillway
 - Outlet works
 - Others
 - Structural Calculations with loading conditions utilized

Comments:

II. DESIGN DRAWINGS/PLANS R655-10-6B,B,C Revision Date _____ Reviewer's Initials _____

R655-11-6,7,8,9,10

A. General Plan

- Cover Sheet with Index
- Signature Block for owner's acceptance
- All drawings stamped and signed by responsible engineer(s)
- Reference to Water Rights assigned to the water storage
- Reservoir stage versus area/storage capacity curve
- Rating curves for the outlet(s) and spillway(s)
- Vicinity / location map
- Topography of site
- Bar scale and north arrow
- Plan view of dam and reservoir area (including showing locations of appurtenant structures)
- Abutment turn-around for dams over 500-feet long and with a dead-end crest
- Outlet controls accessible during a spilling event
- Location of instrumentations (i.e. monuments (200' spacing), piezometers, drain outfall, staff gauge)
- Setback dist. for fences and woody vegetation from embankment and appurtenances – 25 feet

B. Details and Sections

- Cross-section of embankment at maximum section
 - Elevations of dam crest
 - Elevations of maximum water level in reservoir (spillway crest)
 - Freeboard – consider hydrologic routing and/or vertical seismic deformation
 - Original ground surface
 - Limits of foundation excavation
 - Geologic information / cross-section
 - Longitudinal Cutoff trench with sideslopes $\geq 1H:1V$
 - Crest width (0.2*H+5 feet, 12-foot minimum)
 - Crest slope (2-percent minimum towards the reservoir)
 - Crest surface (protected with a wearing surface of granular material)
 - Embankment geometrics including upstream/downstream slope and internal zones
 - Define material properties in drawings
 - Top of clay core and chimney drain up to or above the 100-year flood elevation
 - Chimney drain width
 - Minimum 3-feet wide per zone for vertical drain, possibly wider for inclined drain
 - Filter chimney width at least twice the predicted horizontal deformation
 - Drainage blanket minimum thickness
 - Internal drainage system (i.e., collection pipes ≥ 6 inches)
 - Erosion protection of upstream and downstream slopes
- Profile along dam axis (longitudinal profile)
 - Elevation of dam crest and centerline stationing
 - Camber and anticipated settlement
 - Cutoff trench
 - Limits of foundation excavation
 - Abutment slopes
 - Geologic information / profile
 - Location of outlet(s) and spillway(s)
- Spillway plan view, profile, and details
 - Elevation, grades, and centerline stationing
 - Geologic information / profile
 - Cutoff walls
 - Energy dissipation structure
 - Structural details for reinforcement steel
 - Waterstops at construction joints
- Fuse plug plan view, cross-sections, and details, if applicable
 - Elevation and grades
 - Cutoff walls
 - Structural details for reinforcement steel
 - Waterstops at concrete construction joints

- ___ Outlet works plan view, profile, cross-section, and details
 - ___ Control details
 - ___ Valve stem seals details
 - ___ Intake structure (with trash rack)
 - ___ Guard gate system
 - ___ Air vent pipe (appropriately sized, goose neck, rodent/basket screen)
 - ___ Air vent manifold (perforated holes have equivalent surface area as air vent pipe)
 - ___ Conduit size (minimum 24-inch diameter)
 - ___ Concrete cradle or encasement
 - ___ Battered sides 1H:<10V typical (unless concrete poured against excavation, if approved)
 - ___ Soil side-slopes $\geq 2H:1V$ (unless concrete poured against excavation)
 - ___ Restraint plan during cradle/encasement installation
 - ___ Seepage collar/diaphragm around conduit (2-stage with min. 6-inch cover around drain pipe)
 - ___ Seepage collar drain pipe located off to one side of encasement (not below it)
 - ___ Outlet elevations and grades at both the intake structure and stilling basin
 - ___ Stilling basin / energy dissipation structure
 - ___ Inspection access port (for outlet conduit connected to a distribution line)
 - ___ Emergency bypass line (for outlet conduit connected to a distribution line)
- ___ Internal drainage system
 - ___ Sand filter and gravel drain material (2-stage)
 - ___ Pipe diameter (≥ 6 -inch) – to allow for camera inspection
 - ___ Radius bends (≤ 22.5 -degrees) between straight sections – to allow camera inspection
 - ___ Access ports – to allow for camera inspection
 - ___ Slot width requirement
 - ___ Measuring devices (i.e., V-notch boxes, bucket access, etc.)
 - ___ Rodent screen
- ___ Piezometers/Instrumentation - type and location – **R655-11-10**
- ___ Relief Wells - type and location

Comments

III. SPECIFICATIONS R655-10-6B.D

Revision Date _____

Reviewers Initials _____

- Site preparation (stripping and grubbing)
- Foundation preparation
 - Treatment requirements for soil foundation
 - Cleaning and treatment of bedrock foundation (provide drawing)
 - Grouting
 - Cutoffs
 - Shaping
 - Abutment contacts
 - Dental concrete / slush grout
 - Blasting approved?
- Earthwork
 - Moisture conditioning at borrow and/or stockpile area only
 - Compaction requirements for soil and rock zone
 - Moisture content requirements
 - Initial lift placement (first 2-feet) placed against concrete structures or bedrock
 - Maximum particle size (less than 2-inches)
 - Clay core material placed pneumatically and rolled wet of OMC
 - Lift thickness (heavy compactors and hand operated compactors)
 - Placement and compaction pattern of embankment material
 - Dump and spread parallel to dam axis
 - Uniformly and horizontally (abutment to abutment, upstream to downstream with drainage)
 - Filter and drainage material above adjacent embankment zones or trench method
 - Limited traffic and chimney drain cross-over points on filter and drainage material
 - Segregation, heterogeneous pockets, and rock nesting not allowed
 - Temporary construction slopes (when & where approved by engineer) no steeper than 4H:1V
 - Embankment compaction issues (i.e., shearing or slicken sides, rutting, heaving, cracking, etc.)
 - Treatment of lift surface (i.e., scarification)
 - Embankment fill (zones) gradation requirements
 - Filter and drain gradation requirements – after placement and compaction
 - Filter and drain thickness & width requirements
 - Riprap gradation and durability (i.e. abrasion, sulfate soundness, freeze-thaw) requirements
 - Handling of deleterious material (i.e., organics, frozen soil, debris, etc.)
 - Frost protection for different zones (i.e., filter zones, clay core, shells, etc.)
 - Seed mix design does not include any woody vegetation
- Concrete and reinforcement
 - Concrete mix, admixtures, slump, air entrainment, w/c ratio, and strength requirements
 - Testing requirements
 - Use of chlorides not allowed
 - Free fall limits (to prevent possible aggregate separation/segregation)
 - Form requirements
 - Preparation
 - Concrete mix, placement, and curing requirements, including hot/cold weather conditions
 - Aggregate specifications
 - Finishing requirements
 - Strength or age requirement before form removal / backfilling / structural loading
 - Steel reinforcement requirements
 - Protective cover thickness (i.e., 2" & 3" for concrete placed against wooden form or soil respectively)
 - Waterstops and joint preparation (i.e., sand blasting)
 - Stinging and consolidation of concrete requirements
 - Repair requirements for damaged or improperly placed concrete (i.e., honey combing, exposed steel reinforcement, etc.)
- Pipe materials and installation
 - Outlet conduit
 - Bedding requirements (i.e., concrete cradle or encasement)
 - Hydrostatic pressure test
 - Drain pipe
 - Pipe diameter (≥ 6 -inch) – to allow for camera inspection
 - Minimum radius bends (≥ 22.5 -degrees) – to allow for camera inspection
 - Access ports – to allow for camera inspection

