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**RESUME****Larry Kent Nuss****Address**

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Bureau of Reclamation  
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**Area of Expertise**

- Senior Structural Engineer specializing in the structural analysis and design of concrete dams: Twenty-nine years experience in civil/structural engineering with the Bureau of Reclamation specializing in the advanced state-of-the-art (static and dynamic, linear and non-linear) structural analysis, design, rehabilitation, and security protection of concrete dams (arch, gravity, and buttress dams). Duties have included structural analysis, Technical Approval, Peer Review, mentoring, site inspection, Comprehensive Facility Review, and member of Dam Safety and Security Advisory Teams.
- Structural analysis and design of other structures: Seismic evaluation of buildings, intake towers, and Echelon pumping plant design.
- Team Leader: Team Leader on numerous dam stability evaluation projects.
- Advancement of Profession: Developed and directed numerous research projects related to the seismic stability and blast effects on concrete dams and spillways. Current member of technical committees. Have written and reviewed guidelines for Reclamation and other Agencies.
- Risk Analyses: Performed numerous dam safety and security risk analysis of concrete dams.

**Education**

Master of Science, University of Colorado, Boulder, Colorado, Civil Engineering, 1978, GPA 4.0  
Bachelor of Science, University of Colorado, Boulder, Colorado, Architectural Engineering, 1975, GPA 3.53.  
High School Diploma, Windsor High School, Windsor, Colorado, Graduated 1971.

**Projects and Accomplishments****Team Leader and Structural Engineer**

I have been a Team Leader (TL) of multi-disciplined teams (seismologists, geologists, geotechnical engineers, structural engineers, materials engineers, technicians, and cost estimators) and either the Lead Structural Engineer (LSE) or the Structural Engineer (SE) to determine the seismic stability/safety of dams or to develop feasibility designs. Team Leader duties: I develop project plans, organize teams, track expenditures, keep clients informed of progress, present results to Consultant Review Boards or clients, perform risk analyses, and develop final conclusions. Structural engineer duties: I perform static, dynamic, or thermal, implicit or explicit, linear or non-linear, 2- or 3-dimensional state-of-the-art finite element analysis of solid, thin shell, and frame structures; create finite element models; perform structural and stability analyses; post-process results; evaluate results; determine stability of the structure; coach and mentor (M) others; check and peer review (PR); technically approve (TA); and develop and maintain in-house software.

- Hoover Dam – 727-ft-high thick arch dam (TL, LSE, TA, M, ANACAP, SAP, EACD3D96). Linear and material nonlinear dynamic finite element analyses of the largest curved gravity dam in the USA. First time Reclamation used nonlinear dynamic analysis and linear dynamic with mass in foundation.
- East Canyon Dam – 265-ft-high thin arch dam (TL, LSE, TA, PR, NIKE, DYNA, EACD3D96). Linear and nonlinear dynamic structural analysis of the thinnest arch dam in Reclamation's inventory including eccentric mass shake of dam.
- Warm Springs Dam – 106-ft-high thin-arch dam (TL, LSE, TA, PR, DYNA, SAP4). Linear dynamic finite element analyses for safety evaluation and modification. Feasibility study to replace or resurface dam. Geometric nonlinear analysis of deteriorating structure to determine limit of freeze-thaw damage.
- Friant Dam – 319-ft-high gravity dam (TL, LSE, SAP4). Safety evaluation. Alkali-aggregate reaction problems.

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- Monticello Dam – 304-ft-high thin arch dam (TL, LSE, TA, M, ABAQUS, SAP4, EACD3D96). Linear and geometric nonlinear dynamic finite element analyses. First time Reclamation used contact surfaces to model contraction joints and lift lines.
- Big Timber Creek Dam – 130-ft-high roller-compacted (RCC) gravity dam (TL, LSE, GRAVDAM). Layout of new dam near Leadore, Idaho for the Snake River Area Office and the Fish and Wildlife Service.
- Black Canyon Dam – 183-ft-high curved gravity dam (TL, LSE, TA, PR, M, EAGD, DYNA). In 2005, linear and geometric nonlinear dynamic structural analysis of dam and spillway. In 1984 (SE), dynamic finite element analyses for safety evaluation. First time a comparison between 2-d and 3-d finite element analysis of thick arch.
- Bartlett Dam – 287-ft-high multiple arch and buttress dam (LSE, TA, ABAQUS). Static and dynamic 3-dimensional linear-elastic finite element analyses. This was the first time a 3-dimensional analysis of the entire buttress dam had been performed at Reclamation. Dynamic nonlinear analysis was performed by reducing modulus of overstressed elements to compute displacement beyond yield displacement. Dam modified by raising top of dam 25-feet.
- Clear Lake Dam – 46-ft-high roller-compacted gravity dam (LSE, TA, GRAVDAM). Static, thermal, and dynamic finite element analyses and layout optimization for a new dam.
- Milltown Hill Dam – 187-ft-high roller-compacted gravity dam (SE, GRAVDAM, EAGD). Static, non-linear thermal and linear dynamic finite element analyses and layout optimization for a new dam.
- Stewart Mountain Dam – 207-ft-high thin-arch dam (SE, TA, SAP). Performed static, thermal, and linear dynamic finite element analyses. First arch dam stabilized for dynamic safety with post-tensioned anchors.
- Yellowtail Dam – 525-ft-high medium thick arch dam (LSE, M, TA, PR, EACD3D96). Linear static, thermal, and dynamic finite element analyses.
- Anchor Dam - 208-ft-high medium thick arch dam (M, TA, NIKE)
- Upper Stillwater Dam - 292-ft-high RCC gravity dam (SE, NIKE). Static 2-D analysis of membrane modification to determine limits of drilling to not crack existing concrete.
- Altus Dam – 110-ft-high thick-arch dam (SE, SAP, M). Dynamic linear finite element analyses for safety evaluation.
- Pueblo Dam – 160-ft-high massive head buttress dam (only massive head buttress in United States) (SE, ABAQUS). Nonlinear static and thermal finite element analyses of the roller-compacted concrete rehabilitation.
- Stony Gorge - 140-ft-high slab and buttress dam (PR, ABAQUS). Static and geometric nonlinear dynamic analysis for safety evaluation and modification designs.
- San Joaquin Dam – New 600-ft-high RCC dam (SE, TA, EAGDSLIDE). Feasibility layout design and dynamic finite element analysis of roller compacted concrete dam.
- Green Mountain Spillway – (TA). FLAC dynamic analysis of embankment and spillway using non-linear soil properties (Mohr-Coulomb and Hyperbolic) for pressures on spillway wall.
- Hoover Intake Tower – 350-ft-high reinforced concrete intake tower (LSE, TA, ABAQUS). Static and dynamic finite element stability analysis of the intake tower with 2-d and 3-dimensional finite element analysis. Participated in the on-site vibration tests of an unbalanced cylinder gate closure.
- Medina Dam - 164-ft-high gravity dam (LSE, TA, GRAVDAM). Static stability analysis of this historic gravity dam built in 1919 for the BMA Water District, San Antonio, Texas.
- Carriaso and La Plata Dams - 105-ft and 131-ft-high gravity dams (SA, GRAVDAM, ABAQUS). Static and dynamic 3-D analysis of 2 gravity dams for Puerto Rico.
- Yellowtail Dam Visitor Center (SE) – Building seismic safety evaluation of precasted concrete.
- Bureau of Land Management Fire Center Information Systems Building No. 410A, Boise, Idaho (SE) - Building seismic safety evaluation of unreinforced concrete masonry.
- Echelon Pumping Plant (SE) – Designed an off-canal Echelon pumping plant near Willows, California and developed computer automatic layout program.

**Research Projects**

Since 1987, I have identified over 30 research topics for dam safety and security, developed Project Plans, obtained funding, obtained co-sponsors, performed the study, or led and directed the research efforts as the Contracting Officer's Technical Representative (COTR). A few of the projects include:

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- “Perfectly Matched Layers,” University of California at Berkeley, Dr. Anil Chopra (COTR).
- “Testing Dynamic Properties of Structures Using an Eccentric Mass Vibrator,” Bureau of Reclamation and ANCO Engineers. An eccentric mass vibration system was purchased to test structures (COTR).
- “Nonlinear Seismic Analysis of Morrow Point Dam,” Lawrence Livermore National Laboratory, Dr. Chad Noble (TL).
- “Develop Fragility Curve Analysis for Gravity Dams.” Bureau of Reclamation, Larry Nuss (SE).
- “Plastic-Damage Model for Concrete,” University of California at Berkeley. Co-sponsors: Harza Engineers, Reclamation, Pacific Gas and Electric, and the Corps of Engineers; Dr. Greg Fenves (COTR).
- “Stability of Fix-Wheel and Radial Spillway Gates,” Navy Surface Warfare Center (COTR).
- “Damping in Concrete Dams during Earthquakes and Use and Misuse of Rayleigh Damping,” California Institute of Technology, Dr. John Hall (COTR).
- “Hydrodynamic Interaction Program RSVR2,” California Institute of Technology, Dr. John Hall (COTR).
- “Implementation of Nonlinear C45 Concrete Model in the DYSMAS Family of Finite Element Computer Programs”, Naval Surface Warfare Center (NSWC) (COTR).

### Advisory Teams and Review Panels

- Dam Safety Advisory Team (DSAT). Member of Senior Level team of advisors in the Technical Service Center of the Bureau of Reclamation that review Comprehensive Facility Review Reports (CFR) and Issue Evaluations to make recommendations to the Dam Safety Office.
- Security Advisory Team (SAT). Senior Level team of advisors from the Bureau of Reclamation, Sandia National Laboratory, and the Corps of Engineers that review security upgrades to dam structures and make recommendations to the Security, Safety, and Law Enforcement (SSLE) Division at the Bureau of Reclamation.
- Bluestone Dam. Independent reviewer for the Corps of Engineers on Bluestone Dam (gravity dam).
- Salinas Dam. Independent reviewer for the City of San Luis Obispo on Salinas Dam (thin arch dam).
- Northern Pacific Railroad Dam – Independent reviewer for the State of Montana on stability analysis performed on a small, but very old, gravity dam.
- Prisoner Dam – Independent reviewer for the Bureau of Land Management of a masonry arch dam.
- Comprehensive Facility Reviews (CFR). As a Senior Engineer at Reclamation, I have performed CFRs on: Pueblo Dam, Hungry Horse Dam, Owyhee Dam, Deadwood Dam, Buffalo Bill Dam, Keswick Dam, Seminoe Dam, and Pathfinder Dam. These are reviews of the analysis, design, construction, instrumentation, hydrology, seismology, consequences, and risks imposed by the dam to identify any dam safety deficiencies. I have been the Mentor/Peer Reviewer on 5 CFRs: Savage Rapids Dam, Gerber, Hoover Dam, Stewart Mountain Dam, and Thief Valley Dam.

### Professional Affiliations and Licenses

- License - Professional engineer with the State of Colorado, No. 17615.
- Member - United States Society on Dams (USSD) – Member of Earthquake Committee since 2005.
- Member - American Society of Civil Engineers - Risk Assessment Task Committee, Chapter 3 Leader
- Member - Corp of Engineers CASE Task Group on Massive Concrete Structures and Arch Dams
- Member - Association of State Dam Safety Officials (ASDSO)
- Member - Reclamation technical representative for Electric Power Research Institute (EPRI) Dam Safety Advisory Group
- Reviewer - Civil Engineering Research Foundation (CERF) for various Corps of Engineers and American Society of Civil Engineer publications
- Reviewer – Federal Energy Regulatory Commission (FERC) of their guidelines on gravity dams, on arch dams, and on buttress dams.
- Lecturer - Association of State Dam Safety Officials (ASDSO) Workshop on the Seismic Evaluation of Existing Dams, Durango, Colorado, 1990.
- Lecturer - University of Colorado, Boulder, Colorado, 1998.
- Lecturer - Southern University, Baton Rouge, Louisiana, 1995-2000.
- Lecturer - RCC Dams Short Course, Monterey, California, December, 1995.

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- Lecturer - Dam Safety Short Course, National Commission on Water, Mexico City, Mexico, 2000.

### International Projects/Area Assignments

- Japan Dam Engineering Center (JDEC): Participate in second meeting in Japan. Organized third meeting in United States for Reclamation Assistant Commissioner, Darrel Webber.
- Peoples Republic of China: Lecturer for 2 months of a 6 month training program at Reclamation.
- India: Lecturer for 4 week training program for 3 engineers on dam design at Reclamation.
- South Korea: Lecturer for 3 month training program for 3 engineers on dam design at Reclamation.

### Publications/Articles

- Publication: "Evaluation and Comparison of Stability Analysis and Uplift Criteria for Concrete Gravity Dams by Three Federal Agencies," by Robert M. Ebeling, Larry K. Nuss, Fred T. Tracy, and Bruce Brand, US Army Corps of Engineers, ERDC/ITL TR-00-1, January 2000.
- Draft Publication: "State-of-Practice for the Non-Linear Structural Analysis of Dams at the Bureau of Reclamation," by Barbara Mills-Bria and Larry K. Nuss, 2003.
- "Implicit and Explicit Nonlinear Dynamic Analysis of a Large Thin-Arch Dam using Massively Parallel Computing", by Chad Noble and Larry K. Nuss, 13th World Conference on Earthquake Engineering, Vancouver, BC, Canada, August 1-6, 2004.
- "Comparison of Vibration Generator Tests To Analyses Including Dam-Foundation-Reservoir Interaction for Morrow Point Dam," by Larry K. Nuss, Anil K. Chopra, and John F. Hall, 21<sup>st</sup> ICOLD Congress, Montreal Canada, June 15-21, 2003.
- "Analyses Using Eacd3D96 For Morrow Point Dam," by Larry K. Nuss and Anil K. Chopra, US-Japan Earthquake Engineering Workshop, San Diego, CA, June 22-23, 2002.
- "Comparison of the Nonlinear Behavior of Concrete Arch Dams Using Physical and Numerical Models," by David Harris, Terry Payne, and Larry Nuss, US-Japan Earthquake Engineering Workshop, San Diego, CA, June 22-23, 2002.
- "Concrete Dam Evolution", by John LaBoon, Larry Nuss, and Gregg Scott, Bureau of Reclamation History Symposium, Las Vegas, 2002.
- "Grouted RCC Contraction Joints at Pueblo Dam", by John Trojanowski, Larry Nuss, and Peter Aberle, ASDSO Annual Conference, Park City, Utah, Sept, 2001.
- "Seismic Risk Analysis of Monticello Dam Based on a Nonlinear Finite Element Model", by Roman Koltuniuk and Larry Nuss, 21<sup>st</sup> USSD Annual Meeting and Lecture, Denver, Colorado, July 2001.
- "Influence of Dam-Foundation Interaction in Seismic Safety Evaluation of Two Arch Dams," by Larry Nuss, Anil Chopra, Rich Munoz, and Frank Jackmauh, 12<sup>th</sup> World Conference on Earthquake Engineering, New Zealand, January 30, 2000.
- "Seismic Analysis of Hoover Dam," by Larry K. Nuss, 30th U.S.-Japan Panel on Wind and Seismic Effects, Gaithersburg, Maryland, 1998.
- Similar paper topic for the Association of State Dam Safety Officials (ASDSO), 1998.
- "Case Study of the Dynamic Analyses of an Existing Multiple Arch Dam: Bartlett Dam, Phoenix, Arizona, USA', by L.K. Nuss, T.L. Payne, and M.A. Sozen, Dam Fracture Conference, Chambéry, France, March, 1994.
- Similar paper topic for:
  - International Committee on Large Dams (ICOLD), 1994
  - United States Committee on Large Dams (USCOLD), 1993
  - Association of State Dam Safety Officials (ASDSO), 1993
- "Considerations for and Advantages of Roller-Compacted Concrete (RCC) Arch Dams," by Dolen, Dollar, Higinbotham, Nuss, Richardson, and Roehm, Third JDEC/Reclamation Technical Exchange, Denver, Colorado, October, 1992.
- "Current Seismic Design Methods at the Bureau of Reclamation, Larry K. Nuss, Japan/Reclamation Technical Exchange, Oct, 1991.
- "Cable Anchoring of a Deteriorated Arch Dam', Avinash C. Singhal and Larry K. Nuss, ASCE Journal of Performance of Constructed Facilities, Vol 5, No. 1, February 1991, Paper No. 25481.

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- Similar paper topic for:

- International Committee on Large Dams (ICOLD)
- United States Committee on Large Dams (USCOLD)
- 12th Engineering Mechanics Conference, La Jolla, CA, May 1998
- “Parameters Influencing the Shear Strength between Clay Masonry Units and Mortar,” Larry K. Nuss, Master Thesis, University of Colorado, 1978.

**General**

I was raised on a farm in Northeast Colorado, near Hillrose, Colorado (population 100). There were 9 kids, 6 boys and 3 girls, in my 1<sup>st</sup> through 6<sup>th</sup> grade classes. Hillrose consolidated into the Brush school system where there were 125 kids in my class. I was valedictorian of my class when we moved to Windsor, Colorado (population 2500) my sophomore year in High School (48 classmates). I married Kathy Mortensen in 1982. Our son, Michael, lives in Houston with his wife Emily and daughter Katie.

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Larry K. Nuss

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Date