

WESTERN GEOLOGIC, LLC

CRAIG V. NELSON, P.G., C.E.G., C.E.M.

Title	Principal Engineering Geologist
Expertise	Engineering Geology Groundwater Geology Environmental Due Diligence Environmental Geology Geologic Hazards Litigation Support
Academic Background	M.B.A., Eccles School of Business, University of Utah, 1991 M.S., Geology, Utah State University, 1986 B.S., Geology, Utah State University, 1982
Registration	Professional Geologist - Utah No. 5251804, California No. 4806, Wyoming No. PG-3766 Certified Engineering Geologist - California No. 1585 Certified Environmental Manager - Nevada No. 1975
Experience	<p>Mr. Nelson has over 32 years of experience managing a wide variety of projects in engineering, groundwater, and environmental geology. His expertise in geologic hazards mapping, analysis and mitigation stem from successful completion of numerous geologic hazard studies, fault and seismic investigations, rockfall probability assessments, landslide and debris flow studies, soil liquefaction analysis, and slope stability projects. He has completed geologic studies and risk analysis for engineered structures, public facilities, subdivisions, dams, highways, and corridors throughout the western U.S. and Canada.</p> <p>Mr. Nelson also has experience in engineering geology for surface and underground mining as well as economic evaluation of mineral deposits including metallic minerals, coal, sand and gravel, and other industrial minerals.</p> <p>His environmental and hydrogeology work has included subsurface site characterizations, soil-gas surveys, Phase I Environmental Site Assessments, Transaction Screen analyses, and soil and groundwater remediation projects involving a variety of contaminants and remediation technologies. He has provided expert witness and third-party review services in a number of geology related cases.</p> <p>Mr. Nelson has conducted hydrogeologic evaluations for locating water wells and constructing dewatering systems. He has groundwater modeling experience and the ability to characterize complex groundwater conditions. He has also provided expert witness and third-party review services for groundwater related cases.</p> <p>Environmental Site Assessments</p> <ul style="list-style-type: none">Directed, reviewed, or conducted several thousand Phase I Environmental Site Assessments and Environmental Transaction Screen process projects for a variety of commercial and industrial facilities throughout the western U.S. (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Nebraska, New Mexico, North Dakota, Montana, Oregon, Texas, Utah, Washington, Wyoming), as well as Ireland, Scotland, Great Britain, and Singapore. <p>Geologic Hazards - Comprehensive</p> <ul style="list-style-type: none">Co-author of Salt Lake County's Natural Hazards Ordinance, which required developers to conduct special studies to address soil liquefaction and surface fault rupture in potential hazard areas.Conducted geologic hazard assessments and geoseismic evaluations for a many public facilities, residential subdivisions, dams, highways, and industrial facilities.

Groundwater Studies & Phase II Site Characterizations

- Managed and directed numerous Phase II environmental site characterizations to determine extent and magnitude of soil and ground water contamination for a variety of commercial and industrial facilities across the western U.S.
- Project manager for environmental site assessment of property down gradient from chemical leach ponds at a Salt Lake City chemical company.
- Conducted soil-gas screening surveys to determine if there was evidence of soil/groundwater contamination on site with evidence of historic underground storage tanks.

Geologic Hazards – Regulatory Review Services

- Mr. Nelson has provided geologic review services for Salt Lake County, Salt Lake City, West Valley City, Sandy City, and North Ogden City. Services included: holding pre-development coordinating meetings with developers and their geologic/geotechnical consultants to discuss potential geologic hazards and the scope of needed information to support the proposed development; field review and verification field data exposed in trenches, borings, test pits, etc.; review of technical reports and preparation of recommendations; attending planning commission and community meetings to discuss geologic hazards and development issues.

Geologic Hazards - Land Use Planning

- Prepared the geologic hazards analysis and land use overlays for Salt Lake County Planning Division's Foothill Area Master Plan. Geologic hazards of prime consideration in this land use plan include: surface fault rupture, earthquake ground shaking, liquefaction, landslides, rockfall, debris flow, mine and tunnel ground collapse, and avalanche.
- Prepared the geologic hazards analysis and land use overlays for Salt Lake County Planning Division's Holladay/Cottonwood Master Plan. Geologic hazards of prime consideration in this land use plan include: surface fault rupture, earthquake ground shaking, unstable slopes, and liquefaction.
- Prepared the geologic hazards analysis and land use overlays for Salt Lake County Planning Division's Magna Area Master Plan. Geologic hazards of prime consideration in this land use plan include: surface fault rupture, earthquake ground shaking, unstable slopes, and liquefaction.
- Prepared the geologic hazards analysis and land use overlays for Salt Lake County Planning Division's Taylorsville-Bennion Master Plan. Geologic hazards of prime consideration in this land use plan include: surface fault rupture, earthquake ground shaking, and liquefaction.
- Prepared the geologic hazards analysis and land use overlays for Salt Lake County Planning Division's Herriman Area Master Plan. Geologic hazards of prime consideration in this land use plan include: earthquake ground shaking, landslides, rockfall, debris flow, and liquefaction.

Expert Witness and Litigation Support

- Provided expert witness testimony, litigation support, and third-party review on a variety of geology and hydrogeology cases.

Dam Projects

- Provided engineering geology analysis for the seismic stability evaluation of Twin Lakes (concrete arch) and Lake Mary (concrete gravity) dams. Project included detailed bedrock mapping of abutments, seismic refraction survey, and slope stability analysis.
- Performed the geologic site reconnaissance and seismic design criteria for the reconstruction and enlargement of an earthfill dam in Payson Canyon, Utah.

Geologic Hazards - Surface Fault Rupture

- Completed a surface fault rupture hazard study for a proposed pipeline compressor station facility south of Salt Lake International Airport and north of the suspected trace of the active Granger Fault. Excavated and logged an exploratory trench (total 185m in length) to expose an unfaulted and undeformed marker bed identified at the pre-Holocene pre-Gilbert “red beds” used to demonstrate the low surface fault hazard at the site.
- Conducted a surface fault rupture hazard study for a proposed multi-lot subdivision/apartment complex adjacent to the active East Bench portion of the Wasatch Fault. Performed aerial photography analysis and fault mapping. Excavated and logged 4 exploratory trenches (total 120m in length) to locate the fault and determine rupture history (min. of 2.1m displacement observed). Provided recommendations for building set-backs, grading and footing placement in areas of rubble fill.
- Project manager for a combination fault and geotechnical investigation involving trenching a 59m long, 3.2m deep exploratory trench through Holocene alluvium and debris flow deposits into Pleistocene Lake Bonneville sediments. No active faults were delineated. The trench was logged using standard level-line techniques and a video log was also made to document the stratigraphy. Five test pits were also excavated, logged, and sampled for geotechnical testing.
- Conducted a fault investigation for a proposed residential development in a very structurally complex area within the active Wasatch Fault Zone. This project consisted of aerial photography analysis, fault and surficial geologic mapping, and excavating and logging a 77m long, 3m deep exploratory trench to delineate faulting and determine rupture history (nine active faults splays were documented). Provided recommendations for buildable areas to avoid future rupture hazard. Presentation of seismic techniques and risks to Planning Commission.
- Logs from geotechnical boreholes across this site indicated significant change in stratigraphy from east to west across the site. Analysis of aerial photographs proved inconclusive because of surficial disturbance from development in the earliest available photos (1938). Because the active East Bench portion of the Wasatch Fault has been mapped about 90m east of the site, an exploratory trench was excavated across the building pad to determine if the discontinuous stratigraphy was the result of past surface fault rupture. The 40m long trench was excavated 12m deep into Pleistocene Lake Bonneville sediments and revealed a silty clay lens interfingering with silty clay and gravel deposits. No evidence of faulting or liquefaction was observed; the contacts appeared to be depositional. No surface fault rupture-related constraints were recommended.
- Conducted surface fault rupture hazards evaluation for a proposed Salt Lake County Fire Station near the mouth of Little Cottonwood Canyon. Determined the location of the active Wasatch Fault in the vicinity of the site and provided recommendations to the structural engineer and architect for seismic design values for this critical structure. An exploratory trench 71.5m in length was excavated across the site to investigate the presence of recent fault activity. Recommendations were provided for earthquake ground shaking acceleration, ground tilting and deformation, surface fault rupture, and other geologic hazards. An earthquake probability analysis was prepared and recommendations for a risk assessment of the structure were provided.
- Project manager for a fault study conducted on a steep hillside lot (suspected fault scarp) in a subdivision approved in the mid 1970's before the Natural Hazards Ordinance prohibited placing structures over active faults. A 14.6m long, 5.2m deep trench was excavated into Pleistocene Lake Bonneville deposits. Three faults displacing sediment layers dated at 15,000-16,000 years old were logged. Recommendations were provided for siting the structure to avoid future surface fault rupture.

- Served as project manager and principal geologist for a fault hazard analysis for a proposed development located on 40 acres straddling a wide graben located within the active Wasatch Fault Zone. Project goals were to determine the potential buildable areas in this geologically complex parcel. Prepared a detailed aerial photo-based fault and surficial geology map. Three parallel exploratory trenches were excavated across the site perpendicular to the trend of the faults for a total distance of 733m. A detailed fault map was created based on the fault locations observed in the trenches and air photos. Other geologic hazards were also addressed including: rockfall, debris flow and set-back from steep slopes.
- Conducted a fault investigation for a subdivision approved in the mid-1970's based on work performed by another consultant. The previous work was questioned by the County Geologist because no subsurface exploration was performed to accurately locate the faults. A 22m long exploratory trench was excavated through about 2.5m of Holocene fill and alluvium into Pleistocene sediments. No evidence of faulting was observed, however deformation at the east end of the trench (at the base of the suspected 15m high fault scarp) displayed evidence of drag deformation. A slope stability analysis was performed to determine an appropriate building set-back distance from the base of the slope, should the slope fail during a rupture event.
- This fault study was prepared for a large addition to an industrial building located about 100m northeast of the Granger Fault in the West Valley Fault Zone. Because of the shallow groundwater (about 1.5m) and the amount of fill on the site it was doubtful that any meaningful information would be gained from exploratory trenching. Given these factors and the distance from the proposed structure to the surficial expression of the scarp in the air photo mapping, I was successful in lobbying for development of the site without subsurface exploration.

Geologic Hazards - Debris Flow/Sediment Yield

- Evaluation of debris flow potential and recommendations for emergency watershed protection following the September 1988 Affleck Park wild fire which burned over 5600 acres (22.7 km²) across several drainages in "suburbanized" Emigration Canyon, Utah. Analysis of the burned drainage indicated a 700 percent increase in potential sediment yield over the pre-fire conditions. Based on the recommendations of this study an emergency watershed restoration project was initiated to help mitigate erosion hazards. Erosion control structures consisting of 24 gabion baskets and 84 wire silt fences were installed across the upland slopes and a debris basin was constructed at the base of one major intermittent channel. The following spring a localized, intense rainstorm (estimated to be in excess of the 100 year event) triggered a large mobilization of sediment across a portion of the not-yet-revegetated burn area. Silt fences and gabions helped collect sediment and reduce peak debris flow volumes (although the force of the flows toppled several of the gabion structures). Two homes near the base of one drainage suffered some mud-related basement damage. The debris-basin protected drainage was not impacted by the localized storm. Estimates of the debris generated closely matched the predicted sediment yield for a post-fire event.
- A 6-lot Planned Unit Development (PUD) located within a steep drainage on the northern slope of Mt. Olympus, near Salt Lake City, Utah may be subject to periodic storm flooding and debris flow deposition. The purpose of this study was to determine the risk to the proposed homes from these hazards and to quantify the flow rates for three scenarios: 1) runoff confined to pre-existing drainage channels, 2) runoff as pure sheet flow, and 3) a combination of sheetflow and channel flow. Runoff rates were calculated using the SCS runoff model for 24 hour duration storms with return periods of 2, 10, and 24 years and precipitation of 45, 65, and 94mm respectively. Recommendations were provided for locating the building pads and grading to minimize the risks from storm water and debris.

- An engineering geology report was required the Pleasant View (Utah) City Engineer prior to development of an approximately 200 acre hillside north of Ogden, Utah. The site was located near the apex of an active alluvial fan at the mouth of an intermittent stream drainage. City ordinance required that the runoff from the 10- year storm be addressed. An analysis was performed on the drainage basin to determine the channel size requirements for both the 10 and 100 year storm and associated debris flow events. A probability risk assessment was also provided to help characterize the large-scale debris flow return interval and relative risk to the site.
- Conducted a debris flow hazard assessment for a proposed residential subdivision and golf course in Carbondale, Colorado. Developed a debris flow model based on evidence from prehistoric debris flows observed in alluvial fan test pits and evidence from a large historic debris flood/flow. Provided recommendations for hazard avoidance and reduction.

Mining and Underground Openings

- Served as project geologist on over twenty mining engineering projects including: highwall slope stability analysis; subsidence evaluation; pilot shaft evaluation; portal and main entry stability analyses; ground control assessment; and geotechnical logging/testing studies.

Corridor and Transportation Projects

- Project geologist conducting the geologic hazards analysis for the Independent Review of the Yellowstone Pipeline on Lolo National Forest in Montana and Idaho. Prepared a reconnaissance-level geologic hazards characterization of the pipeline corridor for hazards including: surface fault rupture, liquefaction, seismic ground acceleration, landslide, debris flow, rock fall, avalanche, and other hazards such as acid ground water corrosion.
- Project manager for the geotechnical exploration, testing, analysis and preliminary design recommendations for roadway embankment settlement, bridge abutments, pile design, and retaining walls for the redesign of the complex I-15/I-80 Junction at 2400 South in Salt Lake County. This major reconstruction project involved exploration of over 200 borings and CPT soundings, many in areas of soil and groundwater contamination from heavy metals, hydrocarbons, PCBs, solvents, and low-level radioactive fill material.
- Project manager for exploration and analysis to provide pavement design parameters to UDOT at over 80 sites along existing and planned surface roads adjacent to the I-15 corridor.
- Project manager for geologic and geotechnical exploration of the realignment of U.S. 189 in upper Provo Canyon, Utah. This section included routing through the infamous Hoover landslide complex as well as rock cuts ranging to 75m in height. Coordinated drilling, inclinometer installation and monitoring, downhole geophysics, and soil and rock mechanics testing. Provided detailed geologic maps, cross sections, and geologic hazards analysis including discontinuity and seismic parameters for the transportation design engineers.
- Project manager for the seismic hazard analysis of the I-15 corridor through Salt Lake County. This project involved exploration of 200 and 300 foot borings for downhole shear wave velocity and gamma and EM logging; seismic source characterization; ground-motion analysis; probabilistic and deterministic seismic hazards analyses; site response analyses; and seismic design spectra for more than 50 bridge sites along the corridor.
- Project manager for the geotechnical exploration, testing, analysis and preliminary design recommendations for the redesign of the I-15 “collector” system between 800 South and 1700 South in Salt Lake City. This project involved embankment widening with retaining walls and bridge replacement and widening.

- Project manager for the geotechnical exploration, testing, analysis and preliminary design recommendations for the I-15 600 South off-ramp in Salt Lake City.
- Project manager for the I-15 Stage I geotechnical corridor investigation from 10800 South to 500 North in Salt Lake County, Utah. This project involves providing preliminary geotechnical recommendations for the roadway widening and reconstruction of structures along a 17.6 mile segment of I-15. This project provided preliminary settlement calculations for over 50 bridge sites and wick-drain analysis for embankment settlement.
- Engineering geology analysis for proposed 945m long funicular railway system for ski resort access near Provo, Utah.
- Project manager for the UDOT Stage I geotechnical investigation of the 17.6 mile-long segment of I-15 through the urban Salt Lake Corridor. This project involved CPT soundings and deep SPT borings, preliminary settlement analysis for bridge foundations and highway embankments, wick-drain analysis, and seismic microzonation of the corridor. Dames & Moore also prepared guideline manuals for subsurface, exploration, geotechnical analysis and design, and soil classification.

Professional History

Principal Engineering Geologist, Western GeoLogic, Salt Lake City, UT (2001-present)
 Operations Manager, URS Corporation, Salt Lake City, UT (2000-2001)
 Managing Principal-In-Charge, Dames & Moore, Salt Lake City, UT (1997-2000)
 Sr. Geologist - Geoscience Manager, Dames & Moore Salt Lake City, UT (1995-97)
 Sr. Engineering Geologist, Delta Geotechnical Consultants, Salt Lake City, UT (1992-95)
 County Geologist, Salt Lake County Public Works, Salt Lake City, UT (1985-92)
 Teaching and Research Assistant, Utah State University, Logan, UT (1983-85)
 Staff Engineering Geologist, Seegmiller International, Salt Lake City, UT (1981-83)

Professional Affiliations

Board Member and Chair, Utah Geological Survey (1997-2005)
 Member, University of Utah Geological Engineering Advisory Board (2004-present)
 Member, Utah State University Dept. of Geology Advisory Board (2004-present)
 Member, Utah Geologic Association
 Member, Salt Lake School District Seismic Committee, (1989-1992)
 Member, Geological Review Committee, Nuclear Repository Waste Siting Study, Davis/Lavender Canyons, Utah (1982-1983)

Professional Awards

American Planning Association, *1991 Award of Merit* in recognition of achievement in information technology made to the state of Utah for the Earthquake Awareness and Hazard Mitigation Video.
 American Planning Association: *1990 Award of Merit* for development of Salt Lake County's Natural Hazards Ordinance.
 U.S. Geological Survey: *1989 Certificate of Appreciation* for implementation of measures to reduce losses due to earthquakes in Utah.

Citizenship

United States

Countries Worked In

United States, Canada, Jamaica

Language Proficiency

English

Partial List of Publications

Batatian, L.D., Christenson, G.E., and Nelson, C.V., 2003, Guidelines for Evaluating Surface-Fault Rupture Hazard Studies in Utah: Utah Geological Survey Miscellaneous Publication 03-6, 14p.

Batatian, L.D. and Nelson, C.V., 2002, Salt Lake County Natural Hazards Ordinance, Chapter 19.75 of the Salt Lake County Zoning Ordinance.

Batatian, L.D. and Nelson, C.V., 1999, Fault setback requirements to reduce fault rupture hazards in Salt Lake County: Association of Engineering Geologists Program with Abstracts, 42nd Annual Meeting, p. 59.

Nelson, C.V., Brink, J.D., Heppler, Leslie, Braceras, Carlos, Bishoff, Jon, and Brown Keith, 1997, Interpretation of late-Pleistocene and Holocene stratigraphy and depositional environments in the Salt Lake Valley, Utah using borehole logs and cone penetrometer soundings: Geological Society of America Abstracts with Programs, vol. 29, no. 6, p. 56.

Nelson, C.V., Sakai, S., and Gunalan, K.N., Evaluating soil strength gain due to embankment loading - A case study from the I-15 Corridor reconstruction project, Salt Lake County, Utah: Proceedings of the 32nd Symposium on Engineering Geology and Geotechnical Engineering - March 26-28, 1997, Boise, Idaho, in press.

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Nelson, C.V., 1995, Rockfall hazard risk assessment and probability - A Case Study, Ogden Canyon, Utah: Environmental and Engineering Geology of the Wasatch Front Region, Utah Geological Association Publication 24, p. 157-160.

Nelson, C.V., 1995, Rockfall hazard probabilistic risk analysis, A case study, Ogden Canyon, Utah: Geological Society of America Abstracts With Programs, Vol. 27, No.4, p. 49.

Nelson, C.V., 1993, Rockfall hazards: A guide for land-use planning, Salt Lake County, Utah: U.S. Geological Survey Professional Paper 1519, p. 138-142.

Nelson, C.V., and Christenson, G.E., 1992, Establishing Guidelines for Surface Fault Rupture Hazard Investigations - Salt Lake County, Utah: Proceedings of the Association of Engineering Geologists 35th Annual Meeting, p. 242-249.

Lowe, Mike, Nelson, C.V., Robison, R.M., and Christenson, G.E., 1991, Reducing Earthquake and Other Hazards Through Land-Use Planning, Wasatch Front, Utah: Annual Earthquake Engineering Research Institute Meeting (poster session abstract), Salt Lake City, UT, February 14-16.

Lund, W.M., Christenson, G.E., Harty, K.M., Hecker, S., Atwood, G.A., Case, W.F., Gill, H.E., Gwynn, J.W., Klauk, R.H., Mabey, D.R., Mulvey, W.E., Sprinkel, D.A., Tripp, B.T., Black, B.D., and Nelson, C.V., 1990, Geology of Salt Lake City, Utah, United States of America: Association of Engineering Geologists Bulletin, Vol. 27, No. 4, p. 391-478.

Nelson, C.V., and Raseley, R.C., 1990, Estimating Sediment Yield and Implementing Erosion-Control Mitigation Measures Following A Wild Fire Event, The Affleck Park Fire Case: Utah Non-Point Source Water Quality Conference Abstracts, p. 3.

Madsen, G.E., Anderson L.R., and Nelson, C.V., 1990, The Uses of Opinion Surveys in Earthquake Risk Reduction Programs in Utah: Presented at the Earthquake Engineering Research Institute Meeting, Palm Springs, California.

Nelson, C.V., and Raseley, R.C., 1990, Debris Flow Potential and Sediment Yield Analysis Following Wild Fire Events in Mountainous Terrain: Proceedings of the American Society of Civil Engineers International Symposium on the Hydraulics/Hydrology of Arid Lands, p. 54-59.

Madsen, G.E., Anderson, L.R., Barnes, J.H., and Nelson, C.V., 1989, Earthquake Risk and Defensive Policies as perceived by Community Leaders and the Public: Report to the Utah Council on Intergovernmental Relations, Second Annual Summit Conference, August 25, 1989, Salt Lake City, UT, 15p.

Nelson, C.V., 1989, Rock Fall Hazards, A Guide to Land Use Planning: Salt Lake County, Utah: U.S. Geological Survey Open-File Report 90-225, p. II-1 - II-15.

Nelson, C.V., 1989, Geologic Hazard Maps for Land Use Planning and Development, The Special Study Area Approach, Salt Lake County, Utah: Geological Society of America Abstracts With Programs, Vol. 21, No. 6, p. A-19.

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Nelson, C.V., 1988, Preparation and Use of Earthquake Ground Shaking and Rock Fall Hazard Maps, Wasatch Front, Utah: Geological Society of America Abstracts with Programs, Vol. 20, No. 6, p. 459.

Nelson, C.V., 1988, Dresden Lane Fault Investigation: Utah Geological & Mineral Survey Report of Investigations No. 218, p. 129-131.

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Barnes, J.H., and Nelson, C.V., 1988, Natural Hazards Ordinance: Salt Lake County Code of Ordinances, Chapter 19.75, Book Publishing Company, Seattle, WA, p. 671-673.

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Nelson, C.V., Christenson, G.E., Lowe, Mike, and Robison, R.M., 1987, The Review Process and Adequacy of Engineering Geologic Reports Wasatch Front, Utah, in McCalpin, James, (ed.), Proceedings of the 23rd Annual Symposium on Engineering Geology and Soils Engineering: Utah State University, April 6-8, 1987, p. 83-85.

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