

Richard Thiel

Richard Thiel, P. E., the founder and president of our company, Thiel Engineering, has over thirty years of engineering experience, primarily focused in containment design applications for geotechnical projects, waste containment, secondary containment of fuel, and leach mining applications. Mr. Thiel also has extensive experience in feasibility evaluation, permitting, and design and construction of waste facilities and surface impoundments. Before specializing in containment system design, Mr. Thiel participated in the design of several large rock-fill, clay-core dams.

His professional involvement includes these services:

- testifying as an expert witness
- peer-reviewing designs
- conducting economic evaluations
- performing failure analyses
- designing containment liner systems with soils, geosynthetics, piping, and ancillary facilities
- evaluating and designing liquid and leachate management systems including pump stations, pipe lines, bioreactor programs, storage ponds, tanks, and treatment systems
- carrying out geotechnical site reconnaissance and resource investigations as well as construction quality assurance (CQA)
- geotechnical engineering for slope stability, settlement, and foundation design
- permitting and assisting in developing containment systems regulations for waste and other regulated materials.

Design, Construction, and Project-Management Experience

Recognized national expert for fueling depot secondary containment lining systems for BNSF railroad, tasked with providing design review services and CQA services directly to BNSF as well as to its general civil consulting engineers on dozens of facilities nationwide from 2007 to the present. Conducted 59 construction inspections on projects lasting anywhere from one day to 3 months at sites located in 19 different states.

Project manager, designer, and construction certifying engineer for new composite-lined landfill cells at the Cowlitz County Headquarters landfill. Projects included additional geotechnical and hydrogeological site characterization, excavations and earthfills, hydraulic gradient control underdrain, composite liner and leachate collection systems, overliner landfill gas collection and header piping, storm water runoff and runoff controls, concrete channel and bridges, road infrastructure upgrades; 3 ac Cell 6A (summer 2014); 6 ac Cell 6B (fall 2014); 13 ac Cell 7 (2015).

Engineer for Preliminary Engineering and Design Report (2012) for new 16-mile long 8-inch diameter leachate force main and pump station. Performed hydraulic analyses, pump selection, pump station design, pipeline alignment and profile design, and preliminary construction cost estimate to transfer leachate from Headquarters Landfill to the POTW in Kelso, Washington. Work included evaluations of alternative alignments, preliminary evaluation of soils and geologic hazards, evaluation of methods of construction, cost estimates, and support for SEPA process. Provided engineering quality control review for final design in 2013. Pipeline had successful construction and startup in accordance with the preliminary design and cost estimate in March 2015.

Engineer for new master plan and re-permitting to change Weyerhaeuser regional forest-products industrial landfill in SW Washington to regional county-owned MSW (Municipal Solid Waste) landfill. Work included coordinating with SEPA requirements, revising engineering report including slope stability analyses and alternative liner demonstration, estimating development costs, and following closure and post-closure procedure. Permitting and preliminary engineering work occurred from 2011 to 2013.

Lead consulting engineer for Headquarters Solid Waste Landfill in Cowlitz County, Washington for 25 years (1990-2015). Project manager for the original siting, permitting, design, and construction of this large complex pulp sludge and inert waste landfill and infrastructure for the Weyerhaeuser Company in southwest Washington. The project required more than twenty permits and four years to complete the initial infrastructure. Significant features included the following: a comprehensive siting study that evaluated over 35 sites in a thirty-mile radius; public opposition issues; highly variable volcanic soil conditions; geotechnical challenges related to slope stability and seismic issues; a complex groundwater regime; the need for a rail facility for waste unloading and leachate loading; a three-acre double-lined leachate lagoon with gravity loading to rail cars; a 320-acre landfill footprint comprising a complete underdrain system and innovative composite liner and leachate collection system; large storm water control structures; ten acres of created wetlands; new off-channel fish ponds; and a stream relocation with the creation of 1,500 feet of fish channel habitat. The landfill is being constructed in incremental cells and the site has a life of over 100 years. The planned capacity is 50 million cubic yards. Subsequent to leading all engineering aspects of the initial siting and permitting that culminated in 1993, Richard provided the following services for Weyerhaeuser Company:

- Project manager and engineer of record, and full-time construction resident engineer, for initial \$10 million construction project that included the first 18-acre Cell 1 and ancillary landfill infrastructure at the site (1993).
- Design engineer and certifying construction engineer for 4-acre composite landfill liner expansion (Cell 2B) at the Weyerhaeuser Regional Landfill in western Washington (2000).
- Design engineer and certifying construction engineer for 9-acre landfill closure of the west slope of Cell 1 (2002).

- Design and construction certifying engineer for geotechnical investigation and construction of 11-acre composite liner for Cell 3 (2003).
- Design and construction certifying engineer for construction of 4-acre composite liner for Cell 4 (2003).
- Design and construction certifying engineer for construction of 10.1-acre composite liner for Cell 5 (2008-2011).
- Continuous consultations for site operational and design issues over this period, transitioning to work with Cowlitz County at this site in the period of 2011-2013 (described previously).

Lead consulting engineer for Lane County Solid Waste Management division of Public Works Department over a 12 year period from 2003-2015. During this period services for their main Short Mountain Landfill site included: preparation of annual opinions of cost for landfill closure and thirty-year post-closure period; design of new 1.3 MM gallon leachate holding tank, new pump station, and integrated piping infrastructure (2013-2015); permitting, design and construction management for 9 acre piggyback liner system for Phase V-B (2014-15); permitting and design for 17 acre closure of Phase III landfill (2009); permitting, design and construction management for 17 acre double-lined Phase V landfill cell and pump station (2006-2007); permitting, design and construction management for 19 acre closure of Phase I/II landfill using innovative 2-season construction approach (2006-2007); preparation of new master plan (2006); assistance with trial testing of reverse-osmosis leachate treatment plant including residuals management and resolution of contractual issues related to that system (2003-2014). In addition, coordinated ground water monitoring, landfill gas systems, annual volume estimates for waste and leachate, leachate management planning, and construction services for the County's active and closed landfill facilities around Lane County (2003-2015).

Solid waste engineering consultant for the Coffin Butte Regional Landfill in Benton County, Oregon for 20 years from 1995 to 2014. Served to plan, permit, design, and provide construction services for six new double-lined landfill cells, five landfill closures, two new double-lined leachate ponds, two floating covers and one inflated cover for leachate ponds, one leachate evaporation system, four leachate pump stations and associated force-mains, new master plan and master-plan updates, stormwater management plans and design, and geotechnical analyses for all of the above. Manager of fast-track permitting, design, and construction, and CQA of old leachate pond embankment raise with a composite liner during the floods of 1996.

Project manager for selection, procurement, permitting, and installation of state-of-the-art direct-osmosis leachate management system at the Coffin Butte landfill. This multi-million dollar project began in 1995 with a review of over twenty leachate treatment options, followed by four field-scale pilot plant studies. Final project included an 8,000 sq. ft. building underlain by a liner and leak detection system, four-million gallon double-lined

surge pond, and first-of-its-kind inflatable cover over the surge pond to keep out rain water. (1995-1999)

Reviewer of final cover system design and construction for closure of Monsanto Blackfoot Bridge phosphate mine tailings in Idaho. (2013-2015)

Reviewer of slope stability for 140-acre, 420-foot high silver/gold heap on composite liner system in Nevada. (2013)

Expert design peer review and construction certifying engineer for 150-acre valley-style heap-leach pad for Carlota Copper Company in Miami, AZ. Project review and CQA involved composite GCL and 80-mil LLDPE liner over 150 acres, double liner with leak detection system over 15 acres, two double-lined ponds, 90-million gallon double-lined containment pond, HDPE lining of concrete tanks for the SX/EW process solutions, and storm-water improvements for contact- and non-contact waters (2008-2011). Consulted on site closure options (2013).

Design engineer for water-balance final cover, including silva-culture considerations, for old forest products landfill in NW Washington; project permitting in 2013-15 with construction slated for 2016.

Engineer for development of proprietary under-slab methane collection system for construction around the City of Los Angeles. (2013)

Reviewer of master-plan layout for new Waste Management Facility (WMF) on Grand Cayman Island. Thiel Engineering's master-plan suggestions were accepted for moving forward with the project, and Thiel Engineering provided support to the EIS process. (2012-2013)

Provider of engineering design drawings for secondary leak detection and collection system below concrete roll-off container pads used below public dumping Z-walls; also provided construction design and specifications for storm-water pump station and force main to transfer storm-water collected from these pads to the leachate ponds. (2012)

Provider of CQA services for landfill liner installation in Vietnam. (2012)

Engineer of record for engineering design and operations plan to permit two double-lined ponds in McKinley, New Mexico for the temporary storage and evaporation of by-product waste water from a proposed facility that uses in-situ leaching for the extraction of uranium. The liquids to be contained in the ponds would be the concentrate from reverse-osmosis filtration units. The design consisted of two double-lined HDPE ponds, about three acres each (nominally 10 million gallons capacity each, plus 3 ft freeboard), with incorporation of perimeter-mounted liquid atomizers to enhance evaporation. The ponds were designed with

special provisions to be constructed over soils that could potentially collapse when saturated. (2009)

Engineer for preparation of landfill master plan, design engineer for ACAP (Alternative Covers Assessment Program) for existing landfill, and design engineer for construction drawings for first cell of new landfill Phase 1&2 for Johnson County in Wyoming near Buffalo, Wyoming. Project contract documents and designs were prepared in 2010-2014, and construction services provided in 2014-2015.

Expert reviewer for lining and monofilling of wastewater treatment ponds and solids at the City of Portland's Triangle Lake Wastewater Treatment Plant in northeast Portland, OR as subconsultant to Brown & Caldwell (2010-2015). CQA Certifying Engineer for lining sludge monofill for this project (2013).

Engineer for ACAP permitting for MSW for Waste Management landfill in Spokane, Washington. (2011)

Design reviewer of final cover system and CQA services for geosynthetics installation, on Alcoa triple-lined landfill in Ferndale, Washington. (2011) Provided construction inspection services for remediation of double-lined anchor trenches at this facility in 2014 and again in 2015.

Provider of construction drawings and specifications for final cover construction of landfill in Wamsutter, WY. (2011)

Provider of expert review and opinion, in conjunction with Dr. Ed Kavazanjian, on controversial final cover project for Tullamarine hazardous waste landfill in Melbourne, Australia. (2011)

Expert witness for litigation of geotechnical aspects of C&D landfill reclamation project in New Mexico. (2010-13)

Certifying engineer for CDF (confined disposal facility) pond liners on Superfund project for the Spring Creek Sediment project near Redding, CA; worked as first-tier contractor under CH2M Hill; provided design review recommendations, construction CQA, and final certification. (2009)

Expert for Defendant in preparation of litigation for failed wastewater treatment pond liner in Idaho. (2010)

Provider expert liner inspection and construction services for leaking underground drinking water reservoir lined with RPP in Fortuna, CA. (2010)

Construction certifying engineer and peer reviewer for six large (75-acre each) lined tertiary treated-water storage ponds for the Los Angeles County Sanitation Districts. The projects, located in the cities of Lancaster and Palmdale, CA involved approximately 3 million cubic yards of embankment, 450 acres of 60- and 80-mil HDPE geomembrane installation, large pipe penetrations, and soil-cement armoring. (2007-2010)

Project manager for water-balance alternative cover to be permitted in central Washington Wenatchee landfill for Waste Management in 2009; tasks involved soil resource investigation, laboratory testing of soil-water characteristics, water-balance modeling, and design and CQA reports for regulatory approval. (2009)

Project manager for aerated-static-pile compost facility design and permitting for Valley Landfills near Corvallis, Oregon. (2009)

Designer for lined salt dissolution pads and retaining walls for chlorine-production plant in Longview, WA. (2009)

Expert peer reviewer for a superfund landfill closure design of a Weyerhaeuser landfill in Kalamazoo, Michigan. (2008)

Provider of expert testimony on liner systems for a public hearing for a landfill expansion in McMinville, Oregon. (2008)

Engineer for geotechnical investigation and foundation recommendations for gas-to-energy plant at a landfill in eastern Oregon. (2008)

Certifying engineer-of-record for CQA of four-acre composite liner expansion for a landfill for Waste Management near Spokane, Washington. (2008)

Developer of landfill master plan for Park County in Wyoming for an existing landfill site near Cody, Wyoming. (2008)

Provided expert geotechnical services for S2Li consultants for Florida landfill developments. Projects included: Geotechnical investigation, settlement calculations, and stability analyses for a new landfill in Brevard County, Florida (2008-2010); settlement calculations, stability analyses, detailed responses to regulatory review, and legal testimony for Cedar Trails landfill expansion (2006-2010); slope stability analyses for Gulf Coast Landfill (2006).

Developer of preliminary grading and liner system design for a 500-acre system of evaporation ponds for a potash mine in New Mexico. (2008)

Construction certifying engineer for CQA of five double-lined evaporation ponds for oil-and-gas production water in LaBarge, Wyoming: 7-ac Cell 5 pond (2005); 6-ac Cell 6 pond (2006); 10-ac Cell 7 pond (2006); 16-ac Cell 8 pond (2006); 14-ac Cell 9 pond (2008).

Performer of due diligence evaluation of open sand-and-gravel pit being used as a C&D landfill for potential purchaser. (2007)

CQA and certifying engineer of record at Columbia Ridge Regional Landfill in Arlington, Oregon for several of their landfill cells and closures as follows: 16-acre composite liner expansion for Module 12 (2007); 33-acre Arlington Landfill Alternative Final Cover System (evapo-transpiration cover, (2006); Module 11 composite liner (2005); 10-acre landfill cells Module 9A (2002) and Module 9B/10 (2003). Designer of re-lining system for leachate evaporation pond (2005).

Certifying CQA engineer of record at Chemical Waste Management site near Arlington, Oregon for double-composite liner for 4-ac L-14 Cell 3 hazardous landfill (2011), 4-ac L-14 Cell 2 hazardous landfill (2005), 7-ac L-14 Cell 1 hazardous landfill (2003), 6-ac closure for hazardous waste landfill L-10, 7-ac new cell for haz-waste landfill L-14 Cell 1 (2003). Engineer for permitting of increased slopes and final cover design for three of the site's hazardous waste landfills.

Design engineer for master plan and closure plan update for landfill in Missoula, Montana. (2006). Design engineer for 5-acre composite lined landfill expansion in Missoula, Montana. (2005) Design engineer new 10-acre composite lined landfill in Missoula, Montana. (2004)

Peer reviewer and 2005 certifying construction engineer for Los Angeles County Sanitation Districts Calabasas North Ridge Phase 1 Liner System; reviewed plans and specifications and acted as CQA project manager and certifying engineer for 22-acre expansion in conjunction with Vector Engineering; also performed same certifying engineer function for the 18-acre expansion at this site in 2006 and again in 2008.

Certifying construction engineer for the North Marion County Disposal Facility Cell 3 closure near Salem, Oregon. (2005) Certifying CQA engineer of record for six-acre double-lined ash monofill utilizing encapsulated GCL and electric leak detection in Marion County, Oregon. (2002) Geosynthetics design expert to achieve alternate GCL liner design approval for Marion County, Oregon ash monofill. (2001)

Design engineer and permitting of leachate land application and leachate re-introduction to landfill for Crook County landfill site near Prineville, Oregon. (2005) Design and construction certifying engineer for 10-acre composite liner landfill expansion for Crook County near Prineville, Oregon. (2003)

Designer, CQA and certifying engineer of record at Roosevelt Regional Landfill (now part of Republic Services) in Roosevelt, WA for several of their landfill cells and closures as follows: Design engineer for 20-acre landfill cell (Area 12 - 2004); design and construction certifying engineer for 20-acre composite landfill liner and 3-acre double-lined ash monofill cell (Area 11 and Ash Stage G - 2003); design engineer and certifying construction engineer for 20-acre composite landfill liner expansion (Area 10 - 2002); design engineer and certifying construction engineer for 20-acre composite landfill liner expansion and double-lined ash monofill (Area 9 and Ash Stage F1 - 2001); design engineer and certifying construction engineer for 20-acre composite landfill liner expansion (Area 8 - 2000); CQA engineer of record for 15-acre composite landfill liner expansion (Area 7 - 1999). Also assisted with EIS for expansion of this site (2002) and permitting of use of GCL in lieu of compacted clay liner (2002-03)

Design and construction certifying engineer for closure of Pope & Talbot wood-waste landfill near Oakridge, Oregon. (2001 and 2003)

Design peer reviewer and construction certifying engineer for Los Angeles County Sanitation Districts, Puente Hills Phase-5 liner system, a 20-acre expansion consisting mostly of 1.5:1 slopes and narrow benches, having an encapsulated GCL liner design, and costing \$7.5 million. (2003)

Expert consultant and provider of sealed calculations regarding slope stability for double-liner landfill expansion utilizing encapsulated GundSeal for Brunner landfill site near Zelionople, Pennsylvania. (2002)

Certifying CQA engineer of record for 4-acre landfill Phase IV Cell 2 expansion at the Wasco Landfill in The Dalles, Oregon using GCL composite liner. (2002) Certifying CQA engineer of record for 5-acre landfill Phase IV Cell 1 expansion in The Dalles, Oregon using GCL composite liner, including 3 acres double-lined with leak detection that was verified using electric leak location techniques. (completed July 2001) CQA engineer of record for clay-composite landfill liner expansion at the Wasco Landfill in The Dalles, Oregon. (Phase IIIC - 1999).

Reviewer of closure and post-closure costs for Short Mountain Landfill in Lane County, Oregon. (2001)

On-going peer-reviewer for engineering firms in California, Oregon, and Washington (1995-2001).

Certifying engineer-of-record for closure construction of two MSW landfill sites in Lassen Co., California. (2002)

Design and construction engineer for repair of leaking pond liner in Classical Chinese Garden, Portland, Oregon. (2001-02)

Lead author of *Gundseal Design Manual*, the most comprehensive guide in the industry for designing with GCL liners; co-authors included Dr. Dave Daniel, Mr. Richard Erickson, Dr. Ed Kavazanjian, and Dr. J.P. Giroud. (Published in September 2001).

Geosynthetics design expert and engineer of record to perform hydraulic and slope stability calculations to achieve design approval for alternative GCL double-liner system for two landfills in Pennsylvania. (2001)

Geosynthetic expert subconsultant to design exposed geomembrane cover for two Yolo County experimental bioreactor cells. (2001)

Geosynthetics expert consultant providing design for slope stability analyses and material specifications and directing construction materials acceptance testing for the Dry Creek Landfill near Medford, OR for Cells 3-6 construction (1999-2013). Provider of slope stability analysis and review for proposed revised landfill master plan expansion at the Dry Creek Landfill in Medford, Oregon. (2000-2015)

Expert witness for dispute resolution regarding multi-million square foot cover installation for site remediation in Idaho; issues involved geomembrane wrinkle management and allowable defects. (2000)

Project manager for public recycling facility at the Gaffin Road transfer station in east Salem, Oregon. Project included nine-foot high geosynthetic reinforced soil retaining wall for public tipping. (1999)

Expert peer reviewer for final closure design and construction of the Cowlitz County landfill in southwestern Washington. (1999)

Expert witness for two confidential projects involving failures associated with geomembrane liners. (1998 and 1999)

Expert peer reviewer for geosynthetic composite liner design and stability for a large canyon landfill incorporating 1.5:1 side slopes over 100 feet high in Ventura County, California at the Toland Road landfill. (1999)

Director of an audit of a new geomembrane manufacturing line for two major national solid waste companies.

Preparer of pro-forma economic analysis for consideration of a new landfill near I-5 for Waste Control Systems, Inc. in western Oregon.

Preparer of pro-forma economic analysis for consideration of a new landfill for Weyerhaeuser in North Bend, Oregon; prepared new landfill design and permit application package for the DEQ; engineer of record during construction of the first 3-acre Cell 3A in 1997 and the second 3-acre Cell 3B in 1999. Evaluator of closure options for this facility (1999). Consultant for final closure and abandonment of sludge ponds and the landfill for Weyerhaeuser paper mill shut-down in North Bend, Oregon. (2004)

Provider of expert sub-consultant services for liner and underdrain design at the BFI Keller Canyon facility in California.

Geosynthetics and slope stability subconsultant to EMCON for the City of Willits landfill closure design. Design involved innovative PVC/geotextile composite covered by exposed coarse rock on slopes as steep as 2:1. Special design precautions were developed against the effect of gas pressures on the slope stability. (1995-1996)

Expert consultant and witness for United Waste Systems related to large-scale landfill cover slope stability failure in the Midwest; responsibilities included determination of cause of failure and the proposal and review of remedial solutions.

Preparer of rock quarry master plan and reclamation permitting for S2F Corporation of Albany, Oregon. The rock quarry end use is anticipated to be a landfill.

Peer review and economic evaluator of landfill design for Rogue Waste Systems, Inc. in southern Oregon.

Expert peer reviewer of landfill designs for regional Minnesota engineering firm (Wenck Associates).

Expert peer reviewer for United Waste Systems, Inc.; peer reviews were primarily related to five different landfill cover and bottom liner designs prepared by other consultants.

Provider of expert technical and economic evaluation of numerous alternative liner designs for large Bay Area canyon landfill (BFI Corinda Los Trancos), especially with regard to geosynthetic clay liners (GCLs) in lieu of the prescriptive compacted clay composite; work involved orchestrating product development and testing for several manufacturers.

Project manager for new cell design for Chiquita Canyon Landfill near Los Angeles, California; project involved construction plans, specifications, and construction quality assurance manual. This was one of the first projects in California to use a GCL in the full base liner as a Subtitle D alternative.

Client director for several Sanifill projects over an eighteen-month period for two landfills in Oregon (Hillsboro and Northern Wasco); directed activities related to permitting, final

design, and construction. Projects included land use (support role) and wetlands permitting (support role), new cell permitting, two new cell designs, final cover design, operations plans, and CQA.

Designer and peer reviewer for composite liner and subdrain system construction drawings and specifications for Ox Mountain Landfill near San Francisco, California; project elements included designing amended soil, geomembrane composite liner on 2:1 slopes, and underdrain system for side-slope seeps.

Project advisor for GCL liner design for Kiefer Landfill (two consecutive years of construction).

Project manager and lead engineer for unique landfill closure for Louisiana Pacific. Design for this Ukiah, California site converted closed landfill into a vineyard. Technical justification was provided by a closed-loop groundwater interception pond and slurry wall where the groundwater was used for vineyard irrigation during the summer.

Project manager and engineer of record for design and construction of 37-acre landfill closure for Cowlitz County, Washington; project utilized first-of-its-kind 60-mil very low density polyethylene geomembrane with a co-extruded 6-mil white veneer.

Lead project engineer for the design of the Columbia Ridge Regional Landfill and Leachate Evaporation Pond near Arlington, Oregon. Evaluated geotechnical resources and stability; designed the landfill composite liner and leachate evaporation pond; prepared the engineers' cost estimate; supervised project geotechnicians, project specifications, and site permitting; conducted field test fills; and authored design reports. Resident engineer during construction of the \$2 million Module 1 landfill composite liner and leachate evaporation pond at the Columbia Ridge Regional Landfill.

Engineering task manager for the design and construction of an eight-acre partial landfill closure for Cell 1 Phase 1 at the Coffin Butte Regional Landfill near Corvallis, Oregon. (1991)

Project manager for evaluation of postclosure monitoring and maintenance program for a closed fifteen-acre landfill in Yamhill County, Oregon. Issues included landfill gas, cover vegetation, side slope seeps, storm water control, and ground and surface water monitoring.

Design reviewer for 190-acre St. Johns Landfill cover reclamation plan in Portland, Oregon; work involved evaluating impacts of proposed vegetation on the cover design. Design suggestions were made that saved METRO about \$2.5 million in construction costs.

Lead project engineer for permitting design drawings for two major hazardous waste landfills in central California. Designs included double composite base liners, a leachate collection and removal system, leak detection systems, and composite-cover lining systems.

Preparer of permit engineering drawings for three one-acre hazardous waste surface impoundments for Chemical Waste Management in central California, featuring a triple-lining system consisting of bottom and top composite liners with an intermediate synthetic liner.

Project manager for economic evaluation, preliminary design, and permitting for a new county landfill in Clatsop County, Oregon; work included projecting tipping rates over a twenty-year period. Design included an innovative liner system that set an alternate regulatory standard in western Oregon.

Project manager for feasibility evaluation of a single-purpose, composite-lined landfill to take wastes from a magazine recycling paper mill in western-central Oregon; prepared preliminary design alternatives and life-cycle cost estimates spanning the entire project, from permitting through postclosure care.

Project manager for landfill development, operations, and closure plans for the Coos County, Oregon ash monofill.

Project manager for structural design of a 3,000 sq. ft. transfer station near Raymond, Washington; designed eighteen-foot high concrete retaining wall, slabs, and drains and coordinated metal building procurement.

Project manager for geotechnical evaluation of sixteen miles of existing private "Woods" railroad; work included assessing drainage, slope stability, and landslides. (1990)

Engineer of record for construction certification of an eight-acre composite liner landfill expansion for the Cowlitz County Landfill in Washington.

Geotechnical engineer for evaluation of stability and settlement considerations for vertical expansion of a 25-acre landfill built over 200 feet of unconsolidated, saturated marine sediments; work included managing a field testing program including cone penetrometers, field vane shear testing, and extensive sampling for laboratory testing.

Project manager for the design of a municipal solid-waste compost storage facility liner for the Portland, Oregon Metropolitan Service District.

Geotechnical engineer responsible for providing foundation and retaining wall design parameters for Metro Household Hazardous Waste Facility in Oregon City, Oregon.

Lead project engineer for a process and surface water management system design at the Bohemia Lumber Company in Grass Valley, California; project included a double-lined surface impoundment, run-on control, a concrete diversion pipeline, and discharge alternatives.

Lead geotechnical engineer for a landfill investigation at Clover Flat Landfill in Napa County, California; project included field reconnaissance, rock core drilling, and laboratory testing. Performed rock slope stability analyses and assessed various liner design and construction alternatives.

Lead project engineer for the design of a synthetic-lined surface impoundment for San Diego Gas and Electric Company; project completed using computer-aided drafting and design tools.

Evaluator of cyclone efficiency for tailings sand separation at Chino mines in New Mexico.

Legal Experience

Expert forensic engineer for Plaintiff in failure of 8 acres of landfill cover that occurred during construction in state of Michigan. Provided **expert opinion and forensic engineering** analyses. (1995)

Expert for Plaintiff in mediation of failed secondary liner below chrome plating plant in Pacific Northwest. Documents review and one day of **mediation**. (1998)

Expert for Defendant in mediation of failed potable water reservoir liner in Reno area. Documents review, written expert opinion, and one day of **mediation**. (2003)

Percipient witness for Defendant in a cover slide on geosynthetics during construction. One day **deposition**. (2003)

Expert for Defendant in preparation of litigation for failed wastewater treatment pond liner in South Carolina. Documents review and full-day **deposition**. (2004)

Expert for Defendant in mediation and preparation of litigation for claim of unsatisfactory cover design for landfill. Claim was that cover did not meet seismic stability standard. Performed documents review, engineering analyses and expert report, participated in one day of **mediation**, and one day of **deposition**. (2004-05)

Expert for Defendant (contractor) in failed waste-water pond liner for winery. One day **deposition**. (2006)

Expert for Plaintiff in landfill soil cover slide in west-central California. Provided letter of expert **opinion**. (2008)

Expert for Plaintiff in earthwork construction for dairy pond; fee dispute in central California. Work involved **review and mediation assistance**. (2008)

Expert for Defendant (contractor) of failed landfill liner slope in Montana. Work involved mediation of dispute and resolution through expert review of design and testing and **expert opinion**. (2008)

Expert for Defendant in Florida landfill permitting. Provided courtroom expert **testimony** regarding landfill stability for permit expansion application. (2010)

Expert for Plaintiff, a municipal Idaho wastewater treatment plant, related to failed wastewater treatment liner system. (2010-11)

Expert for Defendant (engineer) regarding disputed standard of care regarding soil reclamation from C&D site in a western state; work involved field investigation, development of **expert opinions**, and preparation for deposition. (2010-12)

Education

M.S., Civil Engineering (emphasis in geomechanics), University of Wisconsin, Milwaukee
B.S., Civil Engineering (emphasis in structural and geotechnical subjects), University of Wisconsin, Milwaukee

Extensive participation in short courses and conferences over entire career.

Professional Registrations and Affiliations

Registered Professional Civil Engineer in California, Oregon, Washington, Wyoming, New Mexico, and Arizona (expired registrations in Pennsylvania, Kansas, Montana, and Florida)

Registered Geotechnical Engineer in Oregon

American Society of Civil Engineers (and the associated Geo-Institute)

American Society for Testing and Materials (member of committee D35)

North American Geosynthetics Society

International Geosynthetics Society

Conferences and Teaching Courses

Instructor Experience

Instructor for the ASCE short course on Design of Waste Containment Liner and Final Cover Systems (2001-2012) presented 2-4 times per year at major cities across the nation.

Engaged by the California State Water Resources Control Board in 2015 to develop training course curriculum and to provide Geosynthetic Liner and Cover Design training services to Water Board staff for up to two years.

Instructor, 2015, one-day course at IFAI “Geosynthetics 2015” Conference in February 15, 2015, Portland, Oregon. Course subject: *Design of Waste Containment Liner and Final Closure Systems*.

Instructor, 2014, two-day course on landfill liner and cover system design, taught in conjunction with TRI Laboratories, in Sao Paulo, Brazil, May 28-29.

Instructor, 2013, one-day course at IFAI “Geosynthetics 2013” Conference in April 2013, Long Beach, California. Course subject: *Design of Waste Containment Systems*.

Instructor, 2012, half-day course at Geoamericas Conference in Lima, Peru (on behalf of CETCO) May 2012; also member of GM Seam discussion lead by Ian Peggs.

Instructor, 2011, half-day course for the Landfill Interest Group in South Africa, October 2011, Durban, South Africa. Course subject: *Slope Stability of Lined Containment Systems*.

Instructor, 2011, one-day course at IFAI/ASCE “Geofrontiers” Conference in March 2011, Dallas, TX. Course subject: *Design of Waste Containment Systems*.

Instructor, 2010, one-day course at 9th International Conference on Geosynthetics in May 2010, Guarujá, Brazil. Course subject: *Geosynthetics in Mining*.

Instructor, 2010, half-day course at 9th International Conference on Geosynthetics in May 2010, Guarujá, Brazil. Course subject: *Slope Stability of Lined Containment Systems*.

Instructor, 2009, half-day course at IFAI Geo ’09 Conference in Salt Lake City, February 2009.

Instructor, 2008, one-day course at IFAI Geoamericas Conference in Cancun, March 2008.

Instructor, 2008, one-day course at IFAI Geosynthetics Conference in January 2008, Washington, DC. Course subject: *Design of Waste Containment Systems*.

Instructor, March 2006, one-day course at University of Nevada-Reno on *Design of Waste Containment Systems*.

Instructor, 2004, one-day course at Boise State University (0.8 CEUs) on *Design of Waste Containment Systems*.

Instructor, GSE Seminar *Geosynthetics for Advanced Solutions*, Seattle, October 2000

Instructor, GSE in-house training seminar, Spearfish, Wyoming, May 1999

Instructor, IFAI short course on *Design of Liner Systems*, Geo ’03, February 2003, Atlanta.

Instructor, CETCO *GCL University*, presented December 2003 for CETCO in-house training in Chicago; June 2004, Madison; November 2004, Sacramento; May 2006, Atlanta; May 2010, Phoenix (for DEQ); January 2011, Reno; April 2012, Washington DC, August 2012, Costa Mesa California.

Instructor, TENAX drainage course, Concord, California, November 2003; Irvine, December 2003.

Conference Positions

Technical Co-Chairman for “Geosynthetics ’97” held in Long Beach, California, March 1997.

Chairman for “Geosynthetics ’99” held in Boston, Massachusetts, April 1999.

Chairman for “Geosynthetics 2001” held in Portland, Oregon, February 2001.

On the technical organizing committees for “Geo ’07” held in Washington DC, January 2007 and “Geoamericas ’08” held in Cancun, March 2008.

Participant as Session Leader or Discussion Panel Expert at many of the conferences at which his papers were presented (see next section).

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