Richard Martin Groundwater LLC

Richard J. Martin, LHG

EDUCATION
Graduate Studies, Hydrogeology, Wright State University
BS, Geology, Wright State University, 1989

REGISTRATION
Licensed Hydrogeologist: WA, 337, 2002

PROFESSIONAL SUMMARY

With over 23 years of experience as a hydrogeologist, Richard has been involved with all aspects of hydrogeologic studies, specializing in construction dewatering and permanent drainage design, groundwater contamination and remediation, evaluation of groundwater resources, design and implementation of aquifer testing, evaluation of groundwater seepage for slope stability problems, evaluation of soil infiltration capacity for stormwater control design, and estimation of groundwater inflows to tunnels and excavations.

PROJECT EXPERIENCE

Sound Transit, Construction Management, North Link Light Rail, Seattle, WA. Richard is part of the Construction Management (CM) team for the Light Rail system to be constructed between the University Station and Northgate. He reviewed contract documents for proposed dewatering and excavation activities prior to the contract going out to bid, providing recommendations to improve specifications for bidding and allocating risk based on discussions with Sound Transit team.

Sound Transit, Construction Management, University Link Light Rail, Seattle, WA. Richard is currently part of the Construction Management (CM) team evaluating soil and groundwater conditions for the Light Rail tunnel and cross passages between University Station and Pine Street, and Capitol Hill Station. Richard evaluated the contractor's proposed dewatering design for Capitol Hill Station and provided recommendations for additional groundwater control measures and design of a temporary drainage system during buildout of the station. For each of the cross passages, Richard reviewed soil and groundwater conditions and provided the CM team with recommendations for additional explorations. For Cross Passage 5, Richard performed and evaluated a pumping test and pilot-scale dewatering test, and designed an in-tunnel vacuum well point system to drain an aquifer overlying the crown of the cross passage. For Cross Passage 17, he designed a combination passive gravity flow and vacuum well point system to control groundwater below the cross passage. He is also reviewing the contractor's design, installation, testing, and operation of a surface dewatering well system, and providing recommendations for additional groundwater control measures, excavation sequencing, and a post-construction grouting program.

Washington State Department of Transportation, Alaskan Way Viaduct/Seawall Replacement Project, Seattle, WA. Richard was Project Hydrogeologist for the Alaskan Way Viaduct/Seawall Replacement Project in Seattle, Washington. He reviewed groundwater conditions along each of the five alternative alignments as part of the Environmental Impact Statement (EIS). For preliminary design, Richard evaluated the feasibility of dewatering for a deep cut and cover structure along the waterfront that has been proposed for two of the alternatives. The dewatering evaluation also considered potential impacts

for the EIS, including dewatering induced ground settlements and the potential of contaminant migration during construction. Richard also constructed a three-dimensional groundwater flow model for the EIS to assess potential impacts to groundwater including mounding behind the finished structure, changes in groundwater discharge volumes and locations to Elliott Bay, and potential degradation of groundwater quality. Richard completed a detailed evaluation of dewatering requirements for the project, including number, location, and design of dewatering wells, the potential impact of dewatering on near surface soil subject to ground settlement, and the use of recharge wells for mitigating drawdown of the water table in shallow soil.

Washington State Department of Transportation, SR520 Floating Bridge Replacement Project, Seattle, WA. Richard was Project Hydrogeologist for the project, evaluating groundwater conditions along the project alignment. He developed a program to collect hydrogeologic data for the project including locations and depths of monitoring wells and piezometers, monthly groundwater levels to evaluate seasonal variability, and slug testing to estimate soil hydraulic parameters. Richard performed hydrogeologic analyses to evaluate numerous structures associated with the new roadway including fish passages, stormwater ponds, and retaining walls. He developed numerical groundwater flow models for the fish passages and stormwater ponds to evaluate design criteria, construction considerations, and the impact of dewatering and drainage on adjacent structures. He has also evaluated the feasibility of stormwater infiltration along the alignment and the impacts of the east approach maintenance facility on groundwater flow and discharge to Lake Washington.

US Army Corps of Engineers, Portland District, Fern Ridge Dam Repair Project, Eugene, OR. Richard was Project Hydrogeologist for this emergency repair of an earth fill dam, which included excavation and replacement of the failing drainage system. In the fall of 2004, the Corps, over concern of potential dam failure, drained the reservoir and developed plans for emergency repairs during the following dry season. Richard evaluated groundwater conditions that could impact excavation for placement of the new drainage system below the earthen dam and designed a groundwater control system using large-diameter dewatering wells to meet the requirements of the project specifications. During excavation, Richard worked closely with the contractors to facilitate installation and operation of the dewatering system so as not to delay excavation activities for this fast-track project. He closely monitored performance of the dewatering system and modified the system design based on measured groundwater levels, which allowed the contractor to reduce the total number of dewatering wells by about 30 percent. The project was successfully completed on schedule and was the largest civil-works project completed by the Corps in 2005.

Port of Tacoma, Gog-le-hi-te II Habitat Project, Tacoma, WA. Richard was Project Hydrogeologist to evaluate groundwater conditions associated with construction of this habitat restoration project along the Puyallup River in Tacoma, Washington. The project involves construction of a new levee, excavation of fill and debris, and breaching of the existing levee to create a low salinity tidal habitat area. Richard completed a dewatering analysis to estimate potential groundwater flow rates into the excavation during various tide stages and provided dewatering recommendations in the vicinity of the new levee to maintain subgrade stability during construction of the levee. He also constructed a two-dimensional computer seepage model through the existing levee to provide a basis for evaluating levee stability during excavation.

Sound Transit, Link Light Rail Beacon Hill Section, Seattle, WA. Richard was Project Hydrogeologist for the Beacon Hill project segment, which consists of about 1 mile of twin 18.9 ft diameter transit tunnels, a deep underground binocular station with twin 550-ft long by 36 ft diameter platform tunnels, multiple shafts to the station, a west portal structure beneath Interstate 5 and opening towards the downtown and an east portal structure that provides access to Rainier Valley. Richard completed a

redesign of the original dewatering system for the station and platform tunnels following the discovery of multiple water-bearing sand units near the crown of the structures and within the platform tunnel excavations. He reviewed groundwater elevation and dewatering system effectiveness on a regular basis and providing recommendations for operation and maintenance of the system. He also evaluated the effects of dewatering on groundwater conditions for the west portal structure crossing under Interstate 5 to determine impacts on column stability for the roadway.

Sound Transit, Link Light Rail Project, Seattle and Tacoma, WA. Richard was the Project Hydrogeologist for the conceptual, preliminary, and design phases of the Link Light Rail Project. The fast-track project included a 23-mile line in Seattle with multiple tunnel segments. He assessed groundwater flow conditions and aquifer parameters for the proposed tunnel alignment under First Hill, Capitol Hill, and the University District from the results of multiple pumping tests and groundwater measurements. Richard estimated potential short-term transient and long-term steady-state groundwater inflows along the tunnel alignment and for related structures including shafts and stations using analytical and numerical computer modeling techniques depending on subsurface conditions and construction methodology. He evaluated preliminary conceptual construction dewatering design for proposed stations and shafts.

Martin Selig, 333 Elliott Development, Seattle, WA. Richard was Project Hydrogeologist on this site cleanup/property development project in downtown Seattle. The property is under a consent decree with the Department of Ecology to remove creosote-contaminated soil and provide groundwater containment. Richard designed a dewatering system to allow excavation of the contaminated soil to a depth of up to 25 feet below the water table and includes perimeter vacuum-extraction well points and large-diameter dewatering wells within the excavation. To mitigate potential drawdown-induced ground settlement beneath the adjacent railroad tracks, he recommended using a water-tight secant pile shoring wall along the railroad property line with recharge wells at the ends of the wall. Because of the permitting challenges and costs associated with disposal of dewatering effluent from a contaminated site, Richard worked closely with the owner, contractors, and regulators to obtain the necessary permits and to minimize dewatering discharge rates for both the temporary construction dewatering and permanent groundwater control systems, thereby reducing costs to the owner.

King County, Regional Detention Facility (RDF), Des Moines, WA. Richard was Project Hydrogeologist for design of a liner for the base of the stormwater retention facility to prevent mobilization of arsenic into the surface water of Des Moines Creek, a salmon bearing stream. The RDF is one of the major components of a series of projects being implemented by the Des Moines Creek Basin Planning Committee to protect and restore Des Moines Creek. During design phase environmental sampling, elevated levels of arsenic were identified in the proposed excavation areas. Richard developed a preliminary construction dewatering design to provide estimates of groundwater discharge rates. Because of the arsenic, discharge of the dewatering effluent is critical for the project and Richard worked with the project team to identify cost-effective and constructible approaches for handling the water, including a phased construction dewatering design. Richard prepared technical plans and specifications for construction dewatering.

Strander Boulevard / SW 27th Street Corridor Improvement Project, Renton and Tukwila, WA. Richard was the Project Hydrogeologist for Phases 1 and 2 of the Strander Boulevard/ SW 27th Street Corridor Improvements project. The project consisted of roadway widening and a proposed underpass providing a grade separation between vehicles and two different railroad track lines. For Phase 1, Preliminary Geotechnical Information, Richard provided preliminary recommendations based on existing information for permanent groundwater control, as well as construction considerations for dewatering including impacts on existing adjacent structures, utilities, and other facilities. Phase 2 for conceptual design

included a groundwater exploration, monitoring, and testing program to evaluate potential dewatering design criteria for excavation and estimates of groundwater flow to a permanent drainage system. In part, because of geotechnical considerations and the need for extensive groundwater control measures based on the Phase 2 evaluation, the cost of an underpass was considerable and the design team recommended that the City consider an overpass as a more cost effective solution. The City determined that the upcoming final design phase would be based on an overpass scheme.

US Navy, NAVFAC NW, Dewatering Evaluation of Drydock No. 6, Puget Sound Naval Shipyard, Bremerton, WA. Settlement in areas of the drydock raised concerns regarding the stability of the slab and the effectiveness of the underlying drainage system to dewater the soils below the slab and prevent excessive uplift pressures on the slab. Richard developed a three-dimensional groundwater flow model to evaluate the current state of the drainage system and the impact of remedial measures proposed to prevent further settlement. His analysis indicated that a series of passive relief wells would be more effective at reducing hydrostatic pressures than the existing drainage system. He designed a deep well dewatering system that could be pumped during construction activities to repair the slab and passively drain during operation of the drydock. Richard also designed a monitoring system to measure water pressure under the slab and an operation procedure during unwatering of the drydock.

Waterfront Marriott Hotel, Seattle, WA. Evaluated aquifer conditions and designed a temporary construction dewatering system for the new hotel. Dewatering was necessary for construction of the two-level underground parking structure. The 26-foot deep excavation was approximately 375 feet by 150 feet and located about 100 feet from Elliott Bay. Aquifer testing was completed to estimate aquifer parameters and to evaluate the potential impact of Elliot Bay on dewatering activities. The dewatering system consisted of 7 large-diameter wells installed on the east and west sides of site for a total of 14 wells. The wells were installed to a depth of 45 to 50 feet below ground surface and were centered on a 50-foot spacing except on the north edge of the site where a 30-foot spacing was necessary because of the less permeable nature of the soils on that side of the site. The dewatering system was designed to limit the influence of the drawdown beneath adjacent structures and minimize the potential for settlements. The dewatering system successfully controlled groundwater at the site, did not cause construction delays, and no settlement of adjacent structures was measured.

Yarrow Bay Office Complex, Kirkland, WA. Evaluated and modified an existing construction dewatering system and provided design recommendations for permanent dewatering system for the Yarrow Bay Office Complex. During excavation, a previously installed dewatering system was not adequate to control groundwater at the site. A review of soil and groundwater conditions indicated that an supplemental dewatering system consisting of over 100 vacuum-extraction well points was necessary to control groundwater perched on a thin silt layer near the bottom of the excavation. In addition to the shallow aquifer dewatering, it was necessary to install a dewatering system in a lower underlying confined aquifer in order to minimize the potential for instability of the base of the excavation. A permanent dewatering system was designed for the project consisting of an under slab drainage system and a passive depressurization well for the lower confined aquifer.

Monroe Wastewater Treatment Plant, Monroe, WA. Designed a temporary dewatering system for construction of the secondary clarifier at the Monroe Treatment Plant. Dewatering was necessary to control groundwater during excavation. Soil and groundwater conditions were evaluated based on soil borings and performance of the dewatering system for the nearby aeration basins. Because of the highly permeable sand and gravel soil at the site, dewatering for the center structure of the clarifier involved installing large-diameter deep dewatering within the excavation on a 15-foot radius. A groundwater model constructed for the evaluation indicated that 3 to 5 wells would be necessary to dewater the area. In order to expedite operation of the dewatering system and minimize the number of wells necessary,

testing of the system was completed concurrently with installation of the wells. The testing indicated that only 3 wells were needed to meet drawdown requirements.

City of Shelton, Basin 2 Inflow and Infiltration Reduction Project, Shelton, WA. Provided construction dewatering recommendations for installation of about 14,000 feet of new sewer line, using shored trench excavations. Groundwater conditions along the alignment were evaluated based on subsurface conditions observed from borings, test pits and the completion of multiple slug tests. Soil conditions consisted of permeable sand and gravel. An analytical groundwater model was constructed to evaluate well spacing and discharge volumes for a series of large-diameter dewatering wells. By incorporating the varying groundwater conditions observed along the proposed alignment relative to excavation depth during the analysis, variable well spacing was recommended to decrease the overall cost of the construction dewatering program.

King County Department of Natural Resources, Juanita Sewage Pump Station, Kirkland, WA. As the Project Hydrogeologist for this sewage pump station, Richard completed dewatering analysis and design for the project that includes construction of a 60-foot-deep, secant-pile, interior-braced excavation, and excavation of 40-foot-deep maintenance access holes and jacking and receiving pits. Two pumping tests were completed in both the shallow and deep aquifers at the site to evaluate groundwater conditions and provide input parameters for parametric dewatering analyses. Analysis of the deep aquifer data indicated that the aquifer could be depressurized using large-diameter dewatering wells. Testing of shallow aquifer indicated a large radius of influence with the potential for dewatering induced ground settlements. As a result, dewatering of the shallow aquifer for the 40-foot-deep excavations was determined to be infeasible, requiring the use of water-tight shoring. Richard also oversaw completion of the Phase 2 environmental investigation to evaluate the potential for soil and groundwater contamination at the site as a result of previous site activities.

Forest Grove Wastewater Treatment Plant Expansion, Forest Grove, OR. Richard was Project Hydrogeologist in support of six new treatment-plant structures: an influent structure, a screening building, an influent pump station, a grit basin, a diversion structure and an aeration basin. Excavations ranging from 20 to 35 feet are required for the construction of the below-grade structures. Richard constructed a three-dimensional groundwater flow computer model to design dewatering systems for each of the excavations. His evaluation also considered the impact of various shoring systems on groundwater inflow to the excavations. Based on his model, Richard recommended a series of vacuum-extraction well points will multiple lifts to dewater and depressurize the fine-grained soil at the site and drainage layers with sumps in the center of the excavations. His evaluation demonstrated that a combination of water-tight shoring adjacent to sensitive structures combined with the well points allowed for groundwater control without excessive drawdown beneath the sensitive structures.

Balch Consolidation Conduit, Bureau of Environmental Services, Portland, OR. Richard was Project Hydrogeologist for this 6,000-plus foot long, 84-inch diameter micro tunnel and shafts project. Richard reviewed soil and groundwater conditions for the project and constructed a three-dimensional groundwater flow computer model to evaluate potential dewatering systems for each of the excavations. He also evaluated potential mitigation measures for the excavation base failure of Shaft M, including various grouting, shoring, and dewatering combinations. From the model, Richard estimated discharge rates for the dewatering systems and potential area of drawdown, which was critical given the presence of sensitive structures founded on soils susceptible to consolidation and ground settlement.

City of Portland Outfall 27, Sellwood CSO, Portland, Oregon. Richard was Project Hydrogeologist for a new wet-weather combined sewage pump station and a new overflow structure connecting the pump station wet well to the existing Outfall 27 in the Willamette River in Portland, Oregon. Richard

completed a parametric analysis of potential dewatering systems for excavation of the Pump Station, Control, Overflow, and Pipeline structures. He recommended the use of deep, large-diameter pumping wells as the primary control for groundwater inflow to the excavation. Richard estimated discharge rates for the dewatering systems and potential area of drawdown.

City of Portland 3rd and Alder Diversion Structure and Outfall 28, East Side CSO, Portland, Oregon. Richard was Project Hydrogeologist for a sewer diversion structure and an outfall in Portland, Oregon. The diversion structure was located near 3rd and Alder near a settlement susceptible building and an area of known groundwater contamination. Richard constructed a groundwater model to perform parametric analyses of various dewatering scenarios. The modeling results indicated that a design consisting of multiple dewatering wells in different soil formations could effectively dewater the excavation while reducing the potential risk of adverse affects during construction. For Outfall 28, adjacent to the Willamette River, Richard developed a groundwater model to evaluate the use of well points and deep dewatering wells to control groundwater during excavation. The model considered variable river stages. The final design consisted of multiple well points around the perimeter of the excavation and a deep dewatering well adjacent to the pipeline going into the river.

WES Interim Diversion Pipeline (CCSD No. 1) Clackamas County, OR. The Interim Diversion for Clackamas County Sewer District No. 1 is a sanitary sewer force main from the northern part of Clackamas east of Interstate I-205 at a new pump station about 25 feet below the ground surface and a diversion structure. The force main pipeline extends approximately 2,800 linear feet to the existing Clackamas pump station, which is also the site for a new pump station that will be about 33 feet deep with a footprint of approximately 30 by 40 feet. The 14-inch pipeline will be trenchless construction under a four lane highway (212/224) and under a railroad line. The subsurface materials consist of a thin layer of sandy silt over sandy gravels with cobbles. Richard was senior hydrogeologist for the evaluation of dewatering impacts, including drawdown distances for potential impacts to nearby contaminated materials, flow estimates, and developing conceptual dewatering methods for the pipeline undercrossings, jacking and retrieval pits, and deep pump stations.

Clean Water Services, Lower Tualatin Pump Station, Tualatin, OR. Richard was Project Hydrogeologist for a deep influent pump station supplying waste to Clean Water Services' main treatment facility. The project required innovative solutions in order to maintain a high level of service the adjacent city park and minimize impacts to two nearby rail lines. Richard developed a three-dimensional groundwater flow computer model to evaluate potential dewatering and shoring scenarios for the pump station and pipeline excavations. Based on the results of his model, we designed a caisson excavation and trenchless construction techniques for several of the pipelines, in lieu of traditional open cut construction to reduce the risk of drawdown-induced ground settlement beneath the rail lines. For other project excavations, Richard evaluated various dewatering systems and estimated dewatering discharge rates for the systems.

South Mount Vernon Sewer Improvements, Mount Vernon, WA. Richard evaluated groundwater conditions and modified an existing dewatering system installed for 25-foot deep pump station excavation. Because of inefficient dewatering wells, the system was not meeting drawdown requirements for the excavation. Two pumping tests were performed to estimate well efficiency and aquifer parameters. Following evaluation of the test data and completing parametric dewatering analyses, Richard recommended redevelopment of the existing dewatering wells by jetting and surging, and installation of two additional dewatering wells in the vicinity of the excavation. The recommended actions were implemented and the dewatering system performed as required.

Snohomish County, Campus Redevelopment Project, Everett, WA. Richard was the hydrogeologist for the project that included construction of an 85-foot-deep soil-nail wall excavation for the parking garage. He evaluated groundwater conditions for the site and designed a three-phased dewatering system for the project. Large-diameter deep dewatering wells were initialed installed to depressurize the outwash aquifer in order for the excavation to proceed downward. Just above the aquifer, a vacuum-extraction well point system was installed around the interior perimeter of the site to dewater the outwash aquifer. Further excavation revealed a previously undetected zone of water-bearing, interbedded sand and silt, primarily in one corner. Using a field observation approach, Richard designed a secondary well point system to dewater this zone. By observing test pits excavated at various locations around the site, and monitoring the installation of the well points, he was able to focus the second well point system on the problem soils, reducing the number well points installed, limiting construction delays, and consequently, reducing the cost to Snohomish County.

King County, Swamp Creek Trunk Sewer Extension, King County, WA. Richard evaluated groundwater conditions along the sewer alignment for construction dewatering. The project consisted of about 4,250 feet of 36- to 48-inch-diameter sanitary sewer pipeline installed using both open-cut and trenchless excavation methods with the depth of pipeline ranged from 15 to 30 feet below ground surface. Richard completed dewatering analysis along portion of alignment incorporating varying subsurface conditions for installation of the pipe and for construction of a shaft. He provided recommendations for dewatering design based on a series of large-diameter dewatering wells specific to differing groundwater conditions observed along the alignment. Richard provided general specifications for installation of dewatering wells.

Bonneville Power Administration, Echo Lake Substation, King County, WA. Developed temporary construction and permanent dewatering recommendations for the new Echo Lake Substation. Evaluate groundwater flow conditions at the site, including rainfall-groundwater interactions. Several numerical and analytical techniques were used to evaluate site groundwater control (dewatering) options including the use of dewatering wells, horizontal drains, and sumps within the excavation. An evaluation of groundwater levels for summer (low-rainfall), winter (high-rainfall), and 50-year storm event conditions was completed to provide a better understanding of dewatering requirements during construction. For the permanent dewatering system, an interceptor trench located upgradient of the facility was designed to capture groundwater.

City of Marysville, Wastewater Treatment Plant Upgrade and Effluent Transfer Pipeline, Marysville, WA. Richard was Project Hydrogeologist for the groundwater aspects of plant improvements and a new effluent transfer pipeline. Plant improvements included construction of additional sand filters and lagoon expansion, while the pipeline involved a 4-mile long pipeline trench and a 5,000-foot long horizontal-directional drill (HDD) undercrossing of Union, Steamboat, and Ebey Sloughs. Richard performed seepage analyses to assess the stability of lagoon dikes during upgrade of the lagoons, provided dewatering recommendations for the pipeline trench taking into consideration that groundwater levels are tidally influenced, evaluated dewatering and shoring requirements for a 20-foot deep excavation for construction of new sand filters, and assessed potential drawdown induced settlements for the trench and other subsurface excavations in soft fill and peat soils.

I-25 Expansion and Light Rail T-REX Project, Denver, CO. Richard was Project Hydrogeologist to evaluate the feasibility of various dewatering designs and provide construction dewatering recommendations for the installation of a junction structure and pipeline beneath I-25. He designed and directed completion of a pumping test to evaluate groundwater conditions within a multi-aquifer system. The results of the testing were used to develop an analytical computer model to assess dewatering

scenarios and designs for a series of large-diameter dewatering wells, including well spacing, location, well design, and dewatering alternatives.

King County WTD, Fairwood Interceptor, WA. Project Hydrogeologist for three phases of a sewer conveyance system including preliminary and final design and development of plans and specifications. The project includes 1,250 feet of gravity sewer line to be constructed with 200 to 650 ft lengths of microtunnel, 10 shored manhole shafts that will be used as launching and receiving shafts, and a 2,300 ft long horizontal directional drill hole. Richard reviewed soil and groundwater conditions along the alignment, completed and analyzed aquifer testing for excavations, and prepared dewatering recommendations. His recommendations included identifying four general soil-groundwater conditions along the alignment, and providing dewatering methods specific to each section, including estimates of potential discharge rates. Richard also evaluated potential impacts to Madsen Creek during horizontal directional drilling.

King County, Denny Way / Lake Union CSO, Seattle, WA. Richard was Project Hydrogeologist for this large CSO project. He assessed soil and groundwater conditions and evaluated dewatering design for this tunnel that was successfully constructed through glacial soils with over 200 feet of soil cover and with water heads greater than 100 feet. Richard also evaluated post-construction groundwater conditions to assess impacts of tunnel and construction activities on groundwater quality in the vicinity of the tunnel.

Washington State Convention and Trade Center (WSCTC)-McKay Block (One Convention Place), Seattle, WA. Richard served as Project Hydrogeologist for the McKay Block portion of the WSCTC expansion project. The McKay Block, located at the southwest corner of 7th Avenue and Pike Street in downtown Seattle, is next to the ACT Theater and existing WSCTC and includes a 16-story office building with a basement, extending 60 feet below the street. Explorations indicated the presence of a water-bearing sand unit between about 25 and 35 feet below ground surface. Groundwater control was a critical element of the project to prevent soil loss during excavation, which could impact the adjacent buildings. Richard provided recommendations for temporary construction dewatering consisting of large-diameter wells. He observed installation and testing of the system to ensure that the wells were effectively lowering groundwater levels to maintain a stable excavation.

Puget Sound Energy, 196th Street SW and 44th Avenue W Project, Lynnwood, WA. Richard was project manager to evaluate soil and groundwater conditions for an excavation to replace a gas-line in Lynnwood, Washington. He estimated potential groundwater inflow rates to the excavation and provided construction dewatering recommendations. Richard also worked with the City of Lynnwood to allow discharge of dewatering water to the sewer, including development of a water quality monitoring plan. He worked closely with the contractor during construction to ensure that dewatering activities would not disrupt work and impact the construction schedule.

University of Washington Capital Projects Office, Medical Center Expansion, Seattle, WA. As Project Hydrogeologist, Richard evaluated soil and groundwater conditions in support of construction dewatering design and permanent drainage. The University of Washington Medical Center addition is near the southeast portion of the campus. The structure will be elevated above Columbia Way, and the foundation will be a combination of 50-foot by 4-foot diameter drilled piers and large spread footings. A connection will be made to the campus utility system with deep shored excavations. Richard provided recommendations for potential construction dewatering approaches and developed contract specifications for dewatering.

WSDOT, Bellevue Downtown Access Project, Bellevue, WA. Richard was Project Hydrogeologist for design and construction of a proposed collection-distribution lane located parallel to Interstate 405 in

Bellevue, Washington. He performed a detailed construction dewatering analysis based on field-testing completed for the project. Dewatering design included both an active temporary construction system consisting of a vacuum-extraction well point system and a passive permanent system to reduce hydrostatic pressure behind structural walls. Wrote technical specifications for both dewatering systems.

South Puget Sound Community College, Humanities and General Education Center, Olympia, WA. Richard evaluated soil and groundwater conditions for design of a passive drainage system for the new Humanities and General Education Center. He designed an underslab drainage system to lower groundwater levels beneath the building and estimated long-term groundwater inflows to the system. He developed plans and specifications for the drainage system.

Lower Meramec River Wastewater Treatment Plant, Saint Louis, MO. Richard was Project Hydrogeologist for review of the tunnel segment between the Baumgartner Treatment Plant and the new Meramec Treatment Plant near the Meramec River. Richard reviewed data during construction to evaluate potential groundwater inflow to the tunnel and shafts from solutioned joints and bedding planes. He provided recommendations for groundwater control alternatives including the use of deep dewatering wells. Richard reviewed analyses for evaluation of the hydraulic connection between the tunnel and the Meramec River. Because the high potential dewatering discharge rates and excessive sulfides in groundwater, grouting was the chosen groundwater control alternative, which allowed successful completion of the tunnel.

King County Brightwater Treatment Plant, North King / South Snohomish County, WA. Richard provided review and summary of groundwater conditions associated with various sites proposed for the treatment plant. He completed a preliminary evaluation of groundwater conditions impacting construction of the Brightwater conveyance and analyzed subsurface conditions based on preliminary field investigation to evaluate dewatering requirements and estimate potential groundwater inflows to tunnel. Richard evaluated potential dewatering requirements for shafts. He completed preliminary assessment of groundwater usage in the vicinity of the conveyance alignment and potential impacts to groundwater as a result of construction as part of the ongoing Environmental Impact Statement.

Fairway Estates Condominiums, Vertical Drain Design, Seattle, WA. As Project Hydrogeologist, Richard evaluated subsurface conditions and designed vertical gravity drains for a condominium complex built in a potential landslide area in Seattle, Washington. The vertical gravity drains were installed to reduce groundwater pressures within soils associated with reported previous slope instability below the site. Monitoring wells were also installed to monitor groundwater levels, evaluate the effectiveness of the system, and determine whether additional drains are required. Richard designed the drains to require less maintenance than previously installed drains, and to enhance groundwater flow and reduce migration of fines.

King County Henderson / Martin Luther King CSO, Seattle, WA. Richard was Project Hydrogeologist reviewing groundwater conditions and dewatering submittals, for this large CSO project. The project included a 1,000-foot segment consisting of a 72-inch-diameter concrete pipe installed by microtunneling. Richard evaluated soil and groundwater conditions and provided dewatering recommendations for a large excavation where the sewer daylighted.

Beers-Inman, Dewatering System, Memphis, TN. Completed an aquifer study in order to design a dewatering system for the new baseball stadium in downtown Memphis. Evaluated site geology and conducted a multi-day pumping test to assess aquifer properties. Designed a dewatering system based on test results to minimize groundwater inflows during excavation and to maintain dry field conditions after construction.