NEWS RELEASE

2017 Top Engineering Award Goes to Magnusson Klemencic Associates for its Design of the Elliott Bay Seawall Habitat and Public Space

BELLEVUE*, Wash*.— Magnusson Klemencic Associates (MKA) received the Platinum Award at the 50th annual Engineering Excellence Awards for their design and project leadership of the Elliott Bay Seawall Habitat and Public Space. The awards are sponsored by the Washington State chapter of the American Council of Engineering Companies (ACEC), and this year ACEC Washington honored 42 projects representing a wide range of engineering achievements and demonstrating the highest degree of skill and ingenuity. The top seven awards -- one Platinum and six Gold -- will go on to compete in the ACEC national competition in Washington, D.C. in April.

Platinum Award – Environmental Design
Magnusson Klemencic Associates – Elliott Bay Seawall Habitat and Public Space
Client: City of Seattle

Seattle's downtown waterfront is a critical economic center for the city and the region, with more than 19 million visitors annually generating more than $9 billion in tourism revenue and $623 million in state and local taxes. One of the waterfront's main players, the Port of Seattle, generates $19.8 billion in business revenue and $894.4 million annually in state and local taxes.

But a dark cloud hung over the city.

Even with the removal of the Alaskan Way Viaduct, Seattle's downtown waterfront seawall was at great risk of collapse in the next earthquake, with its liquefiable soils, and having been pummeled by tidal forces, wind-driven waves and underground marine borers for the past 75 years. The City of Seattle's Department of Transportation, in response, developed the "Central Seawall Project" (CSP) to replace 3,700 linear feet of the dilapidated seawall with a stronger, better and more seismically resistant seawall that would last at least another 75 years.

From the start, the City's goals were clear: provide a new earthquake-resistant seawall; improve the near-shore marine environment; and restore a long-interrupted salmon migration route. The City selected a team headed by Parsons, but stipulated that MKA must be part of the team in a key leadership role based

on their proven expertise in earlier work for the City. MKA became the “Public Realm Lead,” responsible for integrating all urban design, art, and landscape and habitat components into CSP’s construction documents.

One of the big challenges of the project was to improve the waterfront’s adjacent marine environment. The canyons and shadows created by Seattle’s urbanized shoreline were drastically impacting native salmon traveling along their ancestral waterfront migration route, delaying their journey, limiting food sources and exposing them to predators. Research had shown that 29 percent of the area’s pre-settlement salmon population had become extinct, and 27 species are threatened, including the Chinook.

With 90 percent of Seattle’s central waterfront shoreline covered by piers, the project had to include bringing natural light beneath the promenade since research had shown salmon migration was encouraged by as much natural light as possible. Traditional steel grating and other openings in the promenade were ruled out because they would compromise safety for pedestrians above. MKA needed to come up with another answer. The firm conducted a customized two-month study of potential light levels using movie industry technology that included positioning light meters at key elevations in a model to observe how light moved through the promenade surface to the water surface, and even to fish-eye depth. MKA’s engineers then created a custom light-penetrating pedestrian promenade using glass pavers that is stacked over the salmon migration corridor by siting the new seawall face 15 feet landward of its old location. This innovation gives both human and fish habitats ample space to thrive.

MKA also conducted research into marine surface texture designs that would increase habitat biodiversity and encourage marine life attachment, guiding the development of a two-inch-thick “texture zone” of the precast concrete seawall that featured textured bands of sea organisms layered to ocean habitat, plus imprints of tidal transitions.

The Central Seawall Project’s very sensitive nature, highly public location, extremely large size and long list of “neighbors,” required that MKA have excellent communication and project management skills, as well as technical expertise and creative problem-solving abilities. The list of actively involved agencies and stakeholders included Washington State Ferries, the U.S. Army Corps of Engineers, the U.S. Fish & Wildlife Service, the Washington Departments of Natural Resources and Ecology, several Native American tribes, the Seattle Office of Arts & Cultural Affairs, waterfront pier owners and businesses, and many more.

John Buswell, Roadway Structures Manager for Seattle’s Department of Transportation gave special kudos to MKA for their pioneering Light Penetrating Surface which “has never been used in a waterfront

setting. This unique and innovative design is a first for providing both a functional pedestrian surface and needed sunlight to marine habitat…This system is a model for other waterfront communities."

Judges commented that replacing the existing seawall in downtown Seattle was a complex undertaking in its' own right. But finding a way to incorporate ecological enhancements into the basic structural requirements of the new seawall made this project stand out. The team's 'outside the box' thinking about the use of various structural materials and the incorporation of light transference methods to enhance fish passage and the sustainability of the marine environment, while still meeting very stringent seismic requirements, was impressive.

The Six National Gold Awards

Gold Award – Studies, Research and Consulting

WSP Parsons Brinckerhoff/EnviroIssues – Sound Transit Regional HCT System Plan (ST3)

Client: Sound Transit

On November 8, 2016, 54 percent of the voters in King, Snohomish and Pierce Counties approved a $54 billion, 25-year update ("ST3") to Sound Transit's Regional High Capacity Transit (HCT) System Plan that will enhance connectivity and provide reliable transit options as well as a strong, supportive infrastructure. But this critical vote didn't happen in a vacuum.

Months earlier, Sound Transit had tapped the experience and expertise of WSP/Parsons Brinckerhoff along with the proven communications know-how of EnviroIssues to help build the foundation and ultimate public support for an update of Sound Transit's long-term Regional HCT System Plan. Originally adopted in 1996, the plan has needed updating over the years and its progress was approved by the public. The vote this past November ensures the continued growth and sustenance of Sound Transit, particularly of its "spine" connecting major cities in the region – from Everett to Tacoma, and to Redmond and Issaquah on the East Side.

The new ST3 revision of the HCT Plan includes a range of transit investments that will add 62 new miles of light rail, introduce new bus rapid transit service, expand Sounder commuter rail, and provide additional facility and service improvements. These improvements are projected to reduce annual auto vehicle travel in the area by 362 million miles by 2040, resulting in a reduction of more than 130,000 metric tons of emissions annually.

WSP/Parsons Brinkerhoff was the prime consultant leading a team of seven firms to complete the transit and transportation planning, conceptual engineering, cost estimating, financial analysis and ridership forecasting for the ST3 effort. Then it was up to EnviroIssues to convey to the public how the engineering and technical information – resulting in system updates – would improve their lives. This, as it turns out, was key to the success of the vote. EnviroIssues developed an interactive, web-based communications tool to engage with community members throughout the plan development process. Participation and enthusiasm were unprecedented for Sound Transit in the final public review of the draft plan over six weeks in 2016 alone – 91 percent of self-identified respondents supported mass transit expansion. More than 183,000 unique users visited the website. Nearly 35,000 people across the three counties responded to an online survey, and some 500,000 people viewed an advertisement for the plan via social media.

Sound Transit's Ric Ilgenfritz wrote, "The planning, design, and cost estimating efforts conducted by the WSP/Parsons Brinckerhoff team enabled us to put this plan together efficiently and confidently, while the public involvement and communications set the stage for us to quickly launch project implementation in the coming months." Awards judge Jeff Carpenter, Senior Design Engineer with WSDOT commented that, "this study updated and validated Sound Transit's bold plan for the Puget Sound Light Rail. It laid the groundwork for a successful funding campaign which received the approval of the voters.

Gold Award – Structural Systems
COWI North America Inc. – World Trade Center Transportation Hub
Client: The Port Authority of New York and New Jersey

One hundred feet above the ground at the tip of Manhattan Island in New York City, a giant steel and glass dome-like structure rises over the new World Trade Center Transportation Hub. The eye-catching and iconic structure designed by world-renowned architect Santiago Calatrava is called "Oculus" (Latin for "eye"), and is inspired by what appears to be a pair of hands releasing a white dove. The structure consists of two parallel arches spanning a 300-foot-long oval-shaped opening in the roof, supported by columns spaced five-and-a-half-feet apart. Glass panels fit in between the columns, allowing natural light to bathe the 200,000 daily commuters below.

Yes, it is beautiful and inspiring, but it also was an extremely complex and complicated structure to design and build. In fact, because of its bridge-like design, the Port Authority of New York and New Jersey hired -- not a traditional structural engineering company – but rather, one of the world's most reputable bridge engineering companies, COWI North America, Inc., and its New York bridge division, Buckland & Taylor International Inc., to engineer it so it could be safely built.

Ultimately a sequential erection scheme, used in bridge construction, was deemed the ideal approach. Essential to this scheme was a custom finite element (FE) analysis model that determined the cambered shape of each individual steel segment and computed the stresses in the structure and the position of the geometry control points during each stage of the erection. Constant monitoring with the FE model helped define erection sequence, maintain tight geometric tolerances, achieve schedule and reduce costs, plus allowed for slight alterations and adjustments as construction progressed.

The project team also identified significant risks associated with traditional "field welding," so to mitigate these risks, COWI replaced welded splices in the arches with bolted connections. Fully connecting an arch piece by field welding required almost three weeks, but with bolts, the connection could be completed in two days.

Dan Payea, Vice President of Skanska (the contractor), wrote, "Applying bridge engineering concepts and first principles to the erection of the building allowed this highly complex project to be completed safely and accurately." Jeff Carpenter, State Design Engineer for WSDOT added, "COWI's Oculus structural lift plan highlighted the challenges engineers can face when embracing bold architecture."

Gold Award - Structural Systems
HDR Engineering, Inc. – SR 520 Bridge Replacement and HOV Program
Client: WSDOT

The Greater Seattle Area is expected to grow by at least one million more people and 40 percent more traffic in the next 25 years, so how do you fix one of the largest, most obsolete transportation corridors in the area, especially when it crosses the state's second largest lake connecting major commercial and residential centers on both sides? One of the main problems facing the Washington State Department of Transportation (WSDOT) was that water gathered in the hollow pontoons supporting the bridge requiring regular pumping. The bridge deck was less than eight feet above Lake Washington's surface, so heavy rains and winds would create waves that would crash onto the deck endangering motorists and bicyclists and pedestrians were forbidden on the bridge. In addition approach spans were at risk of collapse since they did not meet current seismic standards.

Still more than 115,000 vehicles crossed the bridge daily, and it operated near capacity for more than 13 hours daily.

WSDOT needed an engineering team that could hit the ground running and hired HDR Engineering, Inc., as the general engineering consultant to oversee preliminary design, RFP preparation, construction management and environmental mitigation. Even though the project included roadway renovation on either side of the bridge, the complexity of the challenge was exacerbated by the bridge's location over Lake Washington, which plunges to a depth of more than 200 feet over the top of another 200 feet of soft silt – not the best bridge anchoring scenario. So HDR's team simplified things by turning the marine job into a land job whenever possible even though there was just a 150-foot-wide stretch of shoreline for all land access to over-water construction activities.

The new bridge is supported by 21 of the heaviest, widest, deepest and longest floating bridge pontoons ever built. At 360 feet long, 75 feet wide and 28.5 feet high, the longitudinal pontoons weigh nearly 22 million pounds each. The pontoons are anchored by 3 1/8-inch-diameter cables (nearly an inch thicker than the old cables) that extend up to 1,000 feet into the lake and tie into one of 58 anchors. The bridge now can resist up to 98 mile per hour winds, equivalent of a 100-year storm, and its higher bridge deck (20 feet over the lake versus the old eight feet) prevents large waves from washing over traffic.

The new bridge deck is 56 feet wider than the old bridge deck and includes a 14-foot-wide bicycle-pedestrian path with several "belvederes," or viewpoints, along the way. It also provides six travel lanes for vehicular traffic, including a dedicated transit and high-occupancy vehicle lane in each direction. Also, the team prepared the new bridge for light rail with a design that allows pontoons to be added and the bridge to be widened.

"The new bridge will give our state's most populous and economically robust region much safer, more reliable, and more environmentally responsible transportation for decades to come," said Roger Millar, Secretary of the Washington State Department of Transportation. On opening day, a representative from the Guinness Book of World Records certified that the 7,708-foot-long bridge – 130 feet longer than its predecessor – was, indeed, the longest floating bridge in the world.

Judges spoke to the complexity of this project as well as its significance for the future saying that replacing the longest floating bridge in the world in a modern day urban environment was fraught with technological challenges. In addition to the many technological challenges involved, the project team successfully integrated other aspects into the design such as fire/life safety, emergency power, communications, sustainability, future expansion capability and community concerns. The new bridge will be safer, capable of carrying more traffic, quieter and more environmentally friendly.

Gold Award – Waste and Storm Water

Brown and Caldwell – Chambers Creek WWTP Expansion

Client: Pierce County Public Works and Utilities

Public utilities across the country are struggling with aging facilities that need major renovations at a time where water quality regulations are tightening along with local government budgets. Brown and Caldwell won this Gold Award because they were able to make the impossible possible and in the process far exceed expectations for the client, Pierce County Public Works and Utilities, as well as the citizens who need the public services.

The Chambers Creek Regional Wastewater Treatment Plant (WWTP) in Pierce County is located on 180 acres within a 920-acre regional park with 2 ½ miles of marine waterfront on Puget Sound. The Chambers Park Golf Course in the park was the site for the 2015 U.S. Open tournament and the park also shelters a wetland/watershed reserve. Great credentials for a public park, yes, but with a projected service population increase of at least 130 percent over the next 30 years, some serious planning and renovations were needed. Not only did the county need to upgrade its wastewater treatment plant, but it also needed to plan for continual tightening of environmental regulations as well as the eventual need for even more expansion of service.

This is when Brown and Caldwell (B&C) entered the picture. First, they designed an integrated facilities plan spanning 30 years that provides the county with a clear strategy for adjusting the rate of level-of-service improvements in tune with regulatory changes, public demand and the need to create cutting-edge technology to remove contaminants from the water. Then B&C tapped a relatively new proprietary technology, “Anammox DEMON technology”, developed at the University of Innsbruck in Austria. This technology treats high-strength ammonia streams through “deammonification,” a process where naturally occurring bacteria remove ammonia from wastewater with minimal energy input. B&C and Pierce County conducted one of the first pilot tests of the technology in the United States, proving its efficacy as well as the substantial environmental and economic benefits the county could realize. In fact, DEMON enabled the county to reduce the size of the biological treatment system by 20 percent and cut chemical and oxygen demands by 50 percent and 25 percent, respectively.

Leading up to the facilities planning effort, B&C conducted a plant performance test that resulted in a re-rating of the plant’s National Pollutant Discharge Elimination System permitted capacity from 18 million to 31.7 million gallons per day without any capital expenditures, saving the county more than $50 million by and delayed the need to build new facilities.

An interesting side story to this project is that the plant renovations took place ***during*** the 2015 U.S. Open golf tournament at the nearby Chambers Creek Golf Course. With 30,000 daily visitors plus logistics for a national sporting event, construction was carefully coordinated around a two-month window in early summer 2015 with no visible construction, limited traffic access and no offsite impacts. In fact, during the event, the project's construction offices were even used as a security command post.

This project ultimately pioneered a model for sustainably co-locating community infrastructure within a highly visible and publicly cherished recreational area without compromising the utility's ability to provide a high level of current and future service.

Gold Award –Water Resources

Shannon & Wilson, Inc. – Fir Island Farm Estuary Restoration

Client: Washington Department of Fish & Wildlife

The Skagit River is the largest tributary to Puget Sound and is home to ten salmon species, including the Chinook, which is listed as threatened under the Endangered Species Act of 1999. Chinook smolt rely on estuaries for food and protection as they transition from fresh water to salt water. But the Skagit River Delta had lost approximately 85 percent of its historic estuary, and in 2005 the state's Skagit River Chinook Recovery Plan identified estuary habitat as an important limiting factor for recovery. Enter Shannon & Wilson, Inc., and the Fir Island Farm Estuary Restoration Project.

The Washington State Department of Fish and Wildlife partnered with Shannon & Wilson, Inc. and IMCO Construction to provide a feasibility study, design & permitting, public outreach and construction of the Fir Island Farm Estuary. The project team delivered a large-scale, highly complex habitat restoration, coastal flood protection and drainage project that balances the needs of fish, farmers, flooding and Snow Geese on the Skagit River Delta.

A key challenge with estuary restoration, particularly in the Skagit River Delta, is that the areas most important for Chinook salmon are also some of the most agriculturally productive farmlands in the world, supporting up to 80 different crop varieties and serving as a worldwide producer of vegetable seeds. Much of the farmland, however, is sub-tidal and reliant on a complex system of dikes and drainage infrastructure, presenting quite a challenge to engineers tasked with rebuilding the estuary for wildlife. The project design elements included a mile-long levee setback, a 9,000 gallons-per-minute automated pump station, five tide gates, a 50-acre storage pond, and restoration of 130 acres of tidal marsh estuary habitat critical for juvenile Chinook recovery, including vegetated marsh with blind tidal channels to

minimize impacts to neighboring properties and to the farm drainage infrastructure. The project is expected to increase juvenile Chinook smolt to between 65,000 and 350,000 each year.

Another challenge to the project was developing levee design criteria that considered current engineering design standards as well as climate change and sea level rise. The current design guidelines of the U.S. Army Corps of Engineers and the Natural Resource Conservation Services were not specific for sea level rise and coastal resiliency design in Puget Sound, so Shannon & Wilson performed additional technical studies, modeling, and risk and uncertainty analyses to come up with design criteria that considered a 100-year coastal storm surge with increased wind wave levels, and additional elevation for projected mean sea level rise over the next 50 years.

The Fir Island Farm Estuary Restoration Project was delivered under budget and on schedule. In fact the final construction budget was $2 million less than original cost estimates, allowing Washington State to use those funds for other salmon habitat restoration projects.

Gold Award – Transportation
McMillen Jacobs Associates – University Link Extension
Client: Sound Transit

While “Bertha,” garners media coverage for all of its milestones, relatively few people are aware of the intensive engineering and construction that took place to complete the University Link Extenstion. McMillen Jacobs Associates (MJA) was tapped by Sound Transit to serve as managing partner of the Northlink Transit Partners Joint Venture, responsible for project management of “The University Link Extension” tunnel design, station initial and final structural design, and geotechnical engineering.

The University Link Extension, part of the 1996 voter-approved mass transit system plan, connects the state’s three largest urban centers – downtown Seattle, Capitol Hill and the University of Washington – over 3.15 underground miles, This critical light-rail connecting project required MJA and its team to think both in and outside the box to tackle the challenges. For instance, the tunnel alignment travels east from downtown, crosses under the nine-lane, two-story Interstate 5 to reach the Capitol Hill Station, then continues north under the Montlake Cut to reach the University of Washington. The twin bored tunnels pass beneath existing facilities and traffic at particular locations with less than one tunnel diameter – about 13 feet – of ground cover. At the same time, to clear a path for Bertha, the team had to remove a number of below-grade portions of existing cylinder pile retaining walls along I-5, an extremely risky proposition. To mitigate risk of movement and maintain ground stability, the team designed the passageway using four large piled and top down constructed concrete boxes for support and access.

This effort resulted in less than an inch movement of the retaining walls and less than a quarter of an inch movement in the roadway pavement.

The construction of the Capitol Hill station required extensive street utility coordination along with the complex siting and coordination of three separate station access points. The University of Washington station platform is about 60 feet below groundwater level, requiring the station walls and base slab be designed to resist full groundwater and soil pressures as well as the uplift pressures. A cost-saving top-down construction method used in the UW station involved constructing floors as the excavation proceeded so that they could also serve as bracing for the walls during construction.

Another component of the project was construction of the 427-foot-long Montlake Triangle Pedestrian Bridge that connects the University of Washington campus with Husky Stadium and the popular Burke-Gilman Trail. The bridge is one of the first U.S. applications of highly curved post-tensioned concrete in lieu of steel. The safety impacts of this pedestrian bridge are expected to increase by 2030 when more than 25,000 people will cross it every day.

The University Link Extension increases mobility for residents but also reduces the city's reliance on cars in this corridor, providing a relatively low impact form of transportation that integrates well with other forms of public transit, including buses, streetcars and ferries.

Construction of the University Link Extension was completed approximately six months early and about $200 million under budget. It offers commuters quick and easy access from downtown to Capitol Hill and the UW campus; in fact, travel time from downtown to the UW campus on the light rail extension is roughly ***nine minutes***.

Seven National Silver Awards

Silver and Judges Award – Transportation
AECOM – First Hill Streetcar
Client: Seattle Department of Transportation

Silver Award – Structural Systems
Degenkolb Engineers & Hart Crowser – Elementary School and Tsunami Safe Refuge
Client: Ocosta School District

Silver Award – Structural Systems
Reid Middleton, Inc. – UAA School of Engineering & Pedestrian Bridge
Client: University of Alaska

Silver Award – Structural Systems
TranTech Engineering, LLC – Broadway Bridge Replacement

Client: City of Everett

Silver Award – Structural Systems
TranTech Engineering LLC– Tacoma Avenue S Bridge Rehabilitation
Client: City of Tacoma

Silver Award – Environmental
Integral Consulting Inc. – Terminal 117 Streets and Yards Early Action
Client: City of Seattle

Silver Award – Waste and Storm Water
Parametrix – Point Defiance Stormwater Project
Client: City of Tacoma

Silver Award – Water Resources
PND/GeoEngineers (joint entry)) – PCCP Cofferdam and Permanent Wall Design
Client: US Army Corps of Engineers

Silver Award – Transportation
HNTB Corporation – I-405/NE 6th to I-5 Widening and ETL Project
Client: WSDOT

The Six Best in Washington State Gold Awards

Gold Award – Unique or Innovative Application of New or Existing Techniques
Otak, Inc. – Willapa Hills Trail Bridge Replacements
Client: Washington State Parks and Recreation Commission

In the late 1800s, the Northern Pacific Railway's South Bend Branch line was built to connect Chehalis and South Bend on the coast of the Pacific Ocean to allow lumber and farm products to come over the coastal range and be delivered to the rest of the country. In the late 1900s as railroad commerce died out in the area, the Washington State Parks and Recreation Commission bought the railroad and converted the route into Willapa Hills State Park. The park includes numerous stream and river crossings, including the two largest over the Chehalis River at Spooner and at Dryad, about nine miles apart. In 2007, a devastating flood on the Chehalis River completely destroyed the two trestles, sending the center steel truss spans downriver. Ultimately, the Federal Emergency Management Agency (FEMA) approved funding to replace both bridges.

Otak, Inc., a premier multi-disciplinary design firm, was hired as prime consultant for the Willapa Hills Trail Bridge Replacements. Otak, was responsible for project management, bridge engineering, trail design, landscape architecture and construction support. Challenges facing the design team included performing

a detailed hydraulic analysis on the river to determine the maximum probable flood elevations since the Chehalis River was well known for its flash floods and large wood debris pile-ups from the surrounding forests.

After completing extensive geotechnical and environmental reconnaissance, ten bridge options were studied for each site. Ultimately, the team decided that a 300-foot clear span bridge, minus a center pier which might create debris pile-ups, along with a steel truss superstructure design would work best for both bridges. But the design team realized that the typical 20-foot-high truss sections (to accommodate a 300-foot clear span) would be extremely difficult to get to the remote sites, and it would be too expensive to assemble the trusses piece by piece. The solution involved the use of post-tensioning tendons inside a grouted duct installed inside a bottom chord, a technique rarely done with steel trusses. But the truss height needed to be limited for shipping while still maintaining deflection control, and in this case, the contractor, Quigg Bros. Inc., was able to adjust the final level or camber of the bridge by varying the amount of post-tensioning. Quigg Bros. also devised and constructed unique long-span erection platforms that allowed the bridge erection to occur without any supports in the river, allowing the team to work outside of the normal fish window.

One of the project's unique problems was the ultimate thinness of the overall structures and whether they would be stable enough for trail users. A thorough analysis of bridge movement revealed that the final stiffness and mass of the structures yielded dynamic characteristics that were in the nearly imperceptible range.

The new safe and durable crossing structures are well above the new predicted flood elevations with ample clearance for the large debris flows that can happen. Also, the foundations for the structures are set far back on the bank and protected with riprap, reducing significantly the potential for scour or lateral river movement.

The re-opening of the trail section over the two new pedestrian bridges represents part of the long-term goal of the Washington State Parks and Recreation Commission to have a trail system that connects the Idaho border to the Pacific Ocean. At a total cost of $3.4 million, or about $400 per square foot, the two bridges' design and construction costs were about 50 percent less than the typical long-span pedestrian bridge.

"Constructing two 300-foot span bridges at remote locations was a challenging endeavor," wrote Brian Yearout, Project Manager with the Washington State Parks and Recreation Commission. "Otak produced a design that satisfied permit requirements, design requirements, FEMA, and was aesthetically pleasing."

Gold Award – Future Value to the Engineering Profession and Perception by the Public
DLR Group – American Airlines Arena Solar Canopy
Client: The HEAT Group

When the AmericanAirlines Arena was built in 1999 to host the Miami Heat basketball team, it was built to the highest sustainable "green" standards, and in 2009 it was one of the first two arenas in the country to receive the prestigious Leadership in Energy & Environmental Design ("LEED") certification from the U.S. Green Building Council (USGBC). This means the stadium is on the cutting edge of sustainability, including green roofing materials, reduced overall energy consumption, water-efficient landscaping, underground parking and "walk-off carpets" that trap dirt and contamination to improve indoor air quality.

In 2016, the DLR Group helped the arena gain another sustainable feather in its cap – the AmericanAirlines Arena Solar Canopy. This 24,000-square-foot canopy entryway integrates 14 solar skylight rings with photovoltaic cells that produce approximately 34,000 kilowatts an hour of energy. Concealed within the soffits of each skylight is a dynamic, color-changing LED light system that can be programmed to illuminate the skylight cavities with changing light patterns creating a vibrant and high-energy environment for fans. Coupled with the solar production of the skylights, the lighting system represents a net-zero energy addition to the facility. DLR Group was the lead design firm on the project and provided electrical and structural engineering.

One of the biggest design challenges was the potential for high winds in the arena's coastal location on Biscayne Bay. The Florida Building Code required a design wind speed of 186 miles per hour, and together with the location's Wind Exposure Category D rating, the design pressures exceeded 250 pounds per square foot for certain elements of the canopy, a consideration that drove nearly every component of the structural design. Also, since the canopy was to be supported by the existing structure of the Arena and an adjacent structure, it had to be lightweight as well as geometrically compatible. DLR Group designed a structural steel framing system that incorporated large diameter, thick-walled (24 inches) steel columns, moment frames and multi-directional cantilevers. The thick steel columns provided the necessary strength to resist gravity, lateral and uplift loads, plus allowed room for the conduits that carried electrical and AV wiring, and facilitated welded connections to provide stability to the arena structure. The columns were partially filled with cast-in-place concrete to make them more fire-resistant.

The new canopy provides a new fan amenity space featuring a bar, food and beverage locations, advertisement displays and retail outlets, enabling the Miami Heat to capture additional revenue from game day concession sales and as a rental space during non-game days. During game days, the plaza is now a hive of activity before the event and during halftime. On non-game days, revenue-generating functions like corporate and charity events, group sales and post-game parties dot the arena's calendar. In addition the AmericanAirlines Arena has hosted concerts by such luminaries as Jennifer Lopez, U2, Lady Gaga, Adele, Britney Spears, Taylor Swift, Celine Dion, Katy Perry and the MTV Video Music Awards.

Gold Award – Social Economic and Sustainable Design Consideration
Landau Associates – Waterfront Place Cleanup & Infrastructure
Client: Port of Everett

The old Everett Shipyard site sits along Everett's waterfront within the Port of Everett's North Marina Redevelopment Project. From 1947 to 2009, Everett Shipyard, Inc. and its predecessors used the site as a boat building, maintenance and repair facility that included marine vessel repairs, tank evacuations, equipment disassembly, sandblasting, woodwork, metal work, painting/coating and mechanical repairs. Soil, groundwater and marine sediment samples tested from the 1980s to 2007 contained measurable levels of contaminants (metals, polycyclic aromatic hydrocarbons, petroleum and marine paint additives such as polychlorinated biphenyls.) But now the site was within a state-designated "Puget Sound Initiative Priority Area" that was the subject of special focus by the Washington State Department of Ecology's Toxics Cleanup Program to clean up and restore bays within Puget Sound by 2020. The Port of Everett faced two major problems: (1) Clean up the contaminated soil, groundwater and sediment at the old shipyard site, and (2) construct new infrastructure to support the planned 65-acre "Waterfront Place Central," a new commercial, recreational and residential district. Construction of Waterfront Place Central could not begin until the cleanup and infrastructure projects were completed.

The solution to both problems was to integrate the site cleanup with the infrastructure improvements as a single project in order to leverage financial, permitting and schedule efficiencies, and to complete the work on an aggressive schedule. This was a tall order that Landau Associates, as design and construction team lead, embraced and completed within a 41-month time frame, allowing construction of Waterfront Place Central to begin in June 2016. Landau's remediation team, comprised of geologists, environmental and geotechnical engineers, environmental scientists, attorneys and biologists, was augmented with civil and structural engineers, maritime industry economists and marina planners. This

diverse team allowed for rapid and comprehensive problem solving and an integrated design that took into account the full range of technical, environmental, economic and regulatory needs and challenges.

The scope of the cleanup action included the excavation and offsite disposal of about 17,000 tons of contaminated soil, and the dredging and offsite disposal of about 11,000 tons of contaminated sediment. Also, the marine railway, the boat haul-out piers, and four of the marina docks needed to be removed to facilitate dredging and to realign the old diagonal navigational traverse of the docks. Approximately 230 meters of bulkhead, including 110 meters of creosote-treated timber bulkhead, needed to be replaced with a new epoxy-coated steel sheet-pile bulkhead, and an array of untreated storm water outfalls needed to be reconfigured into just three outfalls with in-line water filter treatment systems just upstream of each outfall.

The project incorporated the construction of a 230-meter shoreline walkway and guardrail system that is supported by the new bulkhead and a new pile-supported wharf on the northeast corner of the Central Marina as part of the shoreline public access amenities. These amenities helped facilitate the permitting process. In fact, the integration of site development with environmental cleanup accelerated and streamlined permitting for the infrastructure improvements. The U.S. Army Corps of Engineers and state and federal resource agencies were responsive to the project because of the environmental benefit achieved by remediating contaminated sediment.

The Port of Everett estimates that private development at this site will generate $8.6 million annually in state and local sales taxes. Port Commission President Troy McClelland said, “It is in the best interest of the community and the Port to turn these brownfield sites into economic assets, which is why we have taken an aggressive approach to our environmental cleanups. These cleanups don’t get less expensive or less complex.”

Gold Award – Complexity

BergerABAM – P-990 Explosives Handling Wharf No. 2

Client: US Navy, Naval Facilities Engineering Command Northwest

Naval Base Kitsap, where the Naval Facilities Engineering Command Northwest (NFECNW) is located, is the third largest Navy base in the U.S. and is the command for the Navy’s fleet in the Pacific Northwest. It features one of the Navy's four nuclear shipyards, one of two strategic nuclear weapons facilities, the only West Coast dry dock capable of handling a Nimitz-class aircraft carrier and the Navy's largest fuel depot. One key component was missing, though: an explosives handling wharf to serve the Trident Submarine, a project that was not only extremely complex but that also required an elevated level of security.

The Navy tapped BergerABAM, a proven engineering firm with more than 60 years' experience in planning, civil and structural engineering, environmental services, construction management and support, surveying, and underwater inspection services. Berger ABAM became the prime design engineering consultant and the engineer-of-record for the Navy's project, P-990, Explosives Handling Wharf No. 2 (EHW-2) project.

The project, which consisted of 226,900 square feet of pile-supported, over-water construction, included upland vehicular access and supporting utilities, approach trestles, the main wharf plus a warping wharf (a long narrow wharf extension used to position submarines prior to their moving into the operations area). The project also included a steel-framed, high-bay wharf cover with two 120-ton overhead bridge cranes, a multistory support building, on-wharf utilities, and six lightning protection towers.

The EHW-2 facility is situated in a seismically active area in deep water over mudline elevations ranging from -70 feet to -95 feet. It is positioned offshore to reduce the effect on the close-in habitat of Hood Canal. Only a slender trestle crosses the intertidal zone, keeping the main portion of the pier and its associated piling and overwater shading in deeper water to keep the shoreline open for fish passage and eelgrass beds. In fact, the existing shoreline is maintained in a nearly undeveloped state creating a cultural and economic resource of shellfish harvesting for the local Indian tribes. Even storm water from the trestles and warping wharf is captured and conveyed to on-site water quality catch basins where it is treated before being discharged.

For construction, instead of implementing the traditional cost-prohibitive and inefficient batter-pile systems, BergerABAM designed an innovative combination of steel plumb piles in bending and lead rubber bearings (LRBs) mounted on cast-in-place concrete pile caps supported on piles. This design stabilized the LRBs and pile-to-deck connections, allowing the wharf cover, plumb piles and wharf LRB dolphin piles to remain elastic during a seismic event, effectively providing base isolation for the wharf and wharf cover and reducing lateral load demands in these structures.

The design also included precast pile cap and deck elements fabricated off-site at concrete plants where quality of materials and fabrication could be better controlled. The EHW-2 design incorporates the use of composite submarine "camels" – an advanced fiber-reinforced polymer composite material that provides improved corrosion resistance, plus reduced maintenance and overall life-cycle costs.

“This project is extremely important to the mission of the Navy and to our national security, and you can be proud of the results of your efforts in meeting our needs,” David Gibson, the Naval Facilities Engineering Command NW project manager, wrote to the Berger ABAM team.

Gold Award – Complexity
Wood Harbinger – SR 520 Evergreen Point Floating Bridge
Client: WSDOT (KPFF for Design, KGM for Commissioning)

The replacement of the State Route 520 floating bridge over Lake Washington was one of Washington State’s largest transportation projects in recent history, involving many engineering and design firms, plus specialty consultants and contractors. Wood Harbinger was part of the team, hired to provide electrical and fire protection engineering as well as commissioning services. This included lighting for the roadway, navigation, pontoons and under the deck, as well as medium voltage power distribution systems that support the East Landings roadway, the 20,000-square-foot maintenance facility and the floating bridge systems. Wood Harbinger also engineered a stand-alone fire suppression system that extracts water from Lake Washington and distributes it through more than two miles of piping. Finally, the firm provided commissioning services for the maintenance facility building and all systems controlled by the Bridge Control System (BCS), including electrical, fire protection, leak detection, cathodic protection, alarms, and a weather station.

The entire electrical distribution system designed by Wood Harbinger includes 300 miles of electrical wiring. Instead of a traditional conduit system, the firm used strong yet flexible CLX cable that enabled long, continuous runs even over expansion joints in the bridge. The CLX cable was looped at these joints to accommodate expansion and ultimately required about 150 less splices, increasing the reliability of the power distribution system. A 2 MW backup 12.47 kV diesel generator ensures that all bridge equipment will remain in continuous operation with or without utility power for an extended period of time.

Wood Harbinger worked closely with the BCS designers to develop a reliable communication network. The BCS system comprises the bridge’s central nervous system, a network of electrical systems communicating over fiber optics. The communication cabling is also a looped system connected to each pontoon, so if there is a break in the fiber loop, bi-directional communication will continue on both sides of the break. The leak detection, bridge fire protection, generator, lighting, intrusion detection, cathodic protection, weather station and alarm systems are all included in this network and can be remotely monitored and controlled from the Maintenance Facility.

The fire protection systems design presented some unique challenges. Because the road deck sits 20 feet above the water at mid-span, and higher at each of the landing approaches, it would not be possible

for a fire truck to draw water out of the lake to fight a car fire on the bridge. So Wood Harbinger designed a system that includes four vertical turbine fire pumps, a 1.4-mile-long, 8-inch standpipe, and a dozen hydrant connections on the road deck for fire department use. When the fire protection system is activated, the piping fills with lake water in less than 10 minutes, supplying 1,000 gallons per minute to a single fire hydrant. The Traffic Management Center operator can remotely start the fire pumps to allow time for the fire suppression system to fill while the fire department is in transit to the scene.

In its commissioning role, Wood Harbinger developed a tailored commissioning plan, witnessed system installation and startup, and developed and performed integrated functional testing for the systems. Endurance tests were implemented to ensure life safety systems were operational before the bridge opened to the public. Throughout the commissioning, Wood Harbinger engineers scaled the 10-story sentinel tower stairs to access the site, climbed up and down pontoon cell access ladders, walked miles across the bridge, sometimes exposed to the cold, wind and rain, and dealt with the high humidity that kept it cold inside the concrete pontoons during the winter.

Wood Harbinger summed up its efforts in their entry: “A bridge is indeed a feat of engineering, and structural expertise is the standard-bearer of its excellence. Yet systems behind the scenes elevate these beacons of civilization to marvels of modern transportation. From the intelligent controls that maintain the orderly flow of movement, to the illumination that lights the way, with electricity empowering myriad systems, and fire-fighting capability that safeguards thousands of lives every day, it’s truly a team effort to bring a bridge to life.”

Gold Award – Successful Fulfillment of Client/Owner Needs
Welch Comer Engineers – Hawthorne Avenue, Walnut to Chestview
Client: City of Colville

The City of Colville (pop. ~5,000) is the county seat of Stevens County in Northeastern Washington. The city’s residents work predominately in agriculture, timber and mining. They also are committed to making their community safe, accessible and more livable. Hawthorne Avenue crosses the city from East to West, connecting schools, churches, a city park and many residences, but the deteriorated avenue was very wide and difficult to cross. Its on-street parking was rarely used, and there were no pedestrian or bicycle facilities, nor was the street ADA (Americans with Disabilities Act)-compatible due to uneven surfaces and connections with driveways.

In 2013, Welch Comer Engineers helped the city develop the Hawthorne Avenue Strategic Plan that included utility coordination, conceptual roadway designs, estimated costs, public involvement and a strategy for funding. The plan recommended two new strategies: a “Road Diet,” and the “Complete

Streets Ethic." The Road Diet modifies an existing public right-of-way from one that gives full priority to the motor vehicle to one that is designed for all users, including pedestrians and bicyclists. The Complete Streets Ethic is used to evaluate the best use of public space to balance the needs of all users.

After the first phase of renovations to Hawthorne Avenue in 2015, the city hired Welch Comer Engineers to help them with phase two of the redesign and reconstruction, this time between Walnut Street and Crestview Drive. The project provided for the narrowing of the roadway, eliminating on-street parking, then reconfiguring the extra space for a shared-use pathway and a wider sidewalk separated from the street by a "hardscaped" buffer – made primarily of colored and scored concrete punctuated with drought-resistant trees that would require little to no irrigation or maintenance.

This phase of the Hawthorne Avenue reconstruction faced challenging road profile grades of up to 13 percent, meaning driveways frequently didn't match up with the road, a situation that would make travel by the disabled difficult to impossible. Also, the ground beneath the city is mostly clay and silt which is not ideal for building heavily travelled roads. Welch Comer worked with a geotechnical firm to design Cement Treated Base (CTB) to strengthen, or "bridge," the weak material. Once the subgrade elevations were established, specific quantities of cement and water were mixed with the clay/silt soils to create a 10-inch layer of rigid foundation material over which sealing, leveling and asphalt were applied. This construction innovation was even used under the pedestrian ramps to prevent seasonal differential frost heaving between the road and the ramps.

The ever-present groundwater obstacle was another challenge in this project. Groundwater was so prominent that it was actually seen flowing into open trenches. Waterline and storm sewer construction required excavating deep into saturated clay soils and flowing water. Any saturated material removed from these utility trenches was replaced with existing base rock and ballast material that was reclaimed from the existing road section.

According to Eric Durpos, Municipal Services Administrator for the City of Colville, "Welch Comer's skill in helping the City prioritize, develop a vision, and construct community-inspired projects are some of the reasons our collaboration has resulted in successful projects like Hawthorne Avenue, Walnut to Crestview."

Nine Best in State Silver Awards

Silver Award – Unique or Innovative Application of New or Existing Techniques
HWA GeoSciences, Inc. – Corrosive Issues for US Embassy in Mauritania
Client: US Department of State

Silver Award – Unique or Innovative Application of New or Existing Techniques
Wood Harbinger – Enatai Elementary School

Client: Bellevue School District (Integrus Architecture)

Silver Award – Future Value to the Engineering Profession and Perception by the Public
Notkin Mechanical Engineers – Historic Pacific Tower Renovation
Client: Seattle Central College/Schreiber Starling & Whitehead

Silver Award – Social Economic and Sustainable Design Considerations
DLR Group – Google Kirkland Campus – Building D
Client: SRMKII, LLC

Silver Award – Social Economic and Sustainable Design Considerations
Herrera Environmental Consultants, Inc. – Port Angeles Landfill Cell Stabilization
Client: City of Port Angeles

Silver Award – Complexity
David Evans and Associates, Inc. – Cushman Trail
Client: City of Gig Harbor

Silver Award – Complexity
DOWL – Boeing 737 MAX Flightline Utilities
Client: Boeing

Silver Award – Successful Fulfillment of Client/Owner Needs
Jacobs Engineering Group – Lodge Creek Culvert Replacement
Client: Kittitas County

Silver Award – Successful Fulfillment of Client/Owner Needs
RH2 Engineering – Butterfield Water Treatment Plant Intake
Client: City of Pasco

12 Best in State Bronze Awards

David Evans and Associates, Inc. – Potter Road South Fork Nooksack River Bridge #148
Client: Whatcom County Public Works

DCI Engineers – Spokane Convention Center Expansion
Client: Spokane Public Facilities District

Exceltech Consulting Inc. – Redondo Boardwalk Repair Project
Client: City of Des Moines

GeoEngineers, Inc. – Sanpoil SR 21 Emergency Spill Response
Client: Able Cleanup Technologies, Inc.

Kleinfelder – Runway 16C-34C Reconstruction
Client: Port of Seattle

Otak, Inc. – Bucklin Hill Bridge & Estuary Enhancement
Client: Kitsap County

Otak, Inc. – Dungeness River Railroad Trestle Replacement
Client: Jamestown S'Klallam Tribe

Parametrix – LOTT BITP SES Replacement
Client: LOTT Clean Water Alliance

T-O Engineers, Inc. – Felts Field Taxiways & Taxilanes Recon
Client: Spokane Airports

Transpo Group USA, Inc. – Madigan Access Improvement Project
Client: City of Lakewood

WSP Parsons Brinckerhoff – Swift Green Line Small Starts Grant Submittal
Client: Community Transit

Entries were evaluated by a distinguished panel of judges including:

Rich Reis – Engineer/Consultant
Jeff Carpenter – WSDOT – state design Engineer
Steve Johnston – retired Engineer
Bob Axley – retired Engineer
Ben Minnick – DJC – Construction Editor

The American Council of Engineering Companies of Washington is a professional trade association representing consulting engineering, land surveying and affiliated scientific and planning firms statewide.

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