

on the piers until you'd driven the piles if you were going to use cast-in-place concrete," Poulson says. "But we're going to be able to precast the piers out in front of the piles being driven, so as soon as the piles have been driven we'll be able to float one of these precast units in and be good to go." Using precast elements will save money by shortening the construction schedule. It will also make for a safer working environment in that the workers will be on land rather than on water, according to Poulson.

The paths for pedestrians and cyclists that will extend along the outer side of each bridge will be supported by the same piers as those supporting the vehicle deck, but the paths will be separate from, and lower than, the main deck. "We wanted to enhance the pedestrian experience and encourage this to be a more pedestrian-friendly, bicycle-friendly facility," Durshimer says. Placing the pathway at a lower level will separate the pedestrians and bicyclists from vehicular traffic; a barrier at least 53 in. tall will add to safety. Employing separate structures will also serve to protect pedestrians and bicyclists from the vibrations created by passing vehicles. "Overall we feel like it's going to be a better experience because people are going to feel protected from the vehicular traffic," Durshimer says. "They are not going to feel the wind buzzing by them from the traffic as they're riding their bikes out here."

Community input influenced the decision to add two paths for pedestrians and cyclists to the crossing rather than just one, according to Poulson. "It also led to the prominence of the aesthetic [design]," he notes.

At night the bridges will be lit so that they will act as a "ribbon of light" across the bay, according to material distributed by the engineers. Given the importance of the crossing's appearance, seven longitudinal conduits will extend seamlessly along the full lengths of both structures to hold the wiring for intelligent transportation systems, roadway lighting, and aesthetic light-

ing. "The conduit network that must be run within the superstructure is the largest our team has seen on a bridge project," Durshimer notes.

Charles Rudie, P.E., a bridge designer and the manager of the project for WSP | Parsons Brinckerhoff, noted in written statements provided to *Civil Engineering* that perhaps the greatest challenge was the need to balance "the owner's and community's desire for a signature facility with enhanced aesthetics" with the desire for an efficient structure that would be "subject to complex ship impact and coastal hydraulic (hurricane) loads." Furthermore, this balance would have to be arrived at within the confines of a competitive design/build contract. "In order to accomplish this balanced design, extensive

EMPLOYING SEPARATE STRUCTURES WILL SERVE TO PROTECT PEDESTRIANS AND BICYCLISTS FROM THE VIBRATIONS CREATED BY PASSING VEHICLES.

communication with all project partners and a highly advanced and iterative preliminary design was required," he said.

After the first of the two bridges is built, all traffic will be routed onto it, and the existing bridge will be demolished, according to the FDOT. Once the second structure is completed, traffic will be shifted to its final arrangement.

On-site construction is currently slated to begin in the spring, with an 860-day schedule being the goal, according to the FDOT website. The design/build team stands to earn a \$15-million bonus by completing all construction work and opening the first bridge to traffic by January 27, 2019, according to the FDOT.

In addition to the crossing itself, the project includes reconstruction of the bridge approaches, as well as improvements to the public facilities at an adjacent park in Gulf Breeze. All work on the project is expected to be complete by the summer of 2020.

—CATHERINE A. CARDNO, PH.D.

INFRASTRUCTURE FUNDING

Growing Spending on Nature-Based Solutions Protects More Water Sources, Report Says

WITH GROWING recognition of the value of ecosystem services for protecting water sources, governments and other entities around the world spent nearly \$25 billion in 2015 on nature-based solutions to secure water supplies, reduce water pollution, decrease flooding, and achieve a host of related environmental benefits, according to a recent report. Funding for efforts to protect and restore such "natural infrastructure" as forests, wetlands, and grasslands has increased steadily in recent years, with Asia and Europe spending the most.

The report, *Alliances for Green Infrastructure: State of Watershed Investment 2016*, was released in mid-December by the Web-based information platform Ecosystem Marketplace. Based in Washington, D.C., Ecosystem Marketplace reports on environmental finance, markets, and payments for ecosystem services. The report defines "watershed investment" as "any transaction between a buyer and seller where financial value is exchanged for activities or outcomes associated with the maintenance, restoration, or enhancement of watershed services or natural areas considered important for watershed services." In this way the report distinguishes between traditional spending on "green" infrastructure and market-based payments intended to secure certain watershed services. For example, city funding to plant trees along public sidewalks would not be included in the study because no incentive or payment is involved, according to the report. By contrast, payments by the city to private property owners to install green roofs or rain gardens would be included.

The report outlines spending conducted by means of four mechanisms: public subsidies for watershed protection, user-driven watershed investments, water quality trading and offsets, and environmental water markets. Provided by governments, public

subsidies are paid to land managers to enhance or protect ecosystem services. By contrast, user-driven watershed investments involve payments from water users, including companies and water utilities, to landholders or others in exchange for measures to conserve, restore, or create green infrastructure. Water quality trading and offsets enable water users to pay others to engage in activities to improve water quality or supply so as to offset their own effects on the environment. Usually based on compliance, such programs involve the purchase of “credits” in an established market. Finally, environmental water markets entail the purchase or lease of water rights either to benefit the environment—a practice commonly referred to as in-stream buybacks—or to maintain aquifer levels by offsetting the effects of groundwater pumping. Such markets are found predominantly in Australia and the western United States.

Of the four mechanisms, public subsidies for watershed protection accounted for the largest chunk of spending by far, amounting to \$23.7 billion in 2015, or 96 percent of the overall amount tracked by Ecosystem Marketplace. “These public subsidies for watershed protection specifically targeted and rewarded sustainable agricultural, pastoral, or forest management practices that supported healthy watershed function,” the report stated. Typically provided by supranational, national, or state and provincial governments, such subsidies “have scaled up rapidly in recent years, growing an average of 14.6 [percent] in value per year from 2013 to 2015,” the report states.

In particular, China and the European Union have led this trend of providing green agricultural payments, according to the report. “In a sense, the traditional agricultural subsidy model was retrofitted to help reverse some of the effects stemming from governments subsidizing agricultural intensification and land-clearing through traditional agricultural subsidy programs in the twentieth century: now governments are using the same institutions to support a greener economy in the twenty-first century,” the report states (emphasis in original).

In China, national and provincial governments spent \$13.5 billion to protect watersheds in 2015. Governmental leaders in China are using public spending to address “very significant threats to water security,” says Genevieve Bennett, a senior associate at Ecosystem Marketplace and the author of the report. In particular, the subsidies pay for such efforts as combating erosion, reforesting hilly farmland, and increasing biodiversity. At the same time, such spending also helps to support rural communities that have not enjoyed the same degree of economic growth as urban areas, Bennett says,

CONSTRUCTION COMMENCES ON POLAND'S TALLEST TOWER

AT 310 M, VARSO TOWER, which is to grace the Polish capital of Warsaw, will be the tallest building in the country. Completion is expected in 2020, and the structure will easily surpass the previous record holder, the 231 m tall Palace of Culture and Science, also in Warsaw. Varso Tower was designed by London-based Foster + Partners for the international real estate developer HB Reavis. The international firm Bu-



roHappold Engineering was responsible for the structural engineering. The overall project, known as Varso Place, will also include two smaller towers designed by Warsaw-based HERMANOWICZ REWSKI ARCHITEKCI. The mixed-use, 53-story Varso Tower will offer a number of public amenities, among them an observation deck at the 230 m level and a two-level restaurant at the 46th and 47th floors. At ground level, it will feature shops, restaurants, and cafés, as well as “covered internal streets . . . open to all throughout the year,” explains a Foster press release. Located adjacent to Warsaw’s central railroad station, Varso Place is expected to “revive the most centrally located brownfield area in the capital city by bringing new life to the vicinity,” the release adds. The neighborhood had been razed during World War II and was never fully revitalized, explains an HB Reavis

announcement. The site will feature four public squares and extensive new plantings and outdoor furniture. The location will also provide easy access to numerous transportation links, including the Warsaw metro system and commuter trains, as well as to some 30 bus and tram lines. Four levels of underground parking will be supplemented by storage space for 750 bicycles to accommodate a nearby bike path, explains a press release from Epstein, the Chicago-based firm serving as the project’s architect of record. Varso Place is being designed to conserve water and electricity and to limit air pollution. It is expected to be the first project of its size in Poland to be certified as outstanding in the BRE Group’s BREEAM (BRE Environmental Assessment Method) appraisal.

and have also experienced environmental degradation.

Although far smaller in scope than public subsidies, user-driven watershed investments also have grown in recent years. In 2015 such investments totaled nearly \$657 million, an increase of more than 10 percent over 2014's roughly \$595 million, Bennett says.

Again, the public sector led the way in terms of user-driven watershed investments, led primarily by governments at the state, regional, or provincial level. Additional buyers included water utilities, for-profit private-sector entities, and nongovernmental organizations and donors. A key goal of all buyers was to "reduce risks to water resources or infrastructure from land-use decisions" in a given watershed, according to the report. Other goals includ-

ed reducing carbon dioxide, increasing biodiversity, and complying with environmental regulations. For the private sector, the main reasons for participating were to "enhance brand value" or "demonstrate leadership on water resource challenges," the report states.

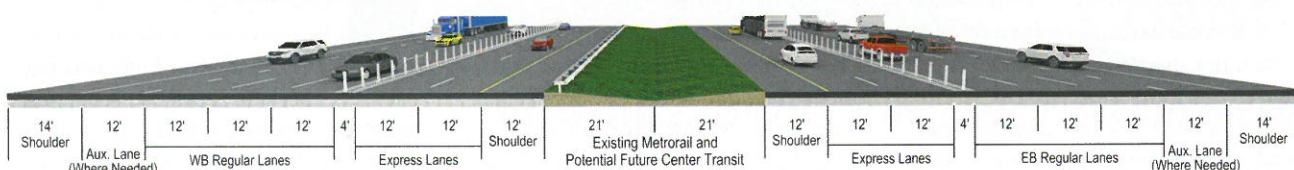
As for water quality trading and offsets, the report listed 22 operational programs that generated \$31.1 million worth of credits in 2015, an all-time high. Of these programs, 16 were in the United States, with the remainder based in Australia, New Zealand, and the United Kingdom. "Collectively, water quality trading markets kept more than [30 million] pounds of nutrient pollution out of waterbodies in these countries in 2015," the report stated.

Environmental water markets involving 20 programs conducted trans-

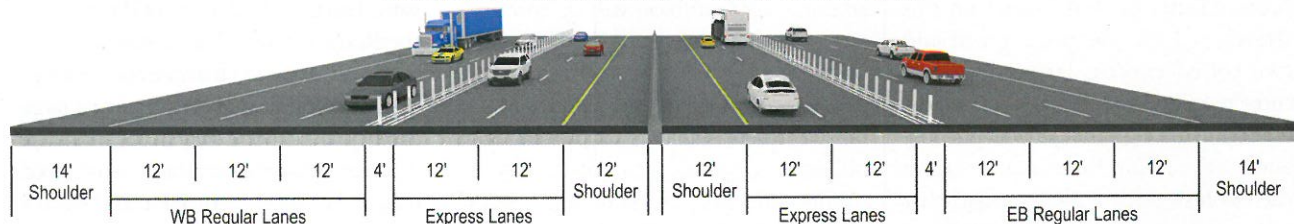
actions valued at \$93.3 million in 2015, an increase of nearly 20 percent above 2014 levels, Bennett says. However, the total remains well below that of earlier years, largely because of sharp cutbacks on the part of Australia's government in buying back water rights from farmers.

All told, spending on all forms of watershed investment worldwide created new habitat on 487 million ha of land, an area roughly 1.5 times the size of India, according to the report. As for the beneficiaries of the funding, private landholders received \$9.8 billion, while households or individuals on lands owned collectively or owned by indigenous peoples and managed according to their customs earned \$6 billion. Some \$7.6 billion was spent to protect public lands. —JAY LANDERS

CROSS SECTION OF GAINESVILLE TO MANASSAS, CENTREVILLE TO BELTWAY SEGMENTS



CROSS SECTION OF MANASSAS TO CENTREVILLE SEGMENT



TRANSPORTATION

Virginia Proceeds with Plans to Add Express Lanes to Busy Stretch Of Interstate 66

AFTER selecting a private partner in November to conduct a high-profile surface transportation project in northern Virginia, the Virginia Department of Transportation (VDOT) kicked the effort into high gear in December. That month VDOT completed a comprehensive agreement with the private team hired to carry out the Transform 66—Outside the Beltway project, an undertaking expected to cost more than \$2 billion to reduce traf-

fic congestion along Interstate 66 immediately west of the Capital Beltway, or I-495. By the end of December VDOT had also instructed the private entity to begin additional design work on the critical project, which will add express lanes to an approximately 22.5 mi long stretch of the heavily traveled east–west highway in Fairfax and Prince William counties.

In early November Governor Terry McAuliffe announced the selection of a consortium known as Express Mobility Partners to finance and deliver the Transform 66—Outside the Beltway project. The consortium includes Cintra and Meridian as equity partners and developers, Ferrovia Argoman US Corp. and Allan Myers VA, Inc., as the principal contractors, and Louis Berger as the principal engineer. As part of the public-private

partnership, the private team will finance, design, build, maintain, and operate the project. Express Mobility Partners prevailed over one other team, a consortium of Transurban and Skanska known as I-66 Express Partners.

The Transform 66—Outside the Beltway project entails the addition of various multimodal improvements to a stretch of I-66 that extends from I-495 on the east to University Boulevard near Gainesville, Virginia, on the west. In its current configuration, a 9 mi long segment running west from I-495 has one high-occupancy vehicle (HOV) lane and two general-purpose lanes in each direction, according to Tamara Rollison, a VDOT spokesperson. (Rollison provided written responses to questions from *Civil Engineering*.) Moreover, one