



TOP LEFT

The Hunters Hole project site was regraded in March 2011.

TOP RIGHT

Hunters Hole planted in July 2012.

RIGHT

Hunters Hole with plant communities established in March 2014.

COURTESY OF U.S. BUREAU OF RECLAMATION, TOP LEFT



FLUID BOUNDARIES

**WETLAND RESTORATION ON THE LOWER COLORADO RIVER
YIELDS PRACTICAL LESSONS FOR TWO COUNTRIES'
ARID EXPANSES.**

BY JONATHAN LERNER / PHOTOGRAPHY BY FRED PHILLIPS, ASLA





AESTHETICS apparently didn't figure in when the United States–Mexico border fence went up. The barrier has no consistent design. Some of it is corrugated steel, some mesh. In some places, it is augmented with barbed wire; in others it is composed of close-set concrete bollards supporting an “anticlimb plate” tilted back overhead at a 45-degree angle. In urban areas where it went up earliest it can look rusty now, trashed with graffiti. But at the southwestern corner of Arizona where the international frontier follows the Colorado River for 22 miles, the fence has a tidy, machinelike regularity. Here it consists of tall, square steel tubes below and smooth horizontal panels above. Anyone hoping to climb over would find nothing to grab for but the top edge, which is in any case unreachable high. Jagged mountains hang in the distance, but terrain along the river is flat, so the fence does not undulate with grade as it does in other locations. It's just a dark line scored across the sun-blasted landscape.

On this part of the border there is another fence as well, which intruders encounter first. Those on foot might climb through its bristling, crisscrossed steel rails, but it was designed to interdict vehicles, not people. Diversions of the Colorado's water upstream support vast agricultural regions in Arizona and California, and thirsty metropolitan areas—Las Vegas, Los Angeles, and Phoenix among them. Apart from an occasional trickle, the river along here is dry. Any vehicle capable of maneuvering on powdery silt and fine sand could easily make the crossing. Before the fences went in, “that whole area was ground zero for illegal immigration,” a major crossing point

for both armed smugglers and undefended migrants, recalls Carlos Dominguez, a special operations supervisor with the Department of Homeland Security. “You had *banditos* that would commit some serious crimes down there, from rape to robbery to assault, not only on the people coming across but also...border patrol agents.” At one location on the U.S. side, called Hunters Hole, a spillway and siphon had been dumping occasional overflows from the region's network of irrigation and drainage canals. As a consequence, this spot was thickly overgrown. “You had all this nonnative vegetation like salt cedar that provided concealment for these bandits. You couldn't see five feet in front of you,” Dominguez says.

The region where the U.S.–Mexico border and the Colorado River corridor coincide is called the *limitrophe*. That's a technical term meaning an edge zone. Though obscure in English, and only slightly less so—*limitrofe*—in Spanish, it's common parlance in this geopolitically and environmentally stressed locale. It comes from the Latin *limes*, boundary, and the Greek *trephein*, nourish, originally describing frontier regions that provided subsistence for armies. Today in the *limitrophe* there are no massed troops, though before the fence the National Guard was deployed there. Now you just see solitary border patrol agents, cruising in their green and white Chevy Tahoes; others must be somewhere remotely monitoring signals from the sensing equipment mounted on high poles here and there. But nourishment is definitely happening in the *limitrophe*, an ambitious effort to reestablish native plant communities and the habitat they provide. In addressing the degradation of the



river corridor, this undertaking transcends the international border. It has implications for law enforcement, too. A pilot project on some 35 acres at Hunters Hole is its ground zero. A similar-sized pilot, across the border in the farming community of Colonia Miguel Aleman, Baja California, is ground zero plus one.

Leading the effort is Fred Phillips, ASLA, who is probably more experienced than anybody at repairing riverside wetland habitat in this desert environment. Two decades ago, just out of college, he went to work for the Colorado River Indian Tribes, designing and directing the restoration of some 1,000 acres along the river on their reservation near Parker, Arizona, two hours' drive north of the border (see "Desert Passage," *LAM*, March 2000). In 2000, he was hired by the Yuma Crossing National Heritage Area to do something similar in the river corridor adjacent to that historic city at the northern edge of the limitrophe (see "The Same River Twice," *LAM*, November 2009). Phillips is a hands-on kind of guy. The Yuma riverfront, when he went to work there, was all "freaking pit bulls, two-story plywood houses, people selling meth," he remembers. "There was 15- to 20-foot-high *Phragmites*—you literally had to crawl on top of it. We would put on long-sleeve shirts, duct tape cardboard to our forearms, duct tape our gloves to the cardboard. We'd have a dust mask, a hat, and we would spend all day crawling through this nastiness. With mace, because of the dogs and the indigents we ran across." Now a 350-acre section of the Yuma East Wetlands is a thriving conservation and recreation area, with the remaining 450 acres permitted

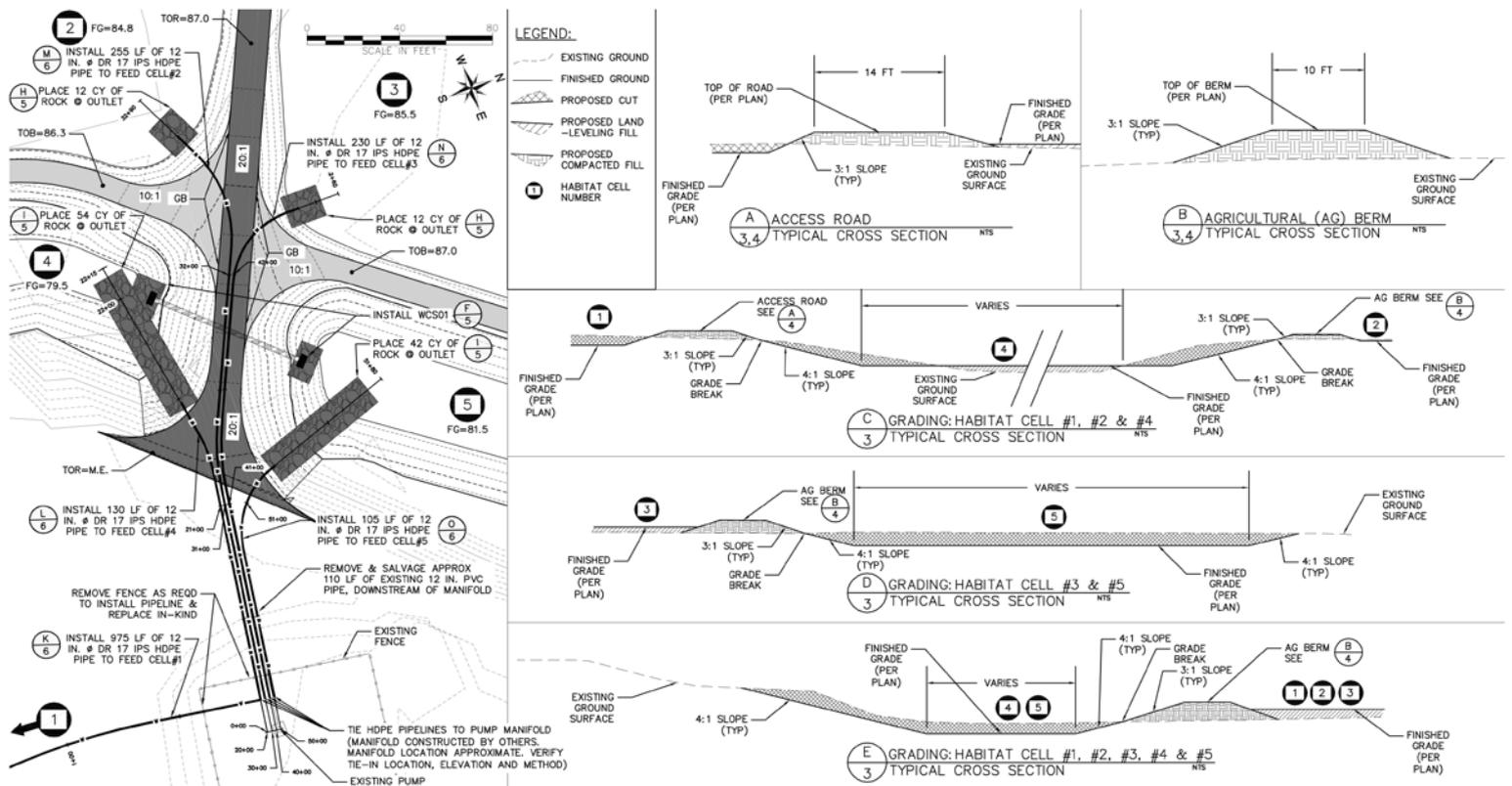
and ready to go. More recently, with funding from the Pacific Institute, Phillips's Flagstaff-based firm Fred Phillips Consulting created another 1,200 acres of wetland just above the Laguna Dam, 20 miles north of Yuma.

His approach, refined through trial and error over the course of all these projects, is conceptually pretty simple. Restoring the riverine landscape of the entire Colorado, and the natural flood cycles it once depended on, is out of the question. There is too much development and investment along the river to allow flooding. Besides, more water is already allocated to various users than actually flows in the Colorado, a situation exacerbated by the current long-term drought. In the limitrophe and farther south in the delta, most of the river has no reliable flow at all. So Phillips looks for old oxbows or locations near canals or wells, spots that can tap a water source with some regularity or that already have a relatively high water table; 11 feet of depth to water, for example, which can sustain mesquite, counts as a pretty high water table in these sere parts. But wherever there has been any water, rampant invasive plant species will have thrived and must be cleared, a procedure tantamount to scraping the earth bare. More earth moving is required to contour new zones hospitable to the various plant communities that will be reintroduced. Then, using fairly rudimentary and, where possible, existing infrastructure—dikes, spillways, and stoplogs, pumps, and pipes—Phillips establishes "flood cells" that can hold what water is delivered to them as long as possible. To be sustainable, "we've got to restore the areas that are already supporting stuff and expand on those—create ↘

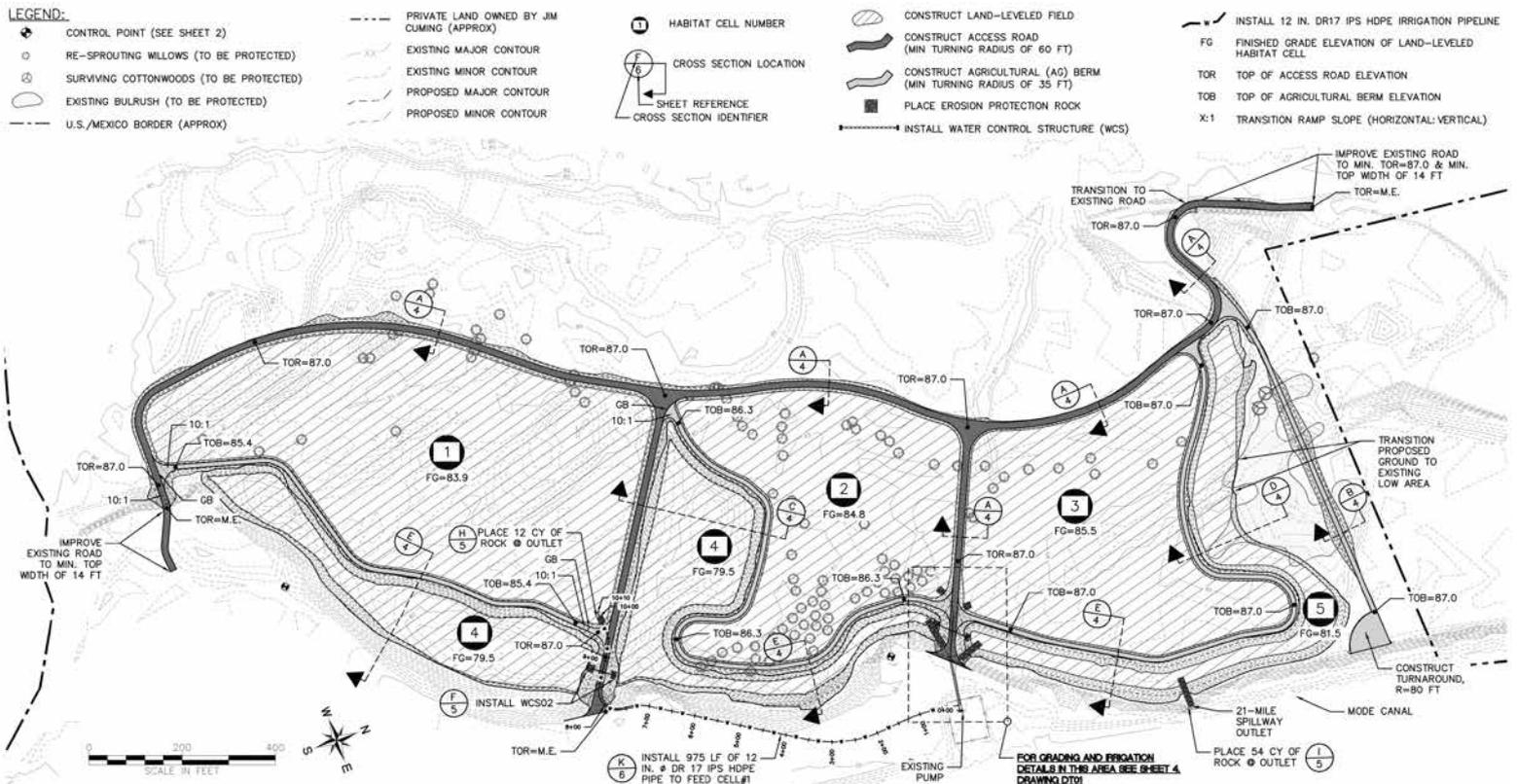
ABOVE
Hunters Hole
in August 2013.

OPPOSITE
The project lies outside
the U.S. border fence.
Beyond the dry river
channel, in Mexico,
are farm fields.

GRADING AND IRRIGATION PLAN AND DETAILS



GRADING AND IRRIGATION PLAN



NATURAL CHANNEL DESIGN/FRED PHILLIPS CONSULTING, TOP: NATURAL CHANNEL DESIGN, BOTTOM



→ an infrastructure where we can dump water in and keep it in," he says. As for all that earth moving, "We're not talking about gingerly restoring landscapes. It's wholesale reconstruction. The Colorado, when it was flowing at 300,000 cubic feet per second—the river's largest known predam flow—"wasn't a gentle river. It destroyed millions of cubic yards of dirt every day. So a bulldozer is nothing compared to what a river can do."

The project at Hunters Hole was initiated by the Yuma Crossing National Heritage Area, even though the heritage area's defined boundaries do not extend into the limtrophe. "That did not prevent this private nonprofit, on a voluntary basis, from being involved," says Charles Flynn, its executive director. The Hunters Hole effort drew on the visible success of his organization's Yuma East Wetlands restoration, which required not only sensitive environmental engineering but also difficult politicking among groups whose agendas often conflict: local and federal government entities, the Quechan

Indian Tribe, environmental groups, and private landowners. "Our attitude is, whatever we do on the East Wetlands can serve as a model to extend up and down the river, however long it takes. Where it's outside our ability to do directly with our own funds, we can involve the other communities to come see how it works," Flynn says, and to show "that these aren't barriers that are impossible to bridge." The heritage area's involvement is just one of many instances of Hunters Hole participants operating outside their normal bailiwicks. The productive synergies that can flow from a shared willingness to do so may be as valuable as the landscape work itself.

Hunters Hole had an even more complex array of participants than the East Wetlands project. Added to the mix were not only the Mexican counterparts of the American governmental entities and nongovernmental organizations (NGOs), but also multiple law enforcement agencies on the U.S. side. In fact, Phillips's first concept plan, in 2007, was titled *A Demonstra-*



tion Project to Combine Environmental Restoration with Border Protection and bore the tagline: “Innovations in Homeland Security.” He quips, “You’ve got to have an angle when you’re dealing with Border Patrol and Homeland Security.” That first plan was for all 435 acres of Hunters Hole, an area many times larger than the pilot project that was eventually executed. It proposed creating a five-mile-long “moat” by excavating a historic oxbow channel to be filled from ground wells, and using the spoils to construct a 12-foot-high perimeter levee that could be patrolled by border agents; the fence had not yet been built in the limitrophe, and these features were conceived as an alternative to it. Phillips also called, of course, for reestablishment of appropriate habitat types. He remembers, “Homeland Security was like, ‘We just got done bulldozing all the tamarisk in the corridor so we can see all the criminals running across. Why the hell would we want a cottonwood-willow forest and a bunch of marsh?’” Also, without offering any detailed scheme, the concept plan

identified possible locations for a pilot restoration project on the Mexican side.

Dominguez, of Homeland Security, has strong personal ties to Hunters Hole. “It’s a place where I grew up, and it’s my office space now, where I patrol,” he says. Back when there was water dependably flowing in the river channel, “that’s where my grandfather would take us to swim or fish. During the fall there were a lot of duck hunters. But before the restoration project, to see it as a wasteland was very sad.” Still, when he and his colleagues considered Phillips’s concept plan, “We were hesitant. We knew they had done it over there in the East Wetlands, which before was a bunch of hobo camps, a lot of drug use, a lot of crime,” he says. “But when he talked about the moat, we were concerned.” The thought was, “‘If this area is that highly trafficked, we’ll end up with a lot of drownings.’ Our mission is to protect the country’s borders, but at the same time, we’re humanitarians. When somebody’s in distress, you don’t care what nationality or legal status.”

TOP RIGHT
Mesquite pods from the Hunters Hole site are collected for repropagation.

BOTTOM RIGHT
Phillips’s team investigates a lack of residual moisture in the river channel four months after the pulse flow.

OPPOSITE
The design of Hunters Hole incorporates improved roads for the Border Patrol to use.

SOIL SALINITY LEVELS AT SURFACE DEPTH

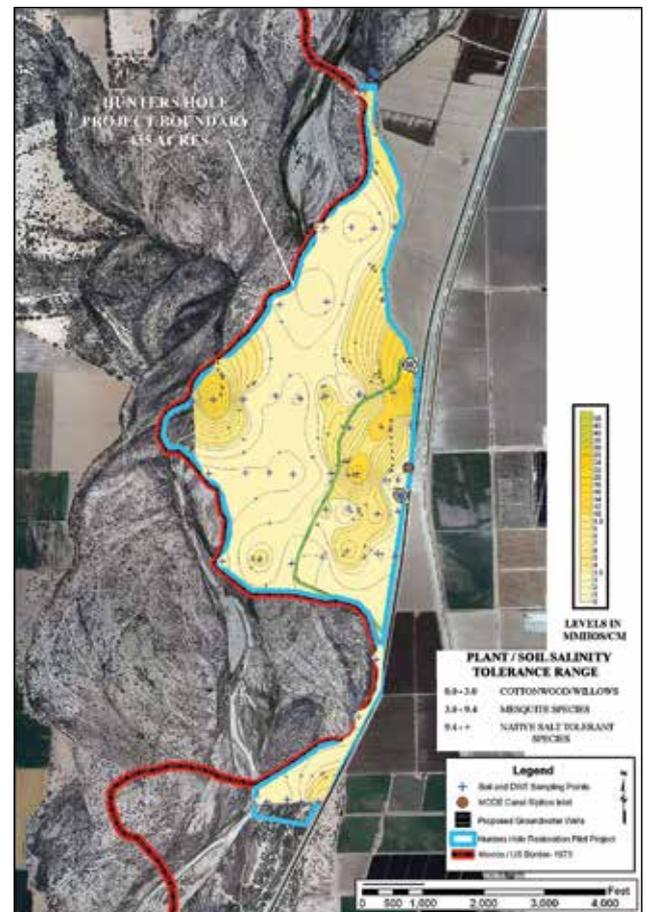


TOP
A fire devoured Hunters Hole during a period of crisis on the border in 2008, cause unknown.

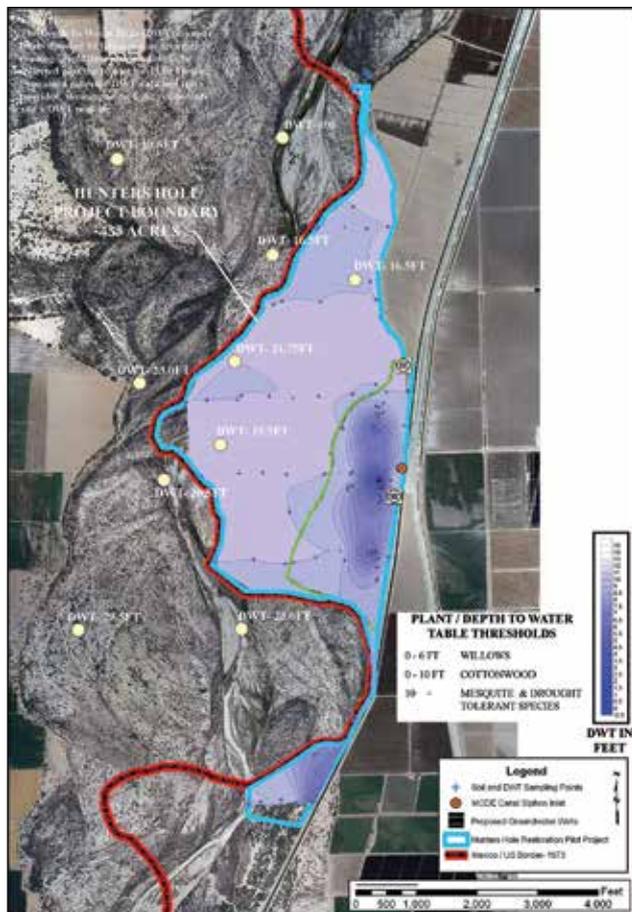
ABOVE
The newly planted Hunters Hole flooded for the first time in January 2011.

LEFT
Planting transects are established for ongoing research at Hunters Hole.

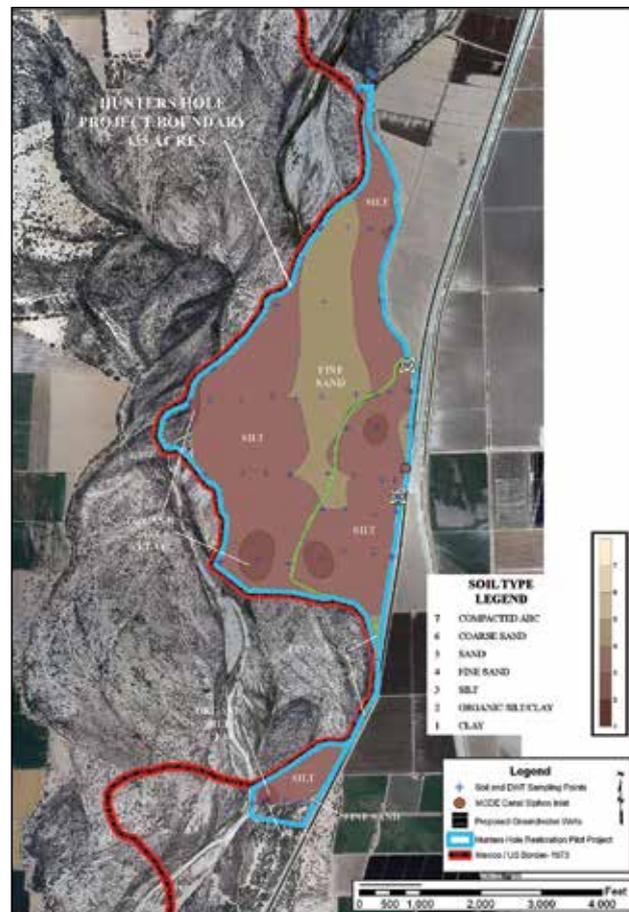
RIGHT
Reestablished vegetation, October 2013.



DEPTH TO WATER TABLE LEVELS



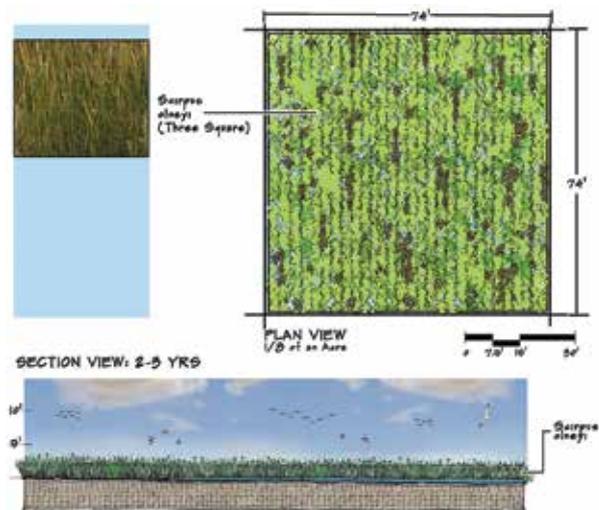
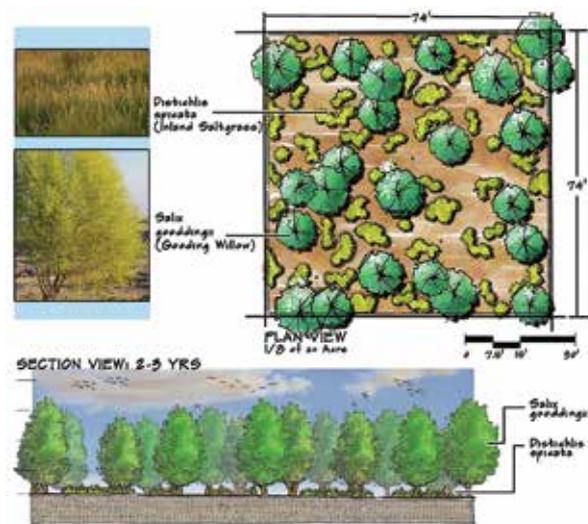
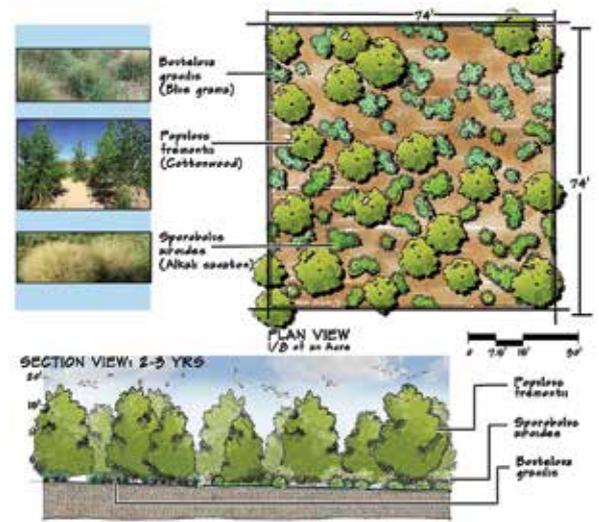
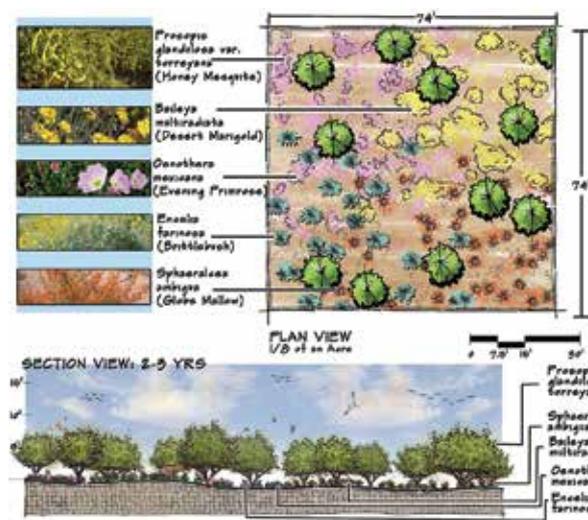
SOIL TEXTURE TYPE AT SURFACE DEPTH



“WE JUST GOT DONE BULLDOZING ALL THE TAMARISK. WHY THE HELL WOULD WE WANT A COTTONWOOD-WILLOW FOREST AND A MARSH?”

The moat idea was eventually abandoned. For one thing, the soil proved impracticably thirsty. In a test, Phillips’s team tried filling the oxbow from a Bureau of Reclamation well on the site. He says, “We turned on the pumps and let them run for two solid months, and filled up maybe two-thirds of the channel. It was dry in three days.” Then the fence was built, obviating the need for both the moat and the perimeter levee. Dubious law enforcement personnel were taken to visit the East Wetlands to judge the improved visibility afforded by the mesquite, cottonwood, and willow habitats that would replace Hunters Hole’s invasive shrubs and grasses. The plan was also revised to include drivable roads that provide sight lines through the project area and across the riverbed into Mexico. “When we bulldozed the site, we designed it to their specs,” Phillips says. The border fence runs just to the American side of Hunters Hole; the restored wetland is U.S. territory, but it’s not really designed for recreation. There’s an agent present whenever the access gates are open. Someone who tried visiting there, Phillips notes, “would be watched by all the cameras, sensors, and border patrol agents the entire time.”

“I never in my wildest dreams thought that I would be working with people who preserve wildlife, people who were in the designing phase of landscape,” Dominguez says. If helping plan a wetland restoration was a stretch for this law enforcement officer, mediating and developing policy among a diverse international cohort of actors—hardly standard landscape architecture school curriculum—was a stretch for Phillips. His Mexican opposite number, Osvel Hinojosa, who is trained as a wildlife ecologist but has been equally involved in the binational planning and is supervising the wetland restoration project at Colonia Miguel Aleman, had to stretch, too. Hinojosa, who works at the Mexican environmental NGO Pronatura Noroeste, was named a National Geographic Emerging Explorer in 2012. “I just wanted to do research with the birds and see how they respond to different conservation practices. And then I thought, well, I’d really like to protect them.” That led him into “active restoration, and to water policy. But it all started with the birds.” The work in the limitrophe has engendered still more pushing of boundaries. The U.S. Bureau of Reclamation, for example, has reached across the border to help fund the project



CLOCKWISE FROM TOP LEFT
Planting designs for mesquite, cottonwood, marsh, and willow habitats.

at Colonia Miguel Aleman and also contributes research support to restorations Hinojosa is involved in farther south in the Colorado delta. Groups of student volunteers from each country have worked on the sites on opposite sides, and the Yuma Crossing National Heritage Area sponsors an annual training workshop in the planning, plant propagation, and management techniques Phillips's team has developed, attended by staffers from Pronatura Noroeste and the Sonoran Institute, another NGO supporting restoration work in the delta.

The planting design at Hunters Hole defines a sequence of zones, each with a different proximity to groundwater. The lowest are marshes planted with Olney's three-square bulrush. Sandbar and Goodding's willows, with understory plantings of inland salt grass, are on the adjacent—if barely perceptible—slopes. Next highest are cottonwood groves with an understory seeded in blue grama and alkali sacaton. At the highest elevations are mesquite bosques, their understories seeded in a mix of desert marigold, evening primrose, brittlebush, and globe mallow. "Water, big trees, open areas, understory—that's the

key to wildlife habitat. That diversity encourages a diversity of animal species as well," Phillips says. Planting plans are similar at the other restoration sites he has designed, including Colonia Miguel Aleman, where "groundwater conditions are fairly good, with depths between seven and 15 feet," says Hinojosa. "The site is in an old meander, and we have irrigation water rights," from a trust established by Mexican environmental groups.

Marshes edged with willow? Sure, but for an observer unfamiliar with desert environments it seems almost delusional to refer to cottonwood and mesquite groves, standing in parched soil and interspersed with brittlebush and alkali sacaton, as "wetlands," something everybody associated with these projects casually does. More accurately described, these efforts are recreating riparian areas, each section of which, no matter how dry it appears, is directly affected by the associated streams or springs. Even upland mesquite bosques in their natural state occasionally flooded, and the management of these new habitats calls for replicating such periodic inundations. "Riparian



LEFT
Revegetation
established,
June 2013.

BELOW
The same view,
two years earlier.



LEFT
Willow reestablished,
June 2014.

ABOVE
Willow poles planted,
two years earlier.





CLOCKWISE FROM TOP
Wildlife enjoys the newly established plant communities; Osvel Hinojosa and others float down the Colorado delta on the pulse flow in March 2014; after two weeks, the pulse flow has reached nearly 40 miles upstream from the sea; the first lick of water pumped into Hunters Hole after replanting.



areas make up about 5 percent of the total landmass in the Southwest, and they support a third of all plant and animal species,” Phillips says. “The density of life is amazing. And 90, 95 percent of it has been destroyed.” Riparian habitat’s survival in the desert depends principally on water supply. While at Colonia Miguel Aleman the water trust can guarantee that, Hunters Hole’s future water deliveries are more uncertain. Since May, the site has been under the management of the Bureau of Reclamation. Phillips worries that they are beginning to slack off, whether because they lack his team’s vision and commitment or because of garden-variety bureaucratic inertia. “You’ve got to see that, with the trees drying out,” he observed in frustration on his first visit to the site after several months’ absence. “With a manipulated system, you still have to do some kind of management on it. We’re building little dams to hold water back, to restore wetlands from impacts from big dams. You’ve got to manage weeds—new exotics are coming in every year. You’ve got to manage the water.”

Over an eight-week period last spring, in a historic effort to temporarily recharge the Colorado River corridor in Mexico, from the border through the delta to the sea, there was a “pulse flow release” of 107,000 acre-feet of water—“a back-of-a-napkin number,” Phillips says tartly. “If you’re going to dump \$7 million worth of water past a dam, in a 20-year drought, to restore a river, you should probably have some idea what the infiltration rate into the soil is going to be.” According to a preliminary monitoring analysis by researchers from the University of Arizona, the Sonoran Institute, and the Nature Conservancy published three months later, “Less than 1 percent of the total pulse flow release mixed with tidal waters from the Gulf of California.” Throughout the river corridor, water tables rose, and there was considerable germination of both native and invasive plant species as a result of the release, although Hinojosa and Phillips expect most of this new vegetation to die in the absence of continuing water delivery. “Most of the pulse flow’s water infiltrated to groundwater,

ABOVE
The pulse flow fills the Colorado’s normally dry channel just upstream of Hunters Hole.

transpired from plants, evaporated from soil and water surfaces, or was retained in soil and topographic depressions,” the analysis reported.

Four months after the release, on a relatively mild August afternoon—the temperature is only 105—Phillips and Hinojosa stand gazing over the riverbed, once again bone dry, in San Luis Rio Colorado, the Mexican border town where Hinojosa is based. When the channel was flowing, “this place was packed. People fishing, dancing, music blaring,” Phillips says. Environmental benefits aside, “it was a raging success—for PR. For people who have been staring at a dry riverbed for 30 years, it was awesome.” Hinojosa adds, “There is a vision developing here now—people got so excited in San Luis. It is not to have the river running, but maybe maintain a mile [filled with water], a small river park, do some native plantings. It would be lovely.” Another positive aspect of the pulse flow was the dialogue between the two governments that led to it. “From the time we started working to now, it’s a complete change,” says Hinojosa, who was involved in the negotiations. “It used to be very difficult just to get a meeting with them to talk about environmental flows. Now they are very active in these negotiations, very active in the restorations.” He applauds the binational International Boundary and Water Commission, Mexico’s National Water Commission, and the U.S. Department of the Interior. “They understand we have this debt with the environment.” This spring, the National Heritage Area is hosting a conference in Yuma to evaluate the pulse flow and further the discussion about how to restore flows in the limitrophe and delta.

The long-term prospects for achieving that? Hinojosa enumerates some challenges. “A big one is the basic recognition that the environment needs water, that it’s a rightful water use,” he says. “That has been moving forward but is not complete. And it’s combined with the legal obstacles that prevent that happening,” like the overallocation of water within the United States. Then there is “inertia” among water users, in particular farmers, many of whom grow cotton, wheat, or alfalfa, thirsty plants of questionable suitability to this environment. “The value of the crop is less than the value it takes to produce it,” he says. “Solving the delta water problem needs to address that, too.”

But project by project, repaired wetland habitat acreage is accumulating along the Colorado. So is the increasingly refined expertise that can be applied to this problem throughout the arid West. Phillips himself has begun work at several sites in the Rio Grande watershed, in Texas. He says, “Hunters Hole and Colonia Miguel Aleman are meant to be catalysts. Like, ‘Hey, this is what we can do on our borders if we’re working together.’” ●

JONATHAN LERNER WRITES ON ARCHITECTURE, PLANNING, ART, AND DESIGN FOR NATIONAL MAGAZINES AND FOR PROFESSIONALS IN THOSE FIELDS. FIND HIM AT WWW.URBANISTCOMMUNICATIONS.COM.

Project Credits

CLIENT YUMA CROSSING NATIONAL HERITAGE AREA. **RESTORATION DESIGNER/ ECOLOGIST** FRED PHILLIPS CONSULTING LLC, FLAGSTAFF, ARIZONA. **CIVIL AND ENVIRONMENTAL ENGINEER** NATURAL CHANNEL DESIGN, FLAGSTAFF, ARIZONA. **GRADING AND CONSTRUCTION** PG&E, LLC CONSTRUCTION, YUMA, ARIZONA. **WATER ENGINEERING AND CONSTRUCTION** U.S. BUREAU OF RECLAMATION, YUMA, ARIZONA; SHUCK DRILLING COMPANY, YUMA, ARIZONA.



**TOP TO BOTTOM
FROM LEFT**
Views of Hunters Hole
before the project
in 2008; graded and
planted, April 2012;
in August 2012;
and June 2013.

