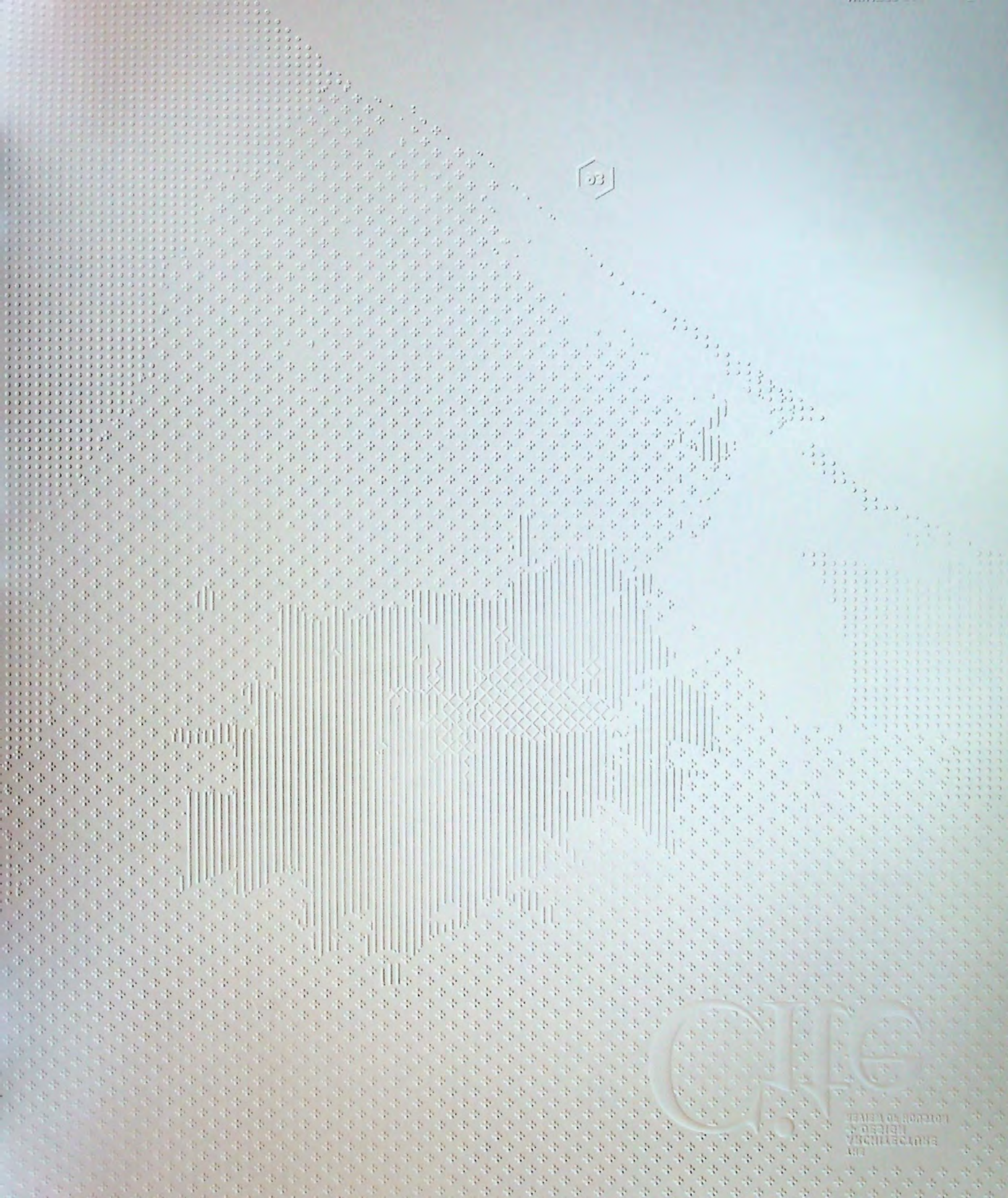
Cite
THE ARCHITECTURE + DESIGN REVIEW OF HOUSTON

93

ENVIRONMENTAL ISSUES



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THE ARCHITECTURE + DESIGN REVIEW OF HOUSTON

A PUBLICATION OF THE RICE DESIGN ALLIANCE

93 WINTER 2014

Cite (ISSN: 8755-0415) is published quarterly by the Rice Design Alliance, Rice University, Anderson Hall, Room 149, 6100 Main Street, Houston, Texas 77005-1892.

Individual Subscriptions:
U.S. and its possessions: $25 for one year, $40 for two years.
Foreign: $50 for one year, $80 for two years.

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EDITOR
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CONTRIBUTORS

John Anderson, Ph.D., is W. Maurice Ewing Professor of Oceanography at Rice University.

Eric Berger is the science correspondent for the *Houston Chronicle*.

Jim Blackburn is an environmental lawyer with Blackburn & Carter, Professor in the Practice of Environmental Law at Rice University, and a researcher for the SSPEED Center.

Robert Bullard, Ph.D., is widely considered a father of the environmental justice movement and is Dean at the Barbara Jordan-Mickey Leland School of Public Affairs at Texas Southern University.

Thomas Colbert is Associate Professor of Architecture at the University of Houston and a researcher with the SSPEED Center.

John Jacob, Ph.D., is Professor & Extension Specialist at the Texas Sea Grant Extension Program and Texas A&M Agrilife Extension Service; and Department of Recreation, Parks, and Tourism.

Raj Mankad, Ph.D., has served as Editor of *Cite* since 2008.

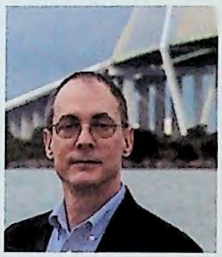
Steven Mikulencak is Program Manager at the Texas Coastal Watershed Program, Texas A&M University System.

Andrew Sansom serves as Executive Director of the Meadows Center for Water and the Environment, and is Research Professor of Geography at Texas State University – San Marcos.

Martha Serpas, Ph.D., is the author of two collections of poetry, *Côte Blanche* (New Issues) and *The Dirty Side of the Storm* (W.W. Norton). Her work has appeared in *The New Yorker*, *The Nation*, and *Image: A Journal of the Arts and Religion*, as well as in a number of anthologies, including the Library of America's *American Religious Poems*.

Larry Soward is a former Commissioner at the Texas Commission on Environmental Quality, an environmental consultant, and attorney.

LETTER FROM THE GUEST EDITOR



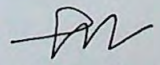
Houston is booming again. Real estate prices are skyrocketing. Apartment buildings and subdivisions are popping up all over the city. Everywhere we look, there are construction cranes, out-of-state license plates, new restaurants, and smiling real estate developers. Industrial developers are happy as well. The Port of Houston is preparing for the arrival of Post-Panamax shipping, coal terminals, expanded refineries, chemical storage facilities, and cruise ships. More industrial expansion is planned for Baytown, Port Arthur, and Freeport. The long anticipated arrival of the Keystone Pipeline will be only a small detail in the rush of industrial expansion that is coming to Houston.

It's great to be in Houston during such good times. But one has to wonder what are the environmental implications of all this growth? What will our corner of the world be like if this kind of development continues? What are the implications for air quality? Will there be enough water to accommodate industrial growth, projected population increases, and shrimp and oysters as well? What about our increasing vulnerability to storms and sea-level rise as development moves into previously undeveloped low-lying areas? Will some segments of the population suffer the worst consequences of industrialization and others be spared? Will land be available for agriculture? In a previous issue of *Cite*, Dr. John Lienhard wrote about birds and butterflies as a kind of infrastructure that we are ineffably dependent on, like pipelines and railroad bridges but without the financial backing. Will they have a place here? The list of environmental and public policy questions goes on and on.

This issue of *Cite* is focused on the environmental challenges that our region is facing. It contains essays by some leading Texas experts in a wide range of disciplines. It is intended to convey something of the broad landscape of concerns that our community must address if we are to improve or even maintain the quality of life that exists in Houston today. There are choices to be made. There will be progress and setbacks, and we need to anticipate what those will be.

We don't have to look far to find examples of environmental decisions that were made without adequate forethought. The continuing disappearance of wetlands in South Louisiana is a result of investments that were made over the last hundred years. Engineering the region to prevent flooding and extract oil and gas was highly profitable, but has resulted in the loss of coastal lands at an astounding rate. Driving through the region, one sees tin-roofed farmhouses that formerly stood beside pastures and cane fields but now lie abandoned, rising up out of brackish water, the fields and farm roads leading to them all submerged. Barrier islands seem to disappear by the handful every day. Fortunately, our part of the Gulf Coast isn't disappearing at the same rate. The ground under our feet is different from the ground under South Louisiana. What we do have in common with Louisiana, though, is the accelerating collision of urban growth, industrial development, and the natural environment.

This issue of *Cite* offers few answers to the environmental challenges that the Houston-Galveston region is facing. What it provides instead is a wide-ranging set of essays on the subject and a call for broad public engagement and informed debate about critical environmental issues. This is a debate that the design community should be centrally involved in because we are trained to bring together the many different disciplines that are needed to evaluate choices and to envision alternative futures. Working with poets, shrimpers, scientists, public policy experts, and the business community, we should be able to help imagine and then build a more sustainable and better future for our region—a future that will see Houston's reputation continue to grow not only as a place of economic opportunity but also as a desirable place to live.



THOMAS COLBERT

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The embossed image on the cover, and reproduced above in color, shows cancer risk by census tract in the Houston region using data from the Environmental Protection Agency. According to Dr. Elena Craft of the Environmental Defense Fund, cancer risk is associated with a wide range of factors including family history, socioeconomic status, lifestyle, age, and exposure to pollution. Though this map does not pinpoint specific causes, it does give an overall idea of risk. As in other cities, the areas closer to the center of Houston have a higher risk for cancer. Houston, however, has a large area of especially high risk on the east side of town near the Ship Channel that extends tentacles along freeways well into affluent southwest neighborhoods, including Southampton and Boulevard Oaks. The map is available in interactive form at epa.gov.

Live Feed

2013 RICE DESIGN ALLIANCE GALA

MORE THAN 900 PEOPLE GATHERED ON Saturday, November 9, for Live Feed, the 2013 Rice Design Alliance gala. Chaired by Betsy Strauch and Lonnie Hoogeboom, the gala honored an Organized Kollaboration on Restaurant Affairs, or OKRA, a group of energetic, like-minded restaurateurs who are recharging Houston's nightlife and restoring historic buildings in core neighborhoods such as Montrose, Midtown, Houston Heights, Downtown, and the Museum District.

Guests mingled all evening at the Hilton Americas-Houston amidst 105 unique auction items. The auction, coordinated by Juliè Gauthier and Kelie Mayfield, included all-expenses-paid trips to Saint Sauvant, France; San Miguel, Mexico; and Washington, D.C.; unique handmade jewelry; wine chosen by OKRA member and PSA sommelier Justin Vann; and many singular local experiences: Tours of the Philip Johnson-designed Menil House, rides along Buffalo Bayou on the "Spirit of the Bayou" pontoon, and parties catered by OKRA establishments Anvil Bar & Refuge, Underbelly, The Pastry War, Grand Prize Bar, and Hay Merchant. Also up for bid were 14 custom works of sculpture, ceramics, painting, and mixed media, resulting from inspired collaborations between Houston artists and OKRA members, organized by Judy Nyquist.

As the Next Level Band played jazz, guests moved into the ballroom. There, the gala environment committee, chaired by Chung Nguyen with assistance from Florence Tang and Karen Lantz, designed an ephemeral installation comprising thousands of strands of piano wire tipped with wheat and "planted" in white styrofoam panels. Lit from below, the waist-high wheat swayed and gave the illusion that guests were wandering through a field toward their tables. Once seated, they enjoyed a four-course meal — with one course prepared specially by Underbelly chef and James Beard Award nominee Chris Shepherd, his famous Korean braised goat and dumplings.

After RDA board president Doug Combes welcomed guests and recognized the 25-year efforts of RDA executive director Linda Sylvan, OKRA president Bobby Heugel accepted the RDA Award for Design Excellence on behalf of the 21 OKRA member organizations. At the end of the night, guests took home complimentary sugar cookies, decorated with the OKRA logo, courtesy of Paul Petronella of Paulie's. Underwritten by Brochsteins, D.E. Harvey Builders, HOK, Haynes Whaley Associates, Inc., Walter P Moore, Satterfield & Pontikes Construction, Inc., and many other generous donors, the gala brought in more than $520,000, which will support RDA's educational programming and publication of *Cite: The Architecture + Design Review of Houston*.

Seen in the crowd were underwriters Larry and Charlotte Whaley; David Harvey and Mikki Hebl; Deborah Brochstein and Steven Hecht; Ray and Elaine Messer; Ben Crawford and Kathrin Brunner; RDA President Doug Combes with wife Lisa; Gala Chairs Lonnie Hoogeboom and Betsy Strauch; Fundraising Chair Dave Mueller; Auction chairs Juliè Gauthier and Kelie Mayfield; Environment Chair Chung Nguyen; Graphics Chair Craig Minor; Andrea and Bob Crawmer, Sheilia Condon, Cindy and Larry Burns, Larry and Joyce Lander, Laura Bellows and Jack Pendergrast; RDA executive director Linda Sylvan with husband Dick; former Rice School of architecture deans John Casbarian with Natalye Appel; and Lars Lerup with Eva Sarraga.

ABOVE *Paul Hester blurs and stitches 70 years of history at the intersection of Westheimer and Waugh into this photograph donated to the gala auction.*


Charlotte and Larry Whaley


Sharon Engelstein and Aaron Parazette


Deborah Brochstein and Stuart Harris


Ben and Kate Crawford


Ed and Carrie Glassman Shoemake, Ronaldo Graga and Amy Hartz


Bao-Tuong Nguyen, Van-Tuong Nguyen, Chung Nguyen and Florence Tang


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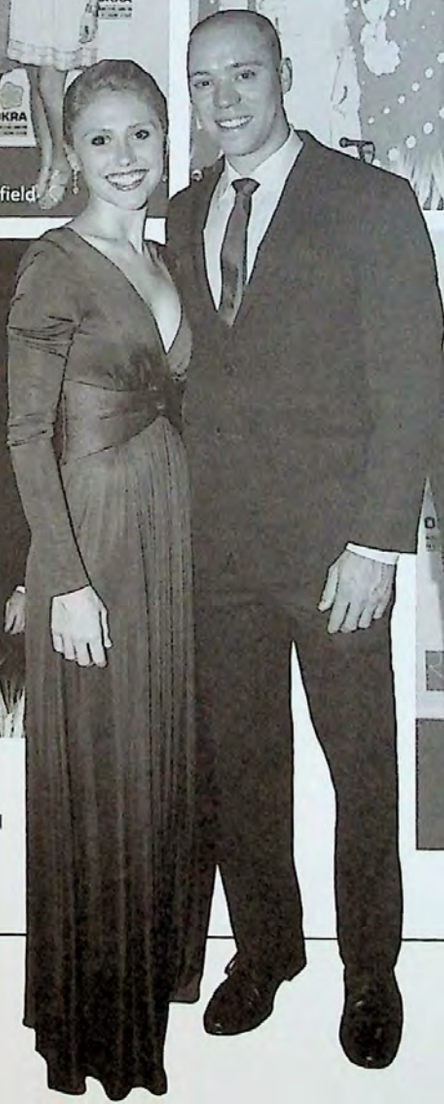
Aria Anderson and Bobby Heugel


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EXCERPTS FROM

OffCite.org

Buried Alive

Experiencing the Resurrected Wetlands of Sheldon Lake State Park

by Colley Hodges

"Typically, in this region you dig a hole in the ground, fill it with water, throw some plants in there, and—voilà—you have a wetland. The problem is that doesn't always work," said wetlands expert Marissa Sipocz. Among the primary reasons it doesn't work, she explained, is that the plant selection is not ideal or the soil chemistry is not quite right. This leads to what makes the Sheldon restoration efforts especially unique. After years of human development, the ideal soils were still in place, just a foot or so beneath the topsoil, buried alive and waiting to be rediscovered.

Read the full article: offcite.org/buried-alive

Holding Ground

A look at University of Houston's "Environmental Past" Exhibit

by Sara Cooper

If the explicit argument of the exhibit was that Houston's environmental history is defined by collective action, the implicit one was that that the face (and biceps) of these efforts belong largely to women. Among the speeches, letters, and meeting minutes preserved in the library's special collection of Hershey's papers is a series of letters between Ginzbarg and Hershey. In one, Ginzbarg writes, "You are Mrs. Bayou Preservation (among other things) and I am Mrs. Armand Bayou. Without either of us, nothing happens, no money is raised and there is no project."

Read the full article: offcite.org/holding-ground

2014 RDA Architecture Tour

Additionally

This spring's tour, *Additionally*, will feature historic homes that have been given architecturally sensitive additions in neighborhoods including Boulevard Oaks, Old Sixth Ward, Montrose, and Tanglewood.

SAVE THE DATE!
3.29 & 3.30
RDA'S 38TH ANNUAL
ARCHITECTURE TOUR
Eight houses demonstrating solutions of adding on to historic residences.

2014 Initiatives for Houston

RDA will begin accepting applications for the 2014 Initiatives for Houston grant program on January 6. Now in its 15th year, the program selects and helps to fund projects with the potential to make a real contribution to the region's built environment by students and faculty at Rice University, University of Houston, Prairie View A&M, and Texas Southern University.

This year, the program will provide separate awards of up to $5,000 for student and faculty winner(s). The application deadline is March 24. Winners will be announced April 28. Last year's winner, Rice University Professor of Architecture Gordon Wittenberg, was awarded $4,200 to map and study "linear parks" and other alternative uses of Houston's utility, pipeline, and railroad right-of-ways.

Jurors will be Andy Icken, Chief Development Officer for the City of Houston; Willard Holmes, Associate Director of Administration at The Museum of Fine Arts, Houston; David Calkins, Regional Managing Principal at Gensler; Kristi M. Grizzle, Senior Associate; Walter P Moore; and Demitra Thomloudis, Adjunct Instructor, Houston Community College.

CALENDAR

HIGHLIGHTS FROM RICEDESIGNALLIANCE.ORG

JANUARY 2014

22 + 29 WED / 7 pm

RSA/RDA SPRING 2014 LECTURE SERIES - *ON IMMEDIACY* / THIS SERIES WILL FEATURE INTERNATIONAL FIRMS WHOSE UNCONVENTIONAL WORK COLLAPSES BORDERS BETWEEN ART AND ARCHITECTURE AND STIMULATES VISCERAL RESPONSES. THE WINE RECEPTION BEGINS AT 6 PM.

BROWN AUDITORIUM / THE MUSEUM OF FINE ARTS, HOUSTON
1001 BISSONNET / OPEN TO THE PUBLIC.

January 22 / **Jan De Vylder**, Architect, de Vylder Vinck Taillieu
Gent, Belgium

January 29 / **José Selgas**, Selgascano, Madrid, Spain

FEBRUARY 2014

5 + 19 WED / 7 pm

RSA/RDA SPRING 2014 LECTURE SERIES - *ON IMMEDIACY* / CONTINUED

BROWN AUDITORIUM / THE MUSEUM OF FINE ARTS, HOUSTON
1001 BISSONNET

February 5 / **Philipp Schaerer**, Zurich, Switzerland

February 19 / **Carlos Bedoya Ikeda**, PRODUCTORA
Mexico City, Mexico

MARCH 2014

29 + 30 SAT + SUN / 1 pm – 6 pm

RDA'S 38TH ANNUAL ARCHITECTURE TOUR - *ADDITIONALLY* / THE TOUR WILL FEATURE EIGHT HOUSES DEMONSTRATING SENSITIVE ARCHITECTURAL SOLUTIONS OF ADDING ON TO HISTORIC RESIDENCES.

216 Avondale
1906 > 2012, m+a architecture

5503 Sturbridge
1960, Marshall S. MacDougal > 2008, Dillon Kyle Architects

823 Peddie
1925, Sears Kit > 2007, Brett Zamore

707 Sabine
1885 > 2000, Gary Eades > 2007, Janusz Design

1701 Colquitt
1925 > 2011, Ben Koush & Associates

1810 Bissonnet
1927 > 2002, Wittenberg Studio

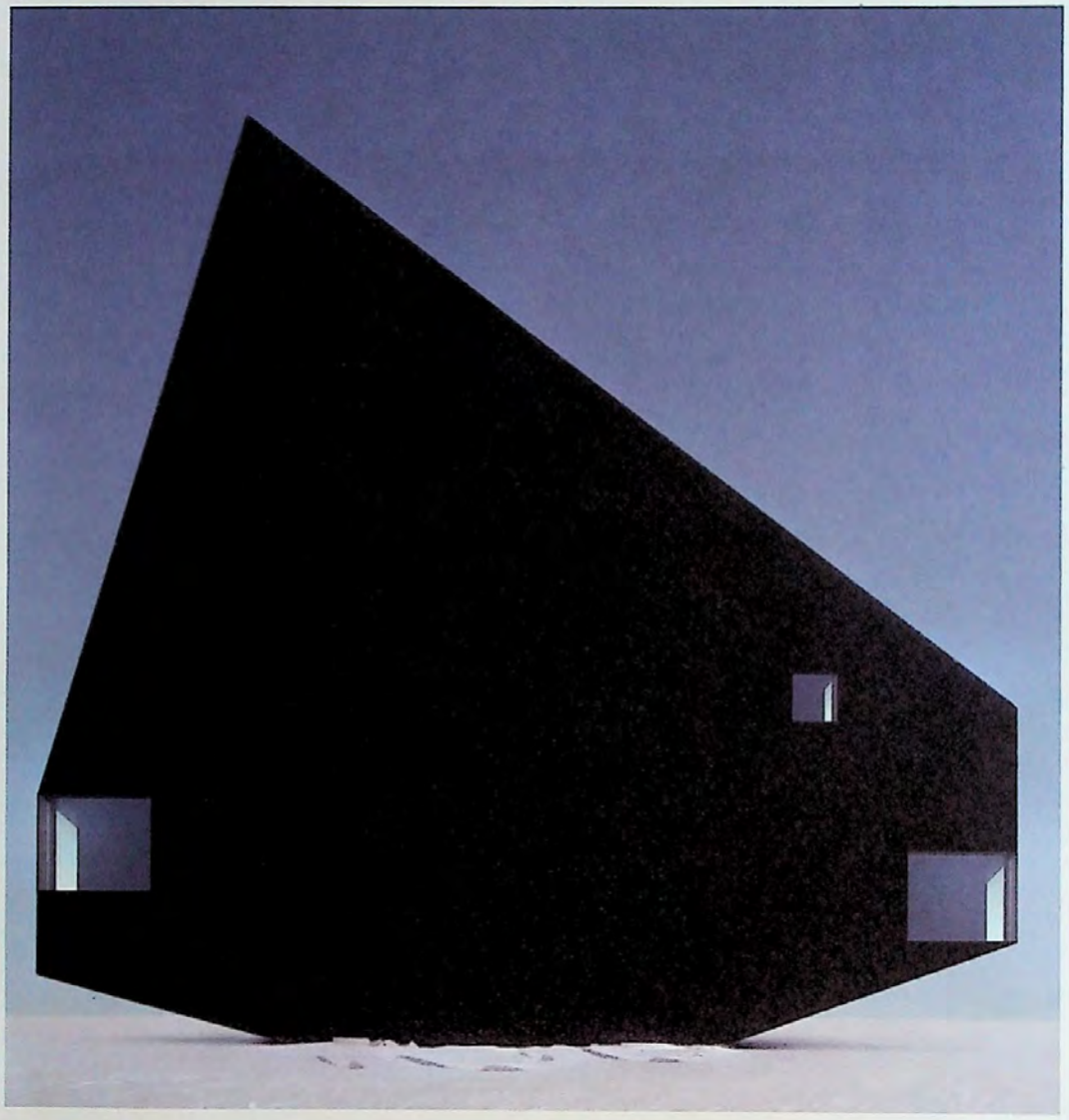
5219 South Braeswood
1964, Arthur Steinberg > 2013, Stern + Bucek

3503 Audubon Place
1920 > 2006 > 2011, Interloop – Architecture

ON IMMEDIACY: RSA/RDA SPRING 2014 LECTURE SERIES
RICE SCHOOL OF ARCHITECTURE ASSISTANT PROFESSOR JESÚS VASSALLO CURATED THIS LECTURE SERIES, ON IMMEDIACY, WHICH WILL BRING PHILIPP SCHAERER AND PRINCIPALS FROM DE VYLDER VINEK TAILLIEU, SELGASCANO, AND PRODUCTORA TO HOUSTON. "I THINK THAT THESE FIRMS' PRACTICES ARE CAPTIVATING BECAUSE THEY ARE EXPERIMENTAL WITHOUT RENOUNCING BUILDING THINGS IN THE REAL WORLD," SAYS VASSALLO. "THEY PRODUCE WORK THAT IS INTELLECTUALLY STIMULATING AS WELL AS SENSUALLY POWERFUL." MARK YOUR CALENDARS FOR JANUARY 22 AND 29 AND FEBRUARY 5 AND 19.

a,e Philipp Schaerer *d* PRODUCTORA
b,c Selgascano

a



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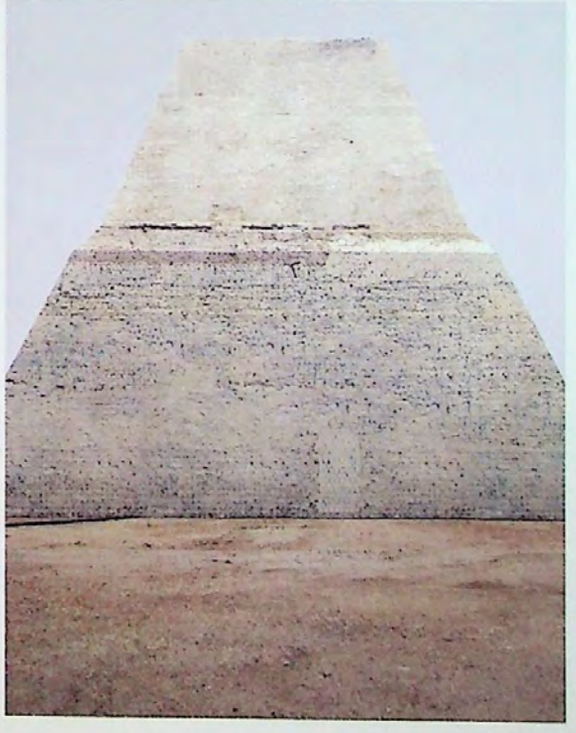



CHESAPEAKE BAY

IMAGINE AN UNDEFILED LAND

REFLECTIONS OF A POET ON THE GULF COAST

BY MARTHA SERPAS

LEFT *"GPS Tracks, April 20–October 4, 2013" shows in black the routes Eric Leshinsky and Zach Moser took as they shrimped Galveston Bay. The map is composed of a satellite image from Google and a recent NOAA nautical chart.*

MY ALMA MATER IS THE GULF OF MEXICO. EVERYTHING I KNOW I LEARNED FROM THE NEARLY IMPENETRABLE SALT WATER: THAT THE SAME JETTY WHICH ALLOWS US TO EXPLORE THE WAVES CAN MASK A VICIOUS UNDERTOW; THAT WHAT FLOATS BY CAN STING; THAT FLOATING IN BATHWATER UNDER AN APPROVING SKY IS EVERY KID'S FREEDOM; THAT TAR BALLS CLING EVEN WHEN THEY AREN'T ON TV; THAT BREAKERS LAUGH AND TOUSLE; THAT REDFISH AND DRUM GRILL QUICKLY; THAT ICE BAG IS A GUY WHO RETURNS TO THE DOCK WITH NOTHING IN HIS COOLER BUT EMPTY PLASTIC; THAT BLUE CRABS LOVE CHICKEN NECKS; AND THAT THOSE WHO WORK OFFSHORE SEVEN-AND-SEVEN CHOOSE TO FISH EVEN BEFORE THEY RETIRE. REAL WISDOM.

× ABOVE *Eric Leshinsky picks through a catch.*

I teach what still puzzles me, and ideally students puzzle with me. Those students, at the University of Houston, are creative writers from all over the country. They love Montrose—so do I, but it breaks my heart to think of them coming to UH and leaving without knowing where they really are: what was here before the tragically hip coffeehouses and the bars, before even the museums or the Medical Center (that mammoth shelter dedicated to health yet bordered by unredressed environmental degradation). Before all that was the Gulf—its barrier islands (what's left of them); its distributaries (Bayou Lafourche, my home, was once the Mississippi's primary outlet); and its seafood and oil stores once undisturbed by human insatiability.

Where you are affects who you are (and what you write) without your always realizing it. Of course, when some storm provokes the Gulf, awareness is unavoidable: Your life stops. After the preparation (please pick up your yard furniture, Houston), the water jugs, canned food, plywood boards, and batteries or solar radios, there is the waiting. If you stay, your house should be weighted against the wind by family, friends, cards, and beer. Board games and candles in mayonnaise jar lids for the kids. Some of us find it shameful to admit, but hurricanes can be fun, restorative. What should I be doing? What errand should I be running? What calls need making? Nothing and none. Only togetherness, meditation, and prayer. Food from that silo of a freezer emptied for a cookout with neighbors. The moment of fear-tinged equilibrium between the before and the after.

I'm thinking about two kinds of groundedness here: the importance of place as made clear in memory through the "enhancement of distance" (Updike) and groundedness in the present through free choice or through the arm-twist of necessity. The images of our

PHOTO COURTESY HARBEER SANDHU

FINALLY, I GIVE UP AND CHUCK THE REMAINING SMALL FISH UP TO THE GULLS. WHY BE A HYPOCRITE AND IGNORE THAT EVERYONE'S MEAL HAS A COST?

past can serve as emotional gravity. Certainly, bodily memory of our sensory impressions inform who we are. (I now understand our minds can revise the images in our memories, but not the physical sensations that originally accompanied them.) We were, and we still are. The tomorrow we spoke of has come after all and another could very well come again. The other kind of groundedness is dependent on our attention. "The art of our necessities is strange. Which makes vile things precious" (*King Lear*). Certainly a tornado renders the fallen, once overlooked telephone poles precious the way exhaust fumes change our perception of August's oppressive air. We notice what survives and mourn what has been dismembered—even the ugliest house, the diseased tree, the scrub brush marsh.

So I take my students to Galveston. Some have never even been on a boat let alone trawled. When I first met the artists Zach Moser and Eric Leshinsky, they looked like trawlers to me: pocket T-shirts, sunburns so red they turned to roux, fingernails lined with diesel. But they said they felt like interlopers, wanting to get inside this singular vocation and free a living work of art. They called their vision the Shrimp Boat Projects: "… the project melds the daily work aboard a commercial shrimp boat … to inspire the creation of art that can more effectively communicate a knowledge of the Houston region that is derived from a true connection to the landscape." UH's Cynthia Woods Mitchell Center for the Arts supported the idea with vigor, as the Center now supports my continued efforts to offer students an artistic connection to the Gulf.

After Eric and Zach rehabbed a docked shrimp boat and started trawling regularly, they invited us to join them on Dickinson Bayou predawn. At that hour the water and sky seem like halves of a gray curtain about to part as the trawlers hoist the nets—all mystery and anticipation about the day's harvest. We hear the chug of the engines and little else. The seagulls are quiet for now. They know when to ask for a freebie. Not to be out-Cajuned by my new friends, I show my crew how to pick shrimp. Once the nets are emptied into plastic baskets, I dump them in a large wooden tray and separate the shrimp from the grass, minnows, squid, and crabs (carefully grabbed at their abdomens). I take great care to toss everything alive overboard. (My "care" is not necessary to the process, slows things down, and seems futile, if not sentimental.) I don't use a net, but chase and pinch the slimy silverfish until I can "save" them, too. Finally, I give up and chuck the remaining small fish up to the gulls. Why be a hypocrite and ignore that everyone's meal has a cost?

Before we head out, though, the students get some grounding in ecogeology and Galveston's history from Sally Antrobus's book *Galveston Bay*, Jim Blackburn's *The Book of Texas Bays*, and other texts. How did the Gulf and its shores take shape? We watch *Veins in the Gulf*, a documentary by Elizabeth Coffman and Ted Hardin, about coastal erosion in southern Louisiana. In the aerial shots, what's left of the land looks like floating velour, and the barrier islands are margined with oily boom. All the Gulf States share the same degradation: lost bird migration, hundreds of species imperiled, oil gushers, impaired marsh filtration and storm surge absorption, reduced economic activity, depleted seafood harvest, lost jobs, lost beauty. Because of the unnaturally channeled and polluted Mississippi River (and some catastrophic early twentieth-century political hubris), Louisiana suffers most. I'm honored my poetry shows up in the film, my small contribution to encouraging awareness. It's invaluable to see your sacred ground through someone else's eyes.

We focus on other Gulf Coast poets, like Darrell Bourque and John Gorman, and other American poets who have written powerful poems about the shore: Elizabeth Bishop, Amy Clampitt, Hart Crane, Walt Whitman, and many more. Most of these compositions are meditations on connectedness, change, and loss. These students venturing into the marsh are primarily poets although we get the occasional fiction writer, painter, or photographer. Experiencing the intersections between the art forms has been powerful. Each artist's sense perception overlaps and diverges. We use similar vocabulary—image, composition, form, representation, context, discovery—and challenge each other.

We meet up with Artist Boat, a group dedicated to integrating the arts and sciences with exploration of coastal habitats, and kayak out to a slender island for sketching and painting. Some in our group collect debris for installation projects. Our guide identifies wax myrtle and anhinga, flora and fauna of all kinds. We look back at the refineries on the Channel and marvel—hubris, necessity, paradox? We take pictures and tell stories of our other encounters on other coasts. As the sharing of wider artistic practice deepens our poetic composition, sharing observations of other coasts help us "see" the Gulf Coast more vibrantly.

CROSSING

Out on the open water, finally, they see all
seven deltas and their depositions,
mouth bars and inlets

running like childhood scars across the coast.

All night while the shrimp run
and into the next hot day,
the last generation sits on Igloos

picking shrimp, following the ones before them
till the nets are empty, passing the time
coaxing loggerheads close, while bored porpoises

drift, with no wake to spin.

A certain quiet fills the hull
for a proper discernment
of the shore, a certain sweat while they scan

for the new order of things,
which is the old order renewed, things

moving swiftly but weighed immovable
in their eyes. Someone might forget
to declare "good" or "very good" or "evil"

as they drift between their last breath, their burial,
and this third death that frees the soul,
this idle wisdom ignorant of its crossing.

Who knows what God will breathe out
after our last breath is drawn?

Some might see estuaries that unite
the brackish bath and fluvial birth,
sandy islands that split the tide,

cypresses both grasping the bank and stretching
their slender shadows on the channel

when God remembers the interstice
of our muddy ossuary and our exhalations—
cordgrass and bulrush, bulltongue
and shellfish, sawgrass and maidencane—

a white coast of grass and salt and dragonflies.

Don't seal me in a marble card catalog
to which no borrowers come.
Let the ferry go. Let me join
the trawlers and gather my broad nets alone.

- Martha Serpas

I have always liked the accoutrements of strenuous outdoor activities—boots, backpacks, pocketknives, flashlights—but I am a poser. Outdoor sports look too much like work and too much like a plunge into the unknown. (I never cared for roller coasters as a child.) So I was somewhat stunned by the epic headwinds we encountered kayaking in the fall of 2011. Pride can be a useful deadly vice, though. Only the refusal to be humiliated in front of my students got me back to the dock.

One unseasonably chilly morning we planted marsh grass with the Audubon Society. (I had on a very convincing Carhartt jacket.) We hesitated over the digging. Is this the designated spot? Are we digging deep enough? Is the pattern we were instructed to follow being maintained? We worried, as if we could stop the erosion ourselves if we could just do it right. We took the ferry toward Anahuac. Another harsh wind and a dousing. We get more and more acquainted with the bay. These students were patient and enduring, and challenged, though, when we tried to get out of the van at High Island for a different view of the water. The mosquitoes swarmed us the way filings race to a magnet. When I was a kid, we only encountered parasites that huge in the swamp. Now because of coastal erosion, they have marched ten miles north of my hometown of Galliano, Louisiana. Saltwater has chased them into our bayous as it overwhelms desalination plants. Poison gas couldn't have gotten us back into the van any faster.

PATHETIC FALLACY SHOULD BE SCORNED BY POETS, WE ARE TAUGHT, BUT WHY ARE WE SO OFTEN DRAWN TO UNDERSTAND OURSELVES THROUGH NATURE OR NATURE THROUGH OURSELVES? IT IS SLOPPY OBSERVATION AND A CLOSED MIND THAT ABUSES OUR CONNECTION TO LIFE'S FULL EXPRESSION, NOT THE IMPULSE TOWARD RELATION. WE ARE HUMAN: WHAT WE CAN'T SEE OURSELVES IN, WE DON'T SEE.

It seems the students grow to love the marsh, the beach, the dirty water. Almost everyone welcomes pelicans into new poems. How unselfconscious the big birds are, flying like rusty loppers and diving with little composure. We are drawn to the successes they achieve despite their awkwardness. The poets sense that the Gulf has to be taken fully, on its own terms, before it will offer its own metaphor, or better before it can be revealed as a mystery that encompasses us all.

Ultimately, compassion is the goal, and that requires imagination. I must imagine what the undefiled land looked like, smelled like, even what a loggerhead feels struggling in a net. What black tip sharks think of the bloated turtle as it floats on the water. Exactly when the backshore became the shoreline. It's a kind of an Ignatian Spiritual Exercise. Compose the scene with all your senses. Sit with it, reflect on it, and let the immersion be to your gain. Let your imagination transform you. This is no disrespect to genuine emotion, no failure to perceive reality. Pathetic fallacy should be scorned by poets, we are taught, but why are we so often drawn to understand ourselves through nature or nature through ourselves? It is sloppy observation and a closed mind that abuses our connection to life's full expression, not the impulse toward relation. We are human: What we can't see ourselves in, we don't see.

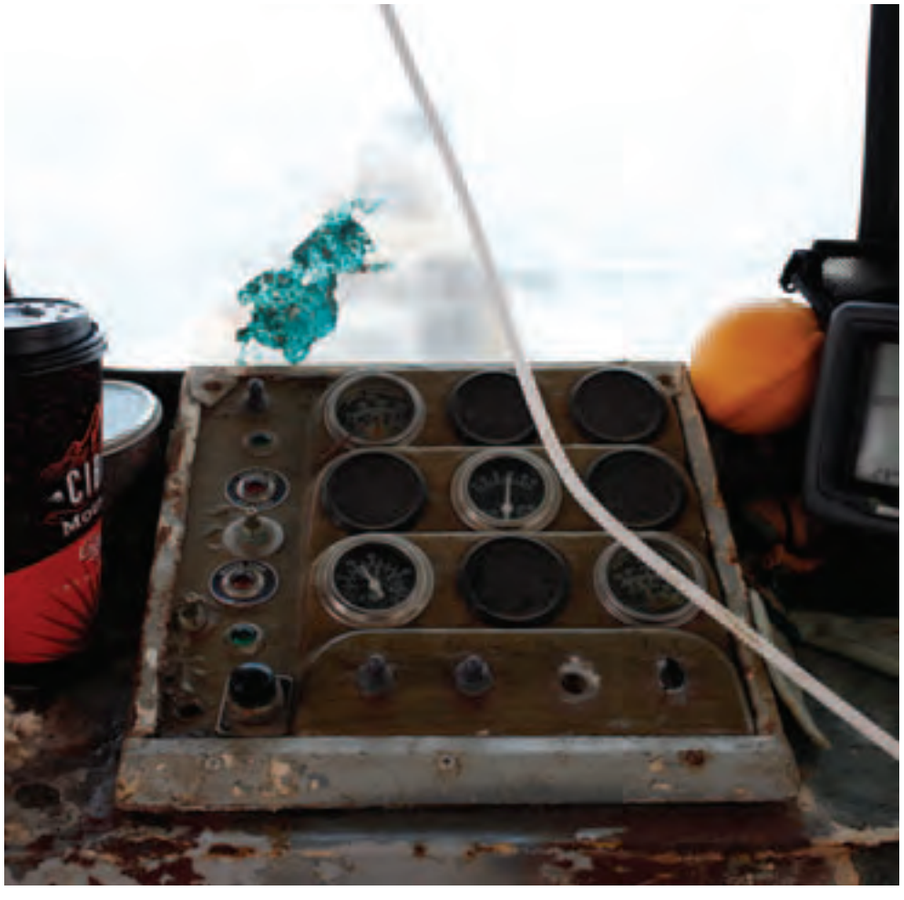
This past spring Eric and Zach invited me to ride in the Blessing of the Fleet in Kemah. I felt as if I'd been invited to a celebrity wedding. I imagined the Blessings of my childhood: Regal trawlers and oyster boats—one with a polished mahogany deck—jammed into the bayou, lots of fried chicken and shrimp, gumbo, accordion music, my father sweaty with a sweaty can of Schlitz. The priest praying and shaking the wand towards us as we pass, and all hopeful for both seasons—shrimp and hurricane.

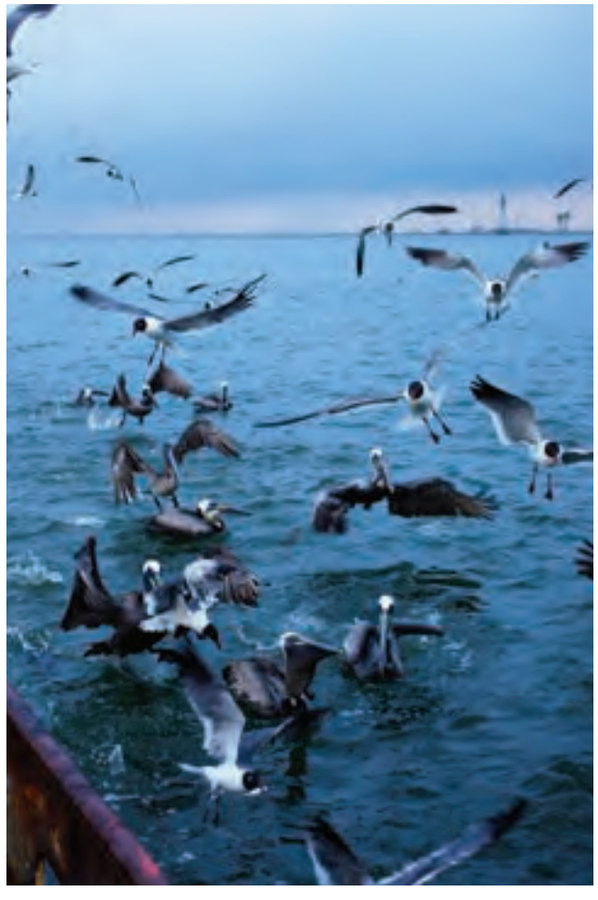
I imagined the Discovery—Eric and Zach's boat—flying crisp streamers and maybe a funny flag. When I arrived, boats were few. Eric and Zach had boiled 10/20 shrimp for us, ritual food for the trip. The feeling was happy but not euphoric, except for one loud boat practicing the Dionysian art of abandon. Speakers shot out music, partiers wore costumes, and everyone danced. A stranger once told me, "At the Last Judgment, God will ask how we liked the party She threw us."

The ride to the Boardwalk was so short we chugged it twice, the second time coming close enough to the pilings that I high-fived a woman in the crowd. The priest was a tiny dot on the Boardwalk. I saw her hand shake the wand, but I couldn't hear what she said, the prayer over the first boat, no doubt, covering us all. C

× RIGHT *Photo by Ship Channel pilot Lou Vest.*

The photographs on this spread (except when noted) were taken by Harbeer Sandhu as a participant of Shrimp Boat Projects' program, the Regional Artist Exchange. Sandhu's full piece on the experience is available at texphrastic.com. Created by Eric Leshinsky and Zach Moser, Shrimp Boat Projects is a conceptual art work that provides a platform for viewing the Houston region from the deck of a shrimp boat working the waters of Galveston Bay. Participants were invited to join them on their daily shrimping trips beginning at 3 a.m., spending the day helping to sort the catch and experiencing a particular view of the region which they believe affords a true understanding of its nuance and complexity. Toward providing this platform, Eric and Zach have spent the past three years becoming full-time commercial fishermen, to the point of it becoming their sole livelihood. They bought a boat in early 2011, spent seven months rehabbing it, and spent the last two seasons fishing full-time. While engaged in this personal transformation that began with a residency at the University of Houston Mitchell Center for the Arts, they have exposed the processes and investigations of the work through public events, classes, exhibitions, and commerce.





SEA LEVEL CHANGE

GLOBAL CLIMATE CHANGE IMPACT ON THE UPPER TEXAS COAST

JOHN B. ANDERSON

VERY FEW SCIENTISTS STILL QUESTION GLOBAL WARMING and the role humans have had in the process, while outside the science community it is largely viewed as a prediction. The reality is that climate change and associated accelerated sea-level rise are not predictions. Tide gauge records are supported by satellite data telling us that the rate of rise has significantly increased within the past two centuries. These combined results indicate that the rate of global sea-level rise averages ~3.0 mm/yr, although the actual rate varies regionally (Rahmstorf et al., 2007; Church et al., 2011; Carlson, 2011). However, within the northwestern Gulf of Mexico, subsidence contributes to relative sea-level rise with rates in east Texas as high as 6.0 mm/yr (Paine, 1993). Regardless of the actual value, this is a multifold increase over the long-term rate of the past few thousand years of ~0.40 to 0.60 mm/yr (Milliken et al., 2008). The only mechanisms that can cause such a rapid increase in the rate of sea-level rise are heating and expansion of the oceans and melting of glaciers and ice sheets; both are known to be occurring at unprecedented rates. The main uncertainty in predicting the actual magnitude of sea-level rise is the contribution from the Greenland and Antarctic ice sheets, but both ice sheets are exhibiting signs of instability.

It is generally accepted that the rate of sea-level rise will continue to increase during the 21st century given rates of heat uptake by the oceans, the fact that the vast majority of glaciers have shifted to a negative mass balance and recent observations indicating a negative mass balance for large portions of the Greenland and West Antarctic ice sheets (Rignot et al., 2011).

While an increase of only a few millimeters per year may seem insignificant, numerical models indicate that an increase of just 1 mm/yr in the rate of rise can result in an increase in the rate of shoreline retreat of several meters per year. It has been more than 7,000 years since sea level was rising as fast as the current rate. At that time the upper Texas coast experienced episodes of retreat as high as 60 m/yr (Figure 1, Rodriguez et al., 2004). Indeed, most modern barrier islands and modern bays did not form until after the rate of sea-level rise had slowed to less than 1 mm/yr (Anderson, 2007), (Figure 2). Add to the equation the impacts of human alteration to sediment delivery to the coast, such as construction of dams that prevent sediment being carried to our bays and coastal lands, and it is easy to understand why our coast is experiencing such dramatic change.

Current rates of shoreline erosion along the upper Texas coast range from 0 to 4 m/yr. The variability in erosion rates is largely due to differences in the rate of sand supply to the coast, differences in rates of subsidence and human alteration of the shoreline.

One of the more problematic impacts of global climate change is increased frequency and magnitude of severe storms (Elsner et al. 2008; Emanuel, 2005; Webster et al., 2005). While the scientific community is still divided on this issue, studies of the geological record of severe storm impacts indicate no notable variation in storm impacts across the northwestern Gulf of Mexico coast during the past few thousand years (Wallace and Anderson, 2010). In addition, there have been no significant differences in the

FIG. 1

GALVESTON TIPPING POINTS

SEA-LEVEL CURVE FOR THE NORTHWESTERN GULF OF MEXICO SHOWING THE LONG-TERM DECLINE IN THE RATE OF RISE OVER THE PAST SEVERAL THOUSAND YEARS. THE BLUE BOX SHOWS THE HISTORICAL (RED) AND PROJECTED (YELLOW) RATE OF RISE. NOTE THAT MODERN BARRIERS OF THE UPPER TEXAS COAST FORMED AFTER THE RATE OF RISE HAD DECREASED TO LESS THAN ABOUT 3 MM/YR, WHICH IS THE CURRENT RATE OF RISE (FROM ANDERSON ET AL., 2010).

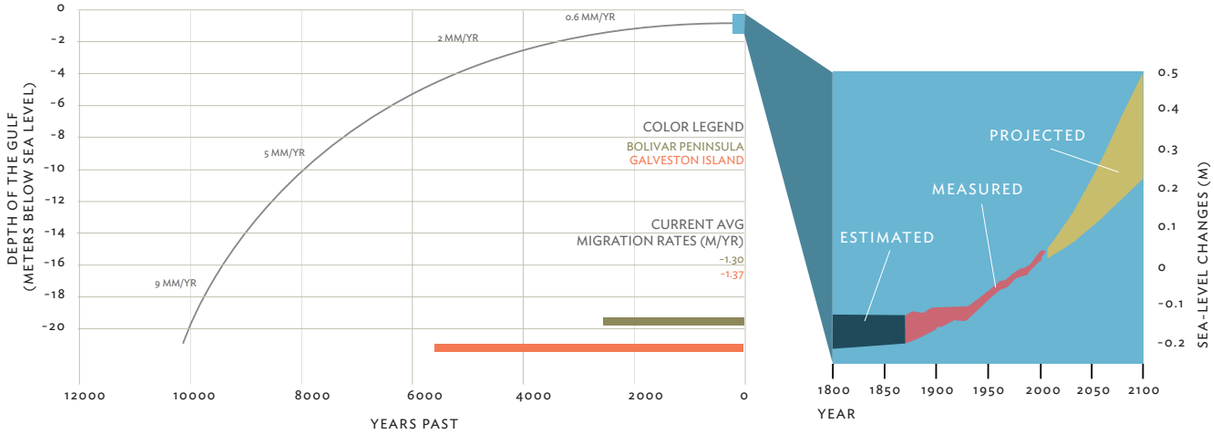


FIG. 2

PALEOLITHIC SHORELINE

CHANGES IN THE UPPER TEXAS SHORELINE DURING THE PAST 7,700 YEARS. THIS MAP IS BASED ON YEARS OF MARINE GEOLOGICAL RESEARCH AIMED AT IDENTIFYING PAST SHORELINE POSITIONS. (MODIFIED FROM RODRIGUEZ ET AL., 2004).

landfall probabilities between the eastern and western Gulf of Mexico, suggesting that storm steering mechanisms have not varied during this time.

Texas is currently experiencing extended droughts, which severely impacts our water supplies, landscape, and economy. Here again, there are lessons to be learned from geological history. Paleoclimate records from around the state reveal a history of climate variability between warm/dry and cool/wet cycles that reflect natural climate variability over millennial time scales. There is a dire need for additional research to understand the natural climate variability along the upper Texas coast to test numerical models for predicting climate change in the region.

The acceleration of sea-level rise, coupled with minimal sediment supply to the coast, has resulted in increased rates of coastal erosion, both along the Gulf Coast and within bays, and loss of wetlands (Morton et al., 2006; Paine et al., 2012). Thus, the first line of defense against storm surge in more

inland areas is being removed. At the same time, the population of the greater Houston area continues to push south and into areas that are highly vulnerable to storm surge. The highly vulnerable Port of Houston and petrochemical industry at the head of Galveston Bay continues to expand. The City of Galveston refuses to adopt a setback policy for new construction along the Gulf shoreline. We are truly living in a "state of denial."

One of the greatest obstacles facing the scientific community is communicating knowledge about global climate change and its impacts to policy makers. In Louisiana, where the problems are more chronic, there is far greater awareness of the issue. As a result, that state has already developed a comprehensive coastal management plan, which is a requirement for future federal funding related to the BP settlement. The Texas General Land Office has just begun working on a comprehensive coastal management plan, but to date that process has resulted in little more than a color brochure and a long shopping list of projects that require attention. We are far behind in our ability to predict coastal response to global climate change, and this is an essential requirement for a comprehensive coastal management plan. Without a comprehensive plan, there will be less money for research and without research there can be no real comprehensive plan. We must break this cycle.

In the past few years there has been an increased effort on the part of the science community to become better organized, share information about the potential impacts of global climate change on coastal environments, and convey scientific knowledge to policy makers (Anderson, 2013). For the most part, these efforts have failed at the city to the state level. Texas has an outstanding academic knowledge base to provide scientific input to the development of a comprehensive coastal management plan. The most widely published academic coastal scientists have joined together in the "Gulf Coastal Science Consortium" intended to provide scientific information and advise on coastal issues (https://shellcenter.rice.edu/Content.aspx?id=2147483966). To date, there has been minimal effort on the part of the General Land Office of Texas to seek input from its leading coastal scientists in preparing a comprehensive coastal management plan. We need to continue to explore ways to inform policy makers about the realities of global climate change, its ongoing impact on our coast, and potential environmental and socio-economic impacts of continued denial of these issues. We owe it to future generations. C

*REFERENCES

Anderson, J.B., 2007. *The Formation and Future of the Upper Texas Coast*. Texas A&M Press, College Station, Texas.

Anderson, J.B., 2013. Coastal Processes and Environments Under Sea-Level Rise and Changing Climate: Science to Inform Management. *GSA Today*, 23, p. 13-14.

Anderson, J.B., Rodriguez, A.B. (Eds.), 2008. Response of Upper Gulf Coast Estuaries to Holocene Climate Change and Sea-Level Rise. *Geological Society of America Special Paper* 443, 146 pp.

Carlson, A. E., 2011. Ice Sheets and Sea Level in Earth's Past. *Nature Education Knowledge* 3, 3.

Church, J. A., White, N. J., 2011. Sea-level rise from the late 19th to the early 21st century. *Surveys in Geophysics* 32, 585–602.

Elsner, J.B., Jagger, T.H., and Liu, K.B., 2008b. Comparison of hurricane return levels using historical and geological records. *Journal of Applied Meteorology and Climatology*, 47, 368–374.

Emanuel, K., 2005. Increasing destructiveness of tropical cyclones over the past 30 years. *Nature*, 436, 686–688.

Milliken, K.T., Anderson, J.B., and Rodriguez, A.B., 2008a. A new composite Holocene sea-level curve for the northern Gulf of Mexico. In: Anderson, J.B., Rodriguez, A.B. (Eds.), Response of Upper Gulf Coast Estuaries to Holocene Climate Change and Sea- Level Rise. *Geological Society of America Special Paper* 443, p. 1-11.

Morton, R.A., Bernier, J.C., Barras, J.A., 2006. Evidence of regional subsidence and associated interior wetland loss induced by hydrocarbon production, Gulf Coast region, USA. *Environmental Geology* 50, 261–274.

Paine, J.G., 1993. Subsidence of the Texas coast: inferences from historical and late Pleistocene sea levels. *Tectonophysics* 222, 445–458.

Paine, J.G., Sojan, M. Tiffany, C., 2012. Historical shoreline change through 2007, Texas Gulf Coast: rates contributing causes, and Holocene context. *Gulf Coast Association of Geological Societies Journal* 1, 13-26.

Rahmstorf, S., Cazenave, A., Church, J.A., Hansen, J.E., Keeling, R.F., Parker, D.E., Somerville, R.C.J., 2007. Recent climate observations compared to projections. *Science* 316, 709.

Rignot, E., Velicogna, I., van den Broeke, M.R., Monaghan, A., Lenaerts, J.T.M., 2011. Acceleration of the contribution of the Greenland and Antarctic ice sheets to sea level rise. *Geophysical Research Letters* 38, L05503, doi:10.1029/2011GL046583.

Rodriguez, A.B., Anderson, J.B., Siringan, F.P., and Taviani, M.,2004, Holocene evolution of the east Texas coast and inner continental shelf: along-strike variability in coastal retreat rates, *Journal of Sedimentary Research*, v. 74, p. 406-422.

Wallace, D.J., Anderson, J.B., 2010. Evidence of similar probability of intense hurricane strikes for the Gulf of Mexico over the late Holocene. *Geology* 38, 511–

Webster, P.J., Holland, G.J., Curray, J.A., and Chang, H.R., 2005, Changes in tropical cyclone number, duration, and intensity in a warming environment. *Science*, 309, 1844–1846.

DOUBLE JEOPARDY

THE DWINDLING WATER SUPPLIES OF TEXAS ARE SOLD TWO TIMES OVER

BY ANDREW SANSOM

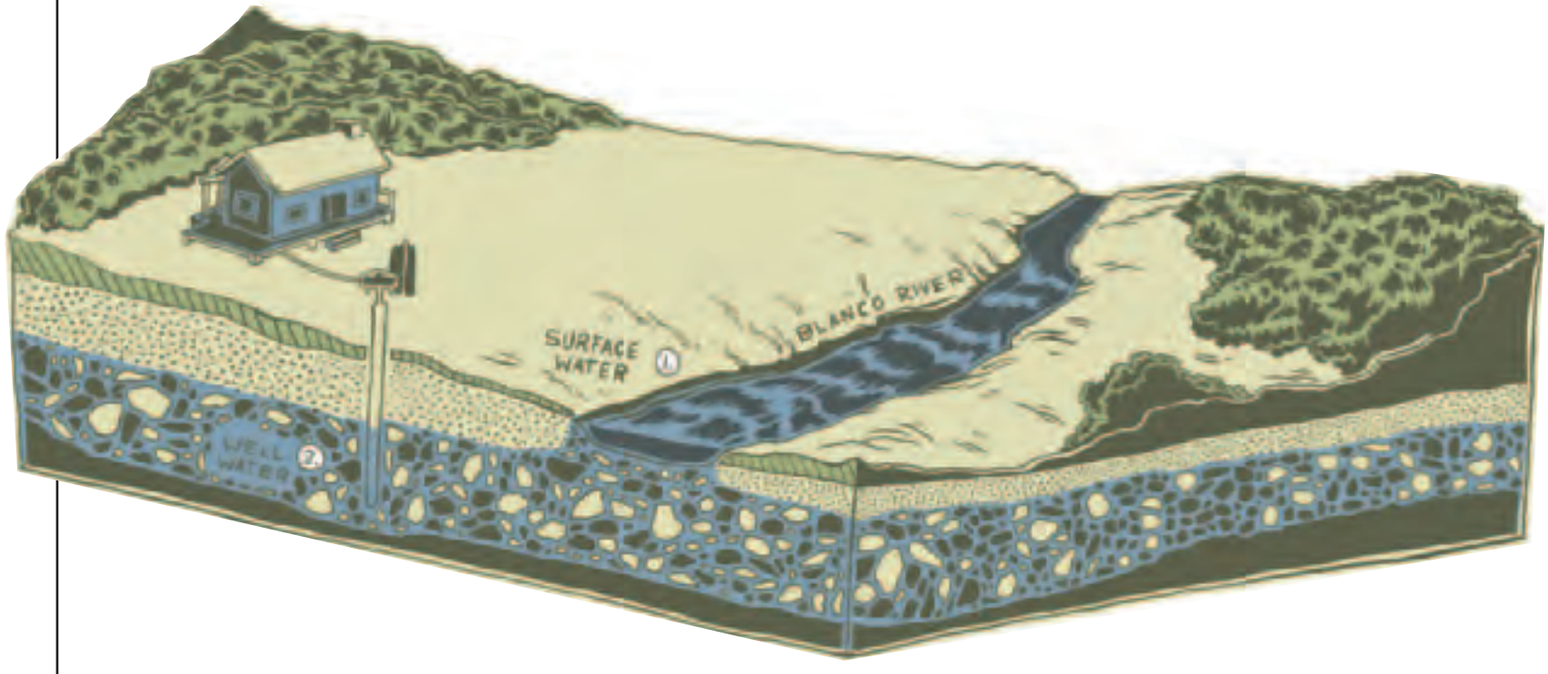


ILLUSTRATION BY SARAH WELCH

IMAGINE, IF YOU WILL, THE BLANCO RIVER. Its source is just below the Gillespie County line, south of Fredericksburg in Kendall County. The Blanco flows southeastward through Blanco County and before reaching Hays County, virtually all its flow goes right back into the ground through the river bed and back into the aquifer. The river flows underground into Hays County where it re-emerges at a lovely spring known as Jacob's Well and forms the headwaters of Cypress Creek. Cypress Creek flows down through the communities of Wood Creek and Wimberley and ultimately back into the Blanco. If you tried to get a water rights permit from the Texas Commission on Environmental Quality to take any substantial amount of "surface" water out of the Blanco, your request would most likely be denied because the river is already over committed—but if you went back upstream above Jacob's Well and drilled a well, you could draw a virtually unlimited amount of "ground" water from the same stream without restraint.

It is the same water whether underground or on the surface, but we are in a situation where the state treats it totally differently and, in effect, has promised different interests that each owns the same water. C

· CITE 93 ·
ENVIRONMENTAL ISSUES

GROWING RISKS

✕ CHALLENGES TO MAINTAINING HOUSTON'S PROSPERITY AND AIR QUALITY

BY LARRY SOWARD

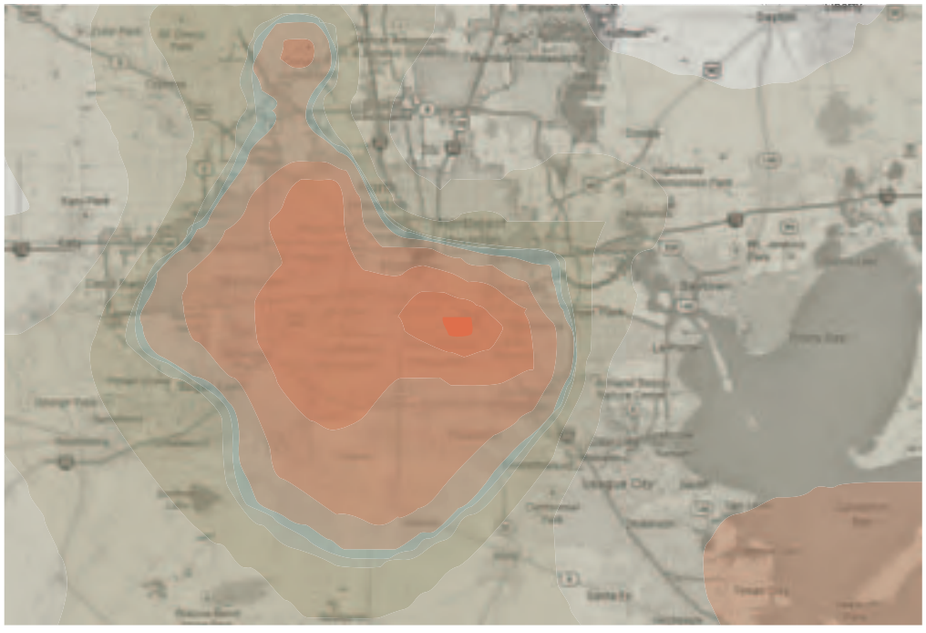
Population and economic growth in the Houston region create a virtuous cycle of business development, cultural vibrancy, and improved quality of life. There are also some significant costs and risks associated with that growth when it comes to our environment and our health. Let's look at **four growth areas** that could significantly inhibit that virtuous cycle by compromising our air quality. The challenges are complex and require the region as a whole to face up to the hard choices ahead.

1
PANAMAX

Unquestionably, one of the most significant growth events in the region involves the Port of Houston. The current expansion of the Panama Canal to accommodate larger vessels will double its capacity in 2014. With the increased container cargo trade resulting from this expansion, the Port of Houston finds itself well-positioned for significant growth and will likely be one of the most positively impacted U.S. ports. The Port predicts up to a 40 percent growth in its shipping activity will come from the Canal's creation of an efficient link between the Gulf of Mexico and the growing markets in East Asia, the west coast of South America, and the southern ports of Central America.

In addition to the Panama Canal expansion, shipping lines are also working with the Port to bring in the largest container vessels ever to call there, requiring significant infrastructure, both at the terminal and in the Ship Channel. To accommodate increased cargo volumes and larger ships, the Port has begun to construct additional or improved terminal facilities. The completion of a substantial portion of the Bayport Container Terminal at approximately the same time as the completion of the Panama Canal expansion is expected to triple the container-handling capacity of the Port. Furthermore, significant improvement or enlargement of the Ship Channel is also planned.

This extensive expansion of Port infrastructure and operations will necessarily have some significant impacts on the environs of the Ship Channel. As the Port expands, additional ship and barge traffic, and attendant support facilities, will raise air-pollutant emission and public health issues for citizens and communities in the area. Truck and rail load increases will not only impact the Port



× LEFT *Houston Clean Air Network Ozone Map; July 4, 2012.*

OZONE PARTS PER BILLION	LEVELS OF HEALTH CONCERN
136+	HAZARDOUS
116–135	VERY UNHEALTHY
96–115	UNHEALTHY
77–95	WARNING
61–76	MODERATE
0–60	GOOD

area, but likely a significant portion of the region. Truck volumes are expected to grow significantly along the major trade corridors serving the area's port and waterway system. In 2007, a majority of all freight (61 percent, or more than 780 million tons) that moved across the region was hauled by truck. By 2035, the truck share is expected to grow to 65 percent, more than 1.2 billion tons yearly.

2
COAL EXPORT TERMINALS

Related to the Port's growth and even further impacting the environs of the Ship Channel are at least three other major development projects. The first involves growing efforts by Gulf Coast ports such as the Port of Houston to further capitalize on the Panama Canal expansion by capturing an exploding coal export market. Significant opposition to the construction and operation of a number of major coal export terminals proposed in the Pacific Northwest to export coal from mining areas in Wyoming and Montana to Asia has led coal producers to look to Gulf Coast ports for greater access. Given the huge economic opportunities presented by increased coal exports, these ports are actively seeking this export business. Where existing capacity is currently limited, the ports are planning necessary expansions to accommodate the projected new export volumes.

Plenty is already happening on the coal export front here in Houston. Kinder Morgan plans to expand its two terminals on the Ship Channel, where it now runs smaller docks for exporting petroleum coke generated by nearby refineries. As part of a $400 million expansion, these two terminals and one in Louisiana will begin exporting Colorado-mined coal in 2014, timed to the Panama Canal expansion completion. Marking the first export of western coal from the Port of Houston, the expanded terminals will handle three 135-car trains daily with an export capacity of over 10 million tons of coal annually. Likewise, down in Galveston, the Texas, Mexico & Pacific Railroad plans to build a railway bridge and tracks out to a new coal export terminal on Pelican Island, where as much as 15 million tons could be exported yearly.

Certainly, this increased coal exportation will bring positive economic impacts in terms of jobs and money. Yet significant environmental hazards and health impacts are also likely to result. By their very nature, coal export terminals are noisy, polluted with diesel fumes and coal dust, and dominated by huge, unsightly piles of coal, all often significantly impacting the environs. Since the cheapest way to get coal to port is by rail, rail traffic will radically increase, crowding out other rail-using commodities and necessarily prompting construction of new rail lines. Extremely long coal trains passing through the area will deposit polluting coal dust everywhere along the routes and bisect urban areas and roadways for hours every day. Finally, the introduction of new or expanded coal export terminals on the Ship Channel will further amplify the Port's own expansion projects.

3
KEYSTONE PIPELINE

Next, there is the Keystone Pipeline—the $7 billion, 1,700-mile, 36-inch pipeline that, if approved, will carry over 700,000 barrels per day of tar sands crude from Alberta, Canada, across six states to the Gulf Coast. The southern portion of the pipeline, known as the Gulf Coast Project, will run 485 miles through 16 counties in

north and east Texas from the Oklahoma border to refineries in Houston and Port Arthur, where coking facilities necessary to refine heavy crude are readily available. The 48-mile Houston Lateral Project will run through the counties of Liberty, Chambers, and Harris, transporting oil to refineries in the refinery/petrochemical complex along the Ship Channel.

Despite the positive economic benefits that the pipeline will bring, there are significant environmental concerns as to both the pipeline's construction and operations, and the refining of the tar sands crude in area refineries. Processing the heavy, molasses-like tar sands oil into useable fuel will release more sulfur, nitrogen oxide, metals, and other toxic pollutants than conventional crude oil refining. Also, given the higher fuel input necessary to refine the tar sands into usable products, about 17 percent more greenhouse gas emissions are expected than with conventional refining. All said, it is only reasonable to expect air pollutant emissions to increase in the region; the only question is how much.

4

PETROCHEMICAL PLANT EXPANSIONS

Finally, on the development front, our region is poised to see the largest petrochemical expansion in Texas since the days of cheap oil in the 1980s. Driven primarily by the natural gas boom, at least a dozen refineries and petrochemical plants in the region are moving forward with expansion projects to capitalize on the abundant supply of cheap natural gas, which is used as chemical feedstock. This has caused a rush of chemical industry investment and a sharp rise in demand for chemical industry employees, thus rejuvenating the petrochemical manufacturing sector and fostering significant exports.

These projects involve big names. ExxonMobil is building a new multibillion-dollar ethane cracker at its Baytown refinery and petrochemical complex. Scheduled to start up in 2016, the new facilities will process up to 1.5 million tons of chemicals annually and provide feedstock for a nearby polyethylene plant. As part of a $4 billion expansion plan also inspired by the shale gas boom, Dow Chemical Company is building a new $1.7 billion ethylene production plant at its huge chemical complex in Freeport. When completed in 2017, it will have an annual ethylene capacity of 3.3 billion pounds. Likewise, Chevron Phillips Chemical Company plans to spend $5 billion to build a new ethane cracker and 1-hexene plant at its Baytown petrochemical plant. And the list goes on!

Unquestionably, all these major expansion projects will create thousands of new jobs and inject billions of dollars into the area economies. However, these enormous projects will also raise significant environmental and public health issues for areas already inundated with petrochemical plants and refineries and overburdened with environmental pollution and health risks. All these planned facilities might not be built, and certainly these newer plants will generally pollute less than plants built just a decade ago, yet those that are built will still add more air pollutants to the total pollution we already experience.

THE COSTS

So, given all this growth and economic development that is happening or about to happen in the Houston region, what are the costs in terms of risks to our environment, our health, and our quality of life?

The most significant costs stemming from all this growth are the impacts on public health. Out of a total population of almost 4.2 million in Harris County, over 93,000 suffer from pediatric asthma; almost 223,000 suffer from adult asthma; 156,000 live with COPD; almost 1 million have cardiovascular disease; and 300,000 have diabetes. At particular risk are the almost 1.2 million residents who are children under age 18; more than 350,000 individuals who are 65 and over; and the more than 800,000 people who live in poverty. Most of the expected major industrial growth will be in communities along the Ship Channel which are already inundated with petrochemical plants and refineries and overburdened with pollution and health risks. Already experiencing higher levels of air pollution, increased incidents of cardiac and respiratory illnesses and increased risks of air toxics-related illnesses, these communities will very likely have their health problems made even worse.

Exposure to elevated levels of ozone and fine particles in the air can cause or aggravate various respiratory symptoms, including decreased lung capacity, asthma, inflammation of lung tissue, and chronic bronchitis. Regular or prolonged exposure can also impair the body's immune system defenses, making people more susceptible to infections and diseases. Increased air pollution levels have been linked to increased cardiac and respiratory-related emergency room visits, hospital admissions, work and school absences, and even higher death rates. A recently released study by Rice University researchers, published in the American Heart Association's journal *Circulation* in February 2013, found a direct link between out-of-hospital cardiac arrests and levels of air pollution and ozone. Based on data collected from Houston's network of air-quality monitors and the more than 11,000 out-of-hospital cardiac arrests logged by Houston Emergency Medical Services between 2004 and 2011, the Rice researchers found that a daily average increase in particulate matter of 6 micrograms per day over two days raised the risk of cardiac arrest by 4.6 percent, and each increase of 20 parts per billion in the ozone level over one to three hours also increased the risk of cardiac arrest up to a peak of 4.4 percent. The study found that 55 percent of these heart attacks occurred during the summer months; that patients died in more than 90 percent of the cases; and that risks were higher for men, African-Americans, and people over age 65. An American Lung Association study also found that children who play active team sports in areas with high levels of ozone are more likely to develop asthma. Studies conducted at the University of Texas Medical Branch in Galveston found that healthy adults experienced increased airway obstruction as ozone levels increased throughout the day, even when those levels remained far below national standards. Exposure to air toxins in high concentrations can precipitate nausea, headaches, confusion, seizures, severe difficulty in breathing, and sometimes death. Other severe health effects that can result include cancer and various immunological, hormonal, neurological, reproductive, developmental, and respiratory effects, depending on the specific air toxin, its

concentration, and exposure time. Many air toxins are neurotoxins and can cause genetic damage.

From a regulatory standpoint, the Houston area has consistently failed to meet national air quality standards for ozone. We have failed to meet the 30-year-old one-hour ozone standard of 125 parts per billion (ppb) and the 1997 eight-hour standard of 85 ppb. The Houston area is now classified as "marginal" in nonattainment for the new 2008 ozone standard of 75 ppb. Our ozone levels currently rank seventh highest on the list of major cities, and the American Lung Association recently gave Houston a failing grade for ozone pollution, ranking it eighth worst among all cities. The number of "ozone alert" days yearly continues to be high: 47 in 2011 and 35 in 2012. Yet we are currently relying on control strategies put in place to meet the old ozone standard in order to attain the new standard or create some margin of safety. These facts become even more significant given that the federal Clean Air Act requires that the 2008 ozone standard be reviewed again this year, and it could be lowered even more.

Furthermore, the Houston area hovers perilously close to nonattainment of the new annual standard for fine particulate matter. As with ozone, the American Lung Association has given Houston an F for particulate matter pollution, ranking it 23rd worst in year-round particle pollution. While many predict Harris County can meet the new standard by 2020 without undertaking any further actions to reduce emissions beyond the controls currently required or planned, all the expected population and economic growth in the region, coupled with our already significant air pollution problems, present significant challenges to achieving and maintaining the new standard.

Toxic air pollutants, such as benzene, styrene, 1,3-butadiene, and others, are also significant in certain areas in and around Houston, such as the highly industrialized East Side along the Ship Channel. While we have made progress in reducing these toxic air pollutants, existing or new sources remain of significant concern and we must continue to focus on necessary strategies to address them.

Finally, Texas ranks first in the nation and eighth in the world in greenhouse gas emissions. The Gulf Coast area is the epicenter of these emissions, with Harris County leading all counties in the nation in CO_2 emissions.

Undoubtedly, all the expected population and economic growth in the region is coming at a time when improving our air quality is already the largest environmental and health challenge we face in the Houston area. Again, all the planned major expansion projects along the Ship Channel and among the refining and petrochemical facilities in the region will only make our current air pollution problems worse. Equally significant is the fact that the almost 2.8 million vehicles in Harris County today are predicted to double by 2040. According to Houston-Galveston Area Council regional transportation studies, by 2040 nearly all of the region's major roadways will have more demand than what they are designed for, and most of the future population growth will occur in new and emerging areas of the region that are not currently served by public transit or have no current plans for future transit services. Since vehicles currently account for over 70 percent of ozone-forming nitrogen oxide, more vehicles simply mean more air pollution.

By their very nature, coal export terminals are noisy, polluted with diesel fumes and coal dust, and dominated by huge, unsightly piles of coal, all often significantly impacting the environs.

THE SOLUTIONS

So, what can we do to meet the enormous challenges associated with cleaning up our air at a time of mushrooming population and economic growth? We certainly can't relax our focus or our efforts, saying like Scarlett O'Hara, "Tomorrow is another day." While we have made significant, positive progress towards cleaning up our air, we still have a long way to go.

We have already "picked the low-hanging fruit." Business and industry sectors have already seen an estimated 80 percent reduction in ozone-forming emissions due to control strategies put in place over the past decade. Now we are faced with either looking at deeper and more costly reductions of emissions from industrial sources, or finding ways to reduce other emissions, especially from vehicles. But the latter involves people—area citizens going about their daily lives, traveling to work, grocery shopping, taking kids to school, and so on. Changing these day-to-day habits won't come easy, especially in our sprawling, vehicle-dependent county where, again, there are almost 2.8 million vehicles today. And that number is predicted to double by 2040. Nevertheless, that kind of change is necessary if we are to ensure that this region remains a healthy and prosperous place to live.

Furthermore, simply meeting minimal air quality standards likely will not achieve our goals. We have no room for complacency, no room for the status quo. We will have to push harder and stretch further than we ever have to make a significant difference. Changing our driving behavior to reduce air pollution and ensure a cleaner, healthier environment now and in the future will require new thinking and open minds in order to develop new and creative strategies. For example, we should encourage strategies like increased mass transit ridership, telecommuting to allow employees to work from home instead of driving into work, or creating more flexible four-day work weeks to eliminate one day's commute. We must also continue the development of cleaner-burning, less-polluting fuels, and should expand upon strategies such as idling reduction.

Houston is an excellent example to dispel the inevitable "doom's day" claims that enhanced environmental protection will surely stall an economic engine and cause our economy to suffer. We have experienced tremendous economic growth and prosperity in recent years and are enjoying one of the strongest and most extensive economic development eras in history. All this has occurred while making significant efforts in every sector to deal with the major and far-reaching environmental issues and challenges of improving our environment. We have shown we can continue to improve our environment, our health, and our quality of life while ensuring a sound and growing economy. We must continue that sound approach. C

ENVIRONMENTAL JUSTICE AND THE POLITICS OF GARBAGE

THE MOUNTAINS OF HOUSTON

ROBERT D. BULLARD

When I began research work in environmental justice at Texas Southern University in 1978, Houston was 52.3 percent White, 27.4 percent Black, 17.6 percent Hispanic, and 2.7 percent Asian and other. The government, however, was all White and all male. This lack of equitable representation had consequences. In place of NIMBY (Not In My Back Yard) politics, Houston practiced a "PIBBY" (Place In Blacks' Back Yard) policy. Government and private industry targeted Houston's Black neighborhoods for landfills, incinerators, garbage dumps, and garbage transfer stations.

The year I arrived at the university, controversy erupted over a proposal to build the Whispering Pines sanitary landfill near Northwood Manor, a mostly Black middle-class neighborhood. In 1979, as a young sociologist, I was asked to conduct a study of solid waste disposal siting in Houston for a class-action lawsuit (Bean v. Southwestern Waste Management) that had been filed against the City of Houston, the State of Texas, and the locally based Browning Ferris Industries. The Northwood Manor neighborhood of trees, single-family homes, and schools was an unlikely location for a garbage landfill—except that over 82 percent of its residents were Black. Though the Bean case was lost, it marked an important beginning as the first lawsuit in the United States that charged environmental discrimination in solid-waste facility siting under the Civil Rights Act.

In that siting study, my graduate students and I mapped the location of every major landfill site in Houston using pushpins on paper. If we noticed a hill in the usually flat landscape, we investigated it because a change in topography often indicated a dump. We found that although at that time Blacks made up just over one-fourth of Houston's population, five out of five city-owned landfills (100 percent) and six of the eight city-owned incinerators (75 percent) were sited in Black neighborhoods. After my study for the Bean case, my career became linked with the environmental justice movement, and I have since then had the opportunity to work with communities all over the world.

FIG 1

Residents of Northwood Manor protest Whispering Pines landfill in 1979.

A new city park constructed in 1985 adjacent to Whispering Pines site.

A vast mountain of garbage covered with grass and dirt looms over the park in 2013.

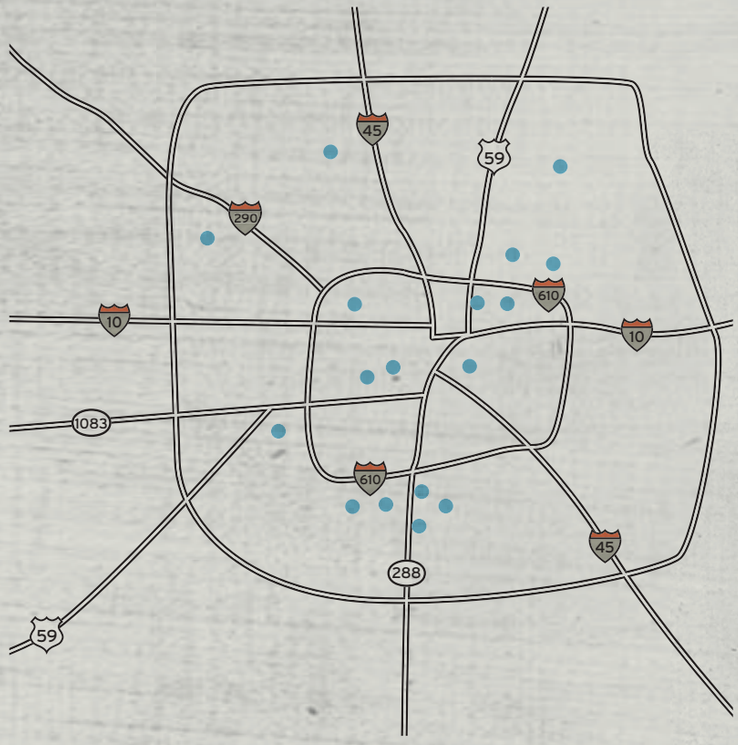
HISTORIC PHOTOS COURTESY ROBERT BULLARD

TABLE 1

FACILITY	NEIGHBORHOOD	TYPE LANDFILL/INCINERATOR	NEIGHBORHOOD ETHNICITY
FOURTH WARD	FOURTH WARD	BOTH	BLACK
HOLMES ROAD	SUNNYSIDE	BOTH	BLACK
REED ROAD	SUNNYSIDE	LANDFILL	BLACK
KIRKPATRIC	TRINITY GARDENS	LANDFILL	BLACK
WEST DONOVANK	ACRES HOMES	LANDFILL	BLACK
NORTHWEST	CARVERDALE	INCINERATOR	BLACK
PATTERSON STREET	COTTAGE GROVE	INCINERATOR	BLACK
KELLEY STREET	KASHMERE GARDENS	INCINERATOR	BLACK
NAVIGATION	SECOND WARD	INCINERATOR	HISPANIC
WESTPARK	LARCHMONT	INCINERATOR	WHITE

CITY OF HOUSTON MUNICIPAL LANDFILLS AND INCINERATORS

*The above city-owned solid waste water facilities operated from the 1920s up until the 1970s when the city got out of the landfilling and incineration business. Ethnicity of neighborhood represents the population at the time the facility was sited.
Source: Robert D. Bullard, *Invisible Houston: The Black Experience in Boom and Bust* (1987)



Landfill and incinerator sites in Houston as of 1979.

TABLE 2

PRIVATELY OWNED HOUSTON SANITARY LANDFILL LOCATIONS BY CITY COUNCIL DISTRICTS 1970-1978

*Only the McCarty Landfill and Whispering Pines Landfill are currently in operation. Source: Robert D. Bullard, *Invisible Houston: The Black Experience in Boom and Bust* (1987).

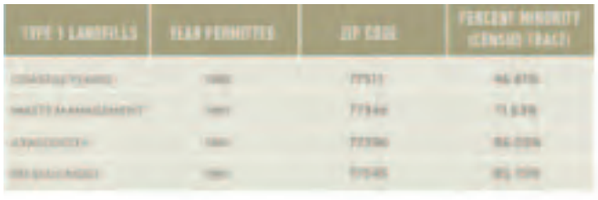


TABLE 3

TYPE I LANDFILLS USED BY HOUSTON THAT ARE NOT IN THE CITY

*Percentages are based on 2010 Census figures.
Source: City of Houston Solid Waste Management Department

I left Houston in 1987 and returned 24 years later. Like Rip Van Winkle, I can see clearly what has and has not changed. What I found upon my return in 2011 was a situation that is more complex, perhaps, but has the same basic dynamics of inequality. In this article, I give a brief history of waste management practices in Houston, look at ongoing challenges, and suggest some first steps towards strategies for the future. Houstonians can learn from other diverse cities about how to work together to fight environmental injustices, but the first step is to understand the scope of the problem.

"UNOFFICIALLY ZONED FOR GARBAGE": HISTORICAL CONTEXT

On May 16, 1967, more than 46 years ago, Black Houstonians picketed the Holmes Road dump in the southeast Sunnyside neighborhood where an 8-year-old Black child had drowned. Not only did residents see the placement of the city dump in their neighborhood as unfair, but that placement had actually resulted in the death of an innocent child. The landfill protesters joined forces with another group protesting racism in Houston schools (charging that Black students were disciplined more harshly than White students) in holding rallies and marches that later fueled the student resistance and police overreaction that led to the 1967 Texas Southern University "riot." According to the 1968 Report of the National Advisory Commission on Civil Disorders, this was the only major civil disturbance that occurred in Houston during the turbulent 1960s.

In 1971, Houston elected its first Black city councilman, Judson Robinson, Jr. Once he was elected, the first crisis he faced involved a city-owned landfill. Councilman Robinson had to quell a near riot at the Kirkpatrick landfill in the mostly Black Trinity Gardens neighborhood. Protesters were demanding that the city-owned landfill be closed. After six months of intense demonstrations, the protestors prevailed.

In 1978, residents of Northwood Manor began resisting plans for the aforementioned Whispering Pines landfill and instead requested a park. The court case dragged on for years. In 1985, Mayor Kathy Whitmire made sure that the neighborhood got a park—the J.T. Trotter Park on East Little York Road. Unfortunately, the court case was lost the same year, and the Whispering Pines landfill was built less than a mile from the new park. Today, as a result of this downgrading intrusion, Northwood Manor residents have numerous industrial facilities—not just the landfill—as neighbors. The original bucolic character of the neighborhood has been forever lost as the sprawling landfill looms near soccer fields, homes, and places of worship.

Research findings in the Bean case exposed a clear pattern of waste facility siting in Houston. From the 1920s through the late 1970s, Black Houston was unofficially zoned for garbage. Eleven of 13 city-owned landfills and incinerators (84.6 percent) were built in Black neighborhoods—a clear overrepresentation of one minority's neighborhoods in the hosting of city-owned solid waste facilities (Table 1).

This city siting pattern in turn set the stage for private waste disposal firms to follow. The Texas Department of Health (TDH) was the state agency charged with permitting Type I standard sanitary landfills. From 1970 to 1978, TDH issued four sanitary landfill permits for the disposal of Houston's solid waste (Table 2). All four of the privately owned Type I solid waste landfills were located in minority council districts (Table 2).

Today, the ethnic makeup of Harris County's 4.09 million residents is now mostly people of color—41 percent Hispanic, 18.4 percent Black, and 7.7 percent Asian, compared to 33 percent White. Yet the brunt of waste disposal is still borne disproportionately by low-income minorities of color. Two Type I landfills, McCarty and Whispering Pines, now operate in Houston, and both are in council district B, which is 93 percent people of color (53 percent Black and 40 percent Hispanic).

After 1978, as the Bean case began making its way through the courts, no other Type I landfills were built in the city. Houston instead began sending some of its household garbage to four landfills located outside of the city. But the discriminatory pattern did not change: three of the four non-Houston landfills are located in census tracts where the majority of the population are people of color—Waste Management (76.6 percent), Atascocita (86.0 percent), and BFI Blue Ridge (85.7 percent) (Table 3).

ILLEGAL DUMPING GROUNDS

Changing the siting of city-owned and private landfills alone will not fully address Houston's problems with unequal exposure to waste. I also identified illegal dumping as a major problem in *Invisible Houston* (1987), and it continues to be a problem today. In June 2012, Mayor Anise Parker appointed the Task Force on Illegal Dumping to bring together the Solid Waste Department, neighborhoods, the police, and the Mayor's Office of Sustainability to coordinate enforcement and education in an effort to cut down on roadside dumping.

Between 2008 and 2011, a total of 18,367 non-emergency "311" calls reporting illegal dumping were made to the Houston Solid Waste Department. The

COUNCIL DISTRICT	PERCENT MINORITY	CALLS 2008	CALLS 2009	CALLS 2010	CALLS 2011
A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
D	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
E	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
F	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
G	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
H	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
I	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
J	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
K	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TOTAL		[illegible]	[illegible]	[illegible]	[illegible]

TABLE 4

ILLEGAL DUMPSITE 311 CALLS
BY COUNCIL DISTRICT 2008-2011

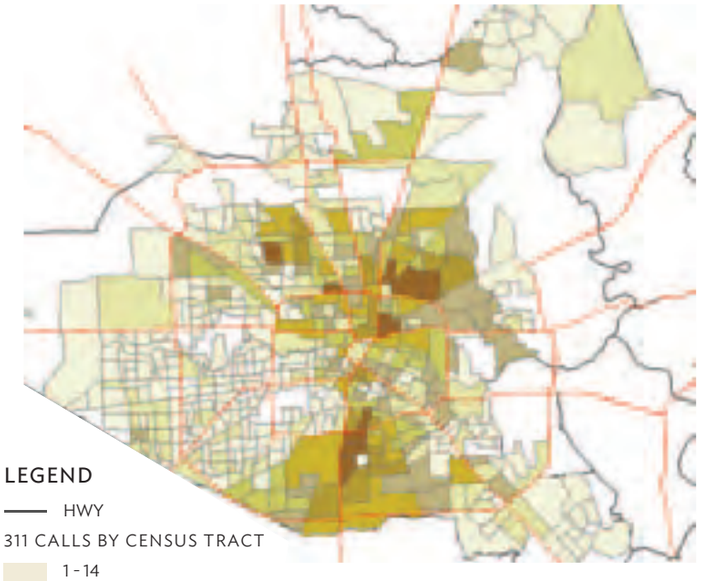
*Percentages are based on 2010 Census figures.

FACILITIES	COUNCIL DISTRICT	PERCENT MINORITY (COUNCIL DISTRICT)	PERCENT MINORITY (CENSUS TRACT)
TRANSFER STATIONS			
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
RECYCLING FACILITIES			
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
ENVIRONMENTAL SERVICE CENTERS (ESC)			
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
NEIGHBORHOOD DEPOSITORIES/ RECYCLING CENTERS			
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

TABLE 5

LOCATIONS OF HOUSTON WASTE TRANSFER STATIONS AND RECYCLING FACILITIES

*Percentages are based on 2010 Census figures.



MAP

CITY OF HOUSTON ILLEGAL DUMPSITE INCIDENTS –
311 CALLS 2008-2011

*Data provided by City of Houston

predominantly Black and Hispanic council districts B, D, and H were the source of a disproportionately large share of the illegal dumping calls for each of the four reporting years—59 percent of the calls in 2008, and 66 percent of the calls in the 2009-2011 period (Figure 1 and Table 4).

It is clear that the same Houston council districts that have hosted solid waste facilities over the years have become prime targets for illegal dumping. This should have been easy to predict: Illegal dumping was already a problem near the Whispering Pines landfill in 1980.

The Mayor's Task Force on Illegal Dumping completed its work in June 2013, resulting in the Houston City Council's passing a budget amendment that has allocated $250,000 for 25 surveillance cameras systems (the cameras cost about $10,000 per unit) to monitor illegal dumping "hot spots" in the five council districts—B, D, H, I, and K—identified by the Solid Waste Department as having major challenges with illegal dumping. Each of the illegal dumping "hot spot" council districts will receive five camera systems for surveillance purposes. This measure, however, is not likely to solve the problem. As I pointed out 25 years ago in *Invisible Houston*, illegal dumping will only end when the residents in the targeted neighborhoods and council districts "take back" their communities. The costs and penalties associated with illegally dumping in Houston have never been severe enough to serve as a serious deterrent.

RECYCLING IN HOUSTON

Houston collects approximately 420,000 tons of solid waste and another 71,000 tons of yard waste annually from residents. Most of this waste ends up at landfills. Houston is one of the few major U.S. cities without a garbage fee, despite the fact that having extra funds in the city's Solid Waste Department could go a long way to addressing critical waste management challenges, from illegal dumping to citywide recycling.

The city picks up garbage at 375,000 homes. Currently, 105,000 homes have single-stream recycling (all recycling materials mixed together) and another 100,000 homes have dual-stream recycling (fiber materials such as paper are separated from materials such as plastic and cans) at the curbside. But even with curbside pickup convenience, Houston has a dismal recycling rate. In 2009, *Waste and Recycling News* reported that Houston ranked ninth out the 10 largest U.S. cities in the United States in terms of recycling—only 16.7 percent of Houston trash was recycled, compared to 65 percent for Los Angeles, 60 percent for San Jose, 55 percent for New York, and 52.4 percent for Chicago. Only San Antonio was worse than Houston, with a 4 percent recycling rate in 2009.

In March 2013, Houston won a $1 million grant from the Bloomberg Philanthropies' Mayors Challenge to implement a "One Bin for All" project where residents place all their trash and recycling in one bin for collection, to be separated later at a transfer station. City leaders believe newer technologies that allow this all-in-one collection directed to a Material Recovery Facility (MRF), or "dirty MRF" collection, will increase Houston's recycling rate from the current 14 percent to at least 75 percent. Some critics of the experiment oppose it, however, because they feel more effort and resources should be spent on expanding single-stream recycling to all Houston neighborhoods.

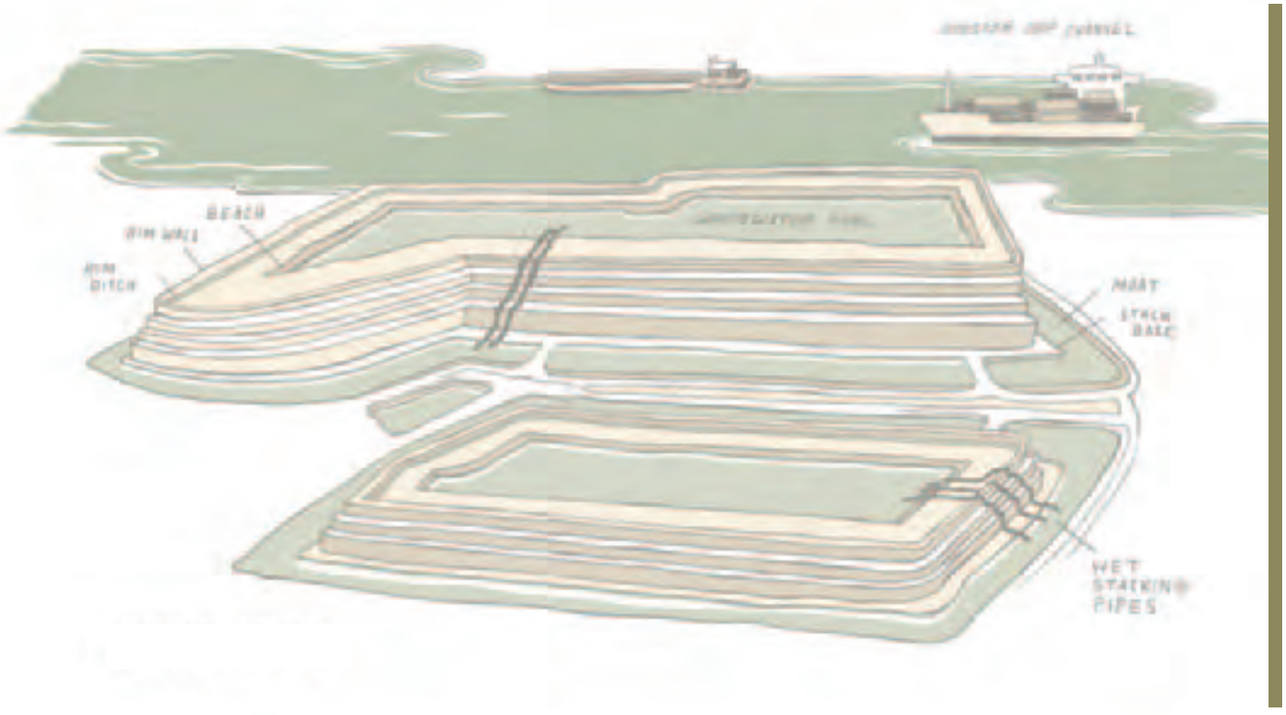
All recycling is not created equal. Which communities get access to recycling first and which communities get the "cleanest" or "dirtiest" recycling facilities are key environmental justice issues. Houston has three garbage transfer stations, and all three are located in minority neighborhoods. In 1983, the first city-owned garbage transfer station was opened in the Carverdale neighborhood. Local residents understandably did not greet this "first" as a victory. Transfer stations are dropoff points for the garbage trucks that make curbside collections and pickup sites for the much larger trucks that haul the garbage off to a landfill. These sites create noise and dust pollution, traffic hazards, and odor problems for their neighbors.

Houston currently has 13 recycling facilities (Table 5). Ten of these 13 recycling facilities (77 percent) are located in neighborhoods populated primarily by people of color. The 13 facilities include five "cleaner" recycling centers, which do not accept junk waste, tree waste, or garbage, but generally accept aluminum and tin cans, glass bottles, paper, and plastics. Three of these five city recycling centers (60 percent) are located in majority White areas. On the other hand, all six "dirtier" neighborhood depositories/recycling centers, which accept and dispose of tree waste, junk waste, and used motor oil, in addition to household recyclables, are located in communities where people of color live.

Four of the six neighborhood depositories/recycling centers are located in council districts (B, D, H, and I) designated as illegal dumping "hot spots," and three are located in the same council districts having garbage transfer stations (J, A, and I).

DIVERSITY CHALLENGES AND OPPORTUNITIES

In 1990, environmental justice leaders sent a letter to the "Big Ten" environmental and conservation groups (Sierra Club, Sierra Club Legal



PASADENA'S ALPS

The fertilizer plant located off the Pasadena Freeway (on the Freedom Trail to the San Jacinto Monument) is the "largest producer of synthetic granulated ammonium sulfate fertilizer in North America," according to its current owner, Rentech Nitrogen.

A mountain range-like series of gypsum stacks were formed by pooling toxic waste water. The water evaporates and leaves the phosphoric gypsum. According to the EPA, under previous ownership, "Several releases from the gypsum stacks have caused the discharge of millions of gallons of untreated process water from the facility to the surrounding environment."

– Raj Mankad

Defense Fund, National Audubon Society, National Wildlife Federation, Environmental Defense Fund, Environmental Policy Institute/Friends of the Earth, Izaak Walton League, The Wilderness Society, National Parks and Conservation Association, and Natural Resources Defense Council), charging them with elitism, classism, and paternalism. The letter also called their attention to their lack of diversity in terms of staff, board members, and program. A March 2013 *Washington Post* article headlined "Within mainstream environmentalist groups, diversity is lacking," hit on this same theme more than two decades later.

Progress in Houston has been slow and uneven. Although Houston is a city with people of color in the majority, for some reason it has not developed a strong network of environmental justice organizations to address issues facing its people of color population such as those in New York, Los Angeles, and Chicago. Although the city has several well-known environmental justice groups run by people of color (Texas Environmental Justice Advocacy Services among them), much of the heavy environmental lifting in Houston is still left to the White environmental groups. One need only examine the member groups of the Houston-Galveston Citizens' Environmental Coalition (CEC) to see that Houston's environmental community has a serious diversity problem. Of the 102 CEC member groups, only two are organized by people of color (Great Plains Restoration Council and Pleasantville Environmental Coalition).

Given the diversity challenges of Houston's environmental organizations and the limited capacity of local environmental justice groups, one has to wonder who is setting the environmental priorities for the city's majority people of color population—including issues of waste management, pollution prevention, health equity, green schools, transportation equity, food security, parks justice and green services access, smart growth, just sustainability, clean and renewable energy, and climate justice.

One also has to wonder if the historical targeting of Black and Hispanic neighborhoods for locally unwanted land uses (LULUs) would be allowed if Houston possessed strong environmental justice organizations and networks. Clearly, Houston is not New York or Chicago, cities that have produced some remarkable leaders who have built multiethnic organizations and networks. Majora Carter of Sustainable South Bronx won a 2005 MacArthur "Genius" Grant for her environmental justice work. Another New Yorker, Peggy Shepard of We Act for Environmental Justice in Harlem, won the 2006 Heinz Award for her work. And Kim Wasserman of Little Village for Environmental Justice in Chicago won the 2013 Goldman Prize for Environment in North America.

Houston is not Los Angeles. Despite similarities in terms of racial and ethnic diversity, Houston has not been able to capitalize on its diversity to grow a robust multiracial, multi-issue network of environmental and social justice organizations that have expertise in organizing, education, policy making, legal action, and scientific research.

How much of the blame for this limited capacity in Houston rests with poor funding? No social movement can sustain itself over time without adequate funds. Nationally, funders spent a whopping $10 billion between 2000 and 2009 on environmental groups. However, just 15 percent of the environmental grant dollars benefited marginalized communities, and only 11 percent went to advancing "social justice" causes, such as community organizing. Environmental justice groups need funding to build capacity. Constrained funding in Houston has made it difficult for efforts at building organizational infrastructure, community organizing, leadership development, and effective participation in the policy arena to succeed. This lack is particularly shortsighted given that building a potent environmental justice presence in Houston will make us a much healthier and more livable city for all. C

ACKNOWLEDGMENTS

The author would like to extend special thanks to his staff at the Mickey Leland Center for Environment, Justice, and Sustainability at Texas Southern University: Glenn S. Johnson, Denae W. King, and Anthony M. Rodriguez. He also thanks the Barbara Jordan-Mickey Leland Scholars Steven C. Washington, Jamila M. Gomez, N. Jenise Young, and Zhirun Chen for their assistance with this project.

ILLUSTRATION BY SARAH WELCH

LEARN THE SONG OF OUR LAND

× IF YOU BELIEVE THE HOUSTON REGION IS A FLAT FEATURELESS LANDSCAPE OF LIMITED NATURAL BEAUTY, THINK AGAIN. NOW IS THE TIME TO PRESERVE THE REMARKABLY COMPLEX ECOSYSTEMS THAT RING OUR CITY.

BY JOHN JACOB

CATEGORIES OF HABITAT

Coastal Prairie: High Integrity

Prairies that have never been land leveled and, for the most part, have never been plowed. The full measure of landscape diversity is present.

Coastal Prairie: Moderate Integrity

Areas have experienced either no land leveling, but significant disturbance in terms of oil fields, very low-density development and the like, or moderate land leveling with no other complications.

Upland Forests

Undifferentiated forests, either hardwoods or pines, but are commonly coastal flatwood hardwood forests.

Bottomland Forests

Undifferentiated bottomland forests, mainly forests in 100-year floodplains.

Salt Marshes

Tidally influenced wetlands including marsh hay cordgrass and smooth cordgrass.

If we are to protect the world's multitude of places and creatures, then we must know them, not just conceptually but imaginatively as well. They must be pictured in the mind and in memory; they must be known with affection, "by heart," so that in seeing or remembering them the heart may be said to sing, to make a music peculiar to its recognition of each particular place or creature that it knows well.

WENDELL BERRY, "LIFE IS A MIRACLE," 2001

Real sustainability has to be about *place*. It can't just be about consuming less. It's not even really about "the planet." It's about *us*, right here where we are. Is *this* place a sustainable place? Could our grandchildren or their grandchildren continue to live here and thrive? Sure, we can buy organic "sustainable" strawberries from the San Joaquin Valley now, but when it becomes too expensive to ship those strawberries 1,800 miles to Houston, will there be sustainable produce grown right here that we can buy? Just exactly what *could* we buy locally if skyrocketing fuel prices meant we would have to live off the land? Off our land, that is. What is there here that could sustain us?

But we need more than farmland to sustain us. We also need natural areas, both prairies and forests, to make sure we have enough clean air to breathe and enough clean water for both us and the rest of creation that depends on the waterways in this area. The farmlands, prairies, and forests that surround us can be thought of as our "agroecological" infrastructure. We can't do much without the "gray" infrastructure we are all familiar with—bridges, buildings, power lines, the Internet—but in the long run, we can't do *anything* at all without the green or agroecological infrastructure that sustains us and provides us with clean air and water. Unfortunately, we are about to lose the very best of what is left in terms of both farmland and natural areas, all in the next 30 to 50 years. We will consume at least 1,000 square miles of forests, farms, and prairies in this period if we continue building out in the same pattern and at the same density as we do today. What does this say about our long-term prospects for sustainability?

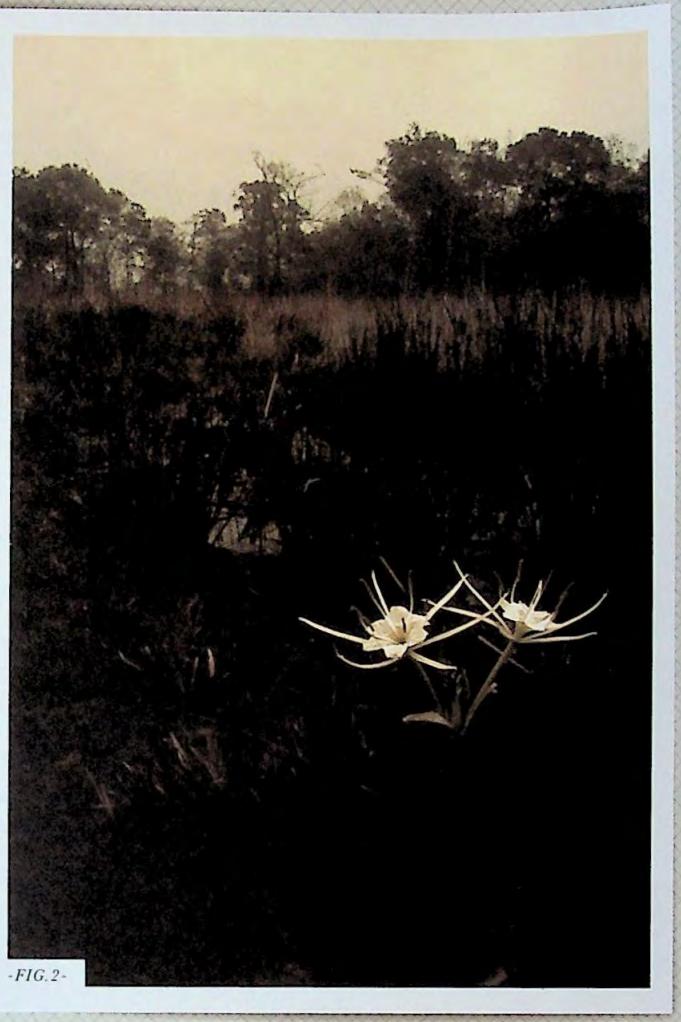
Incredibly, we do have a fair amount of agroecological infrastructure remaining in relatively good condition, even now, after all that sprawl has destroyed. There are still some large, very significant expanses of farmland and natural areas across the eight-county region centered on Houston. Our city could be a thriving, sustainable metropolis hundreds of years from now, with a vibrant and productive hinterland providing real, place-based sustainability for the foreseeable future. But our window of opportunity for putting that future into place is fast closing.

THE STORY OF OUR LAND

Place-based sustainability begins with understanding the makeup of our particular place. We have to learn the "song" of our place, as Wendell Berry suggests. But first we have to learn the notes of the song, the pieces that make up our landscape.

Just a few years ago, my grandson excitedly told me about a new program in his elementary school: "recycling for the rainforest." I was happy that he was learning about recycling, but for the rainforest? What about the coastal flatwoods of Texas? What about the coastal prairies? How is it that our children are learning about rainforests before they learn about *our* land? I argue below that landscapes on the upper Gulf Coast of Texas are extremely diverse and worthy of study by our best minds. It is a shameful travesty that our children are not learning about their own place on the planet. But the reality is that we have very few scientists studying the ecologies of our prairies or our forests. For so long, the Houston region has just been about developers making money and getting out. It is starting to be more than that, but we have so far to go.

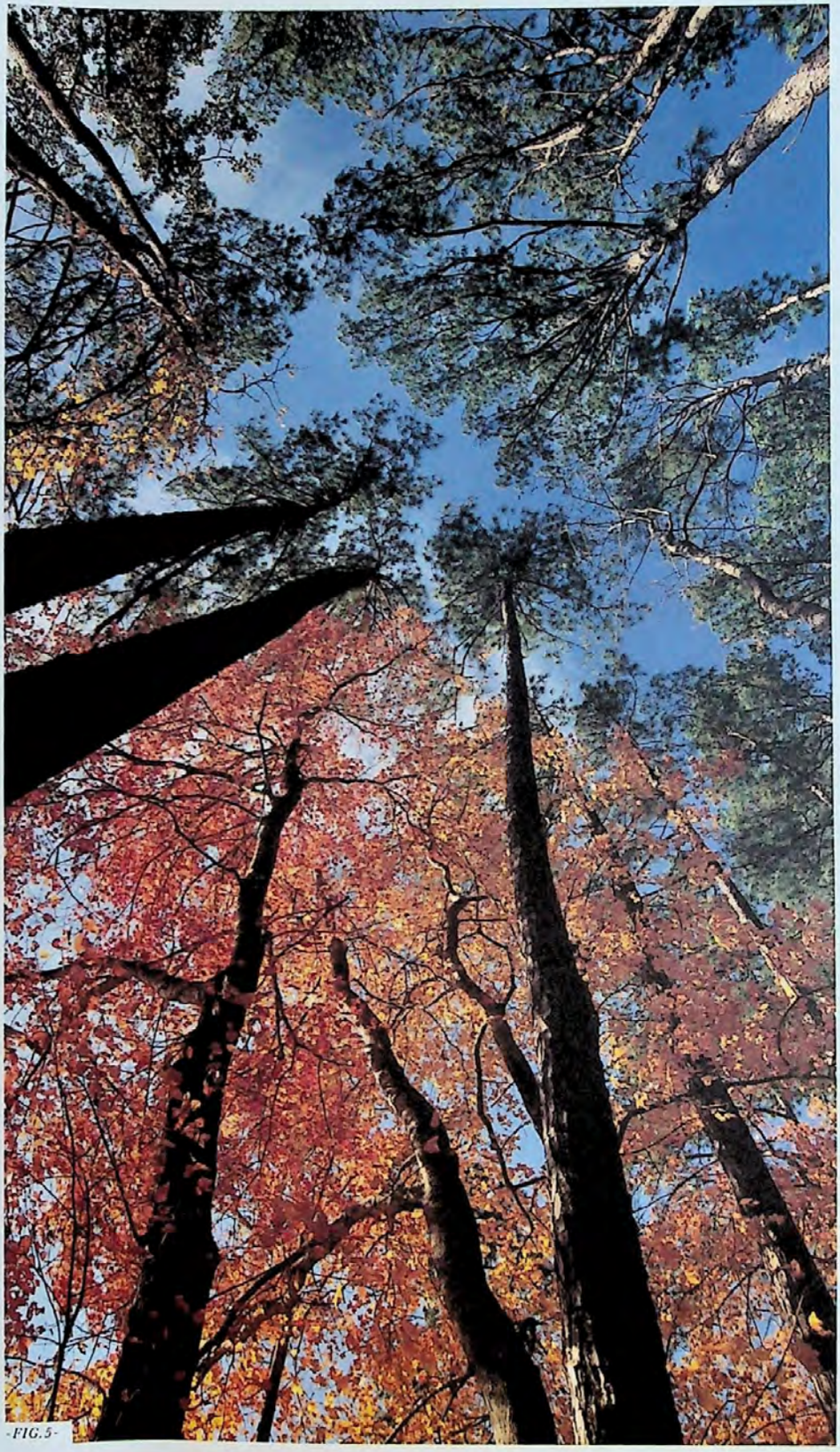
-FIG. 1-



-FIG. 2-

-FIG. 3-

-FIG. 4-



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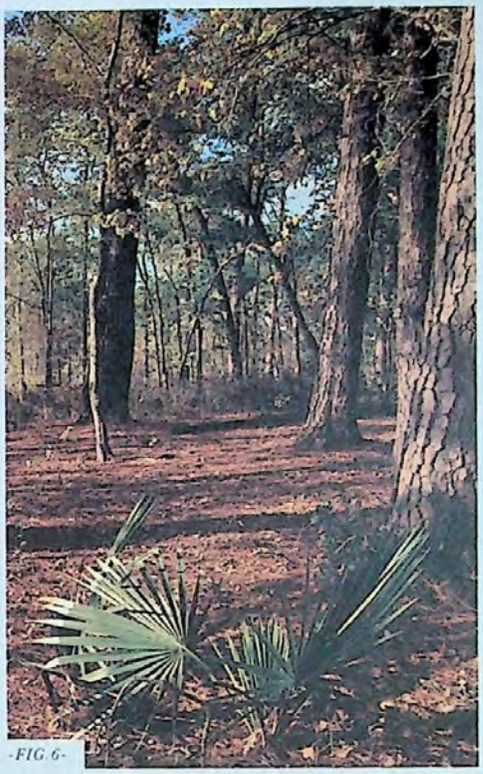


-FIG. 6-

COASTAL PRAIRIE: HIGH INTEGRITY

OPPOSITE

FIG. 1 *Shaped by wind, the small round white "dots" are "pimple mounds." The elongated and circular potholes (darker areas) are ancient river channel scar remnants.*

FIG. 2 *A spider lily rises from a prairie pothole.*

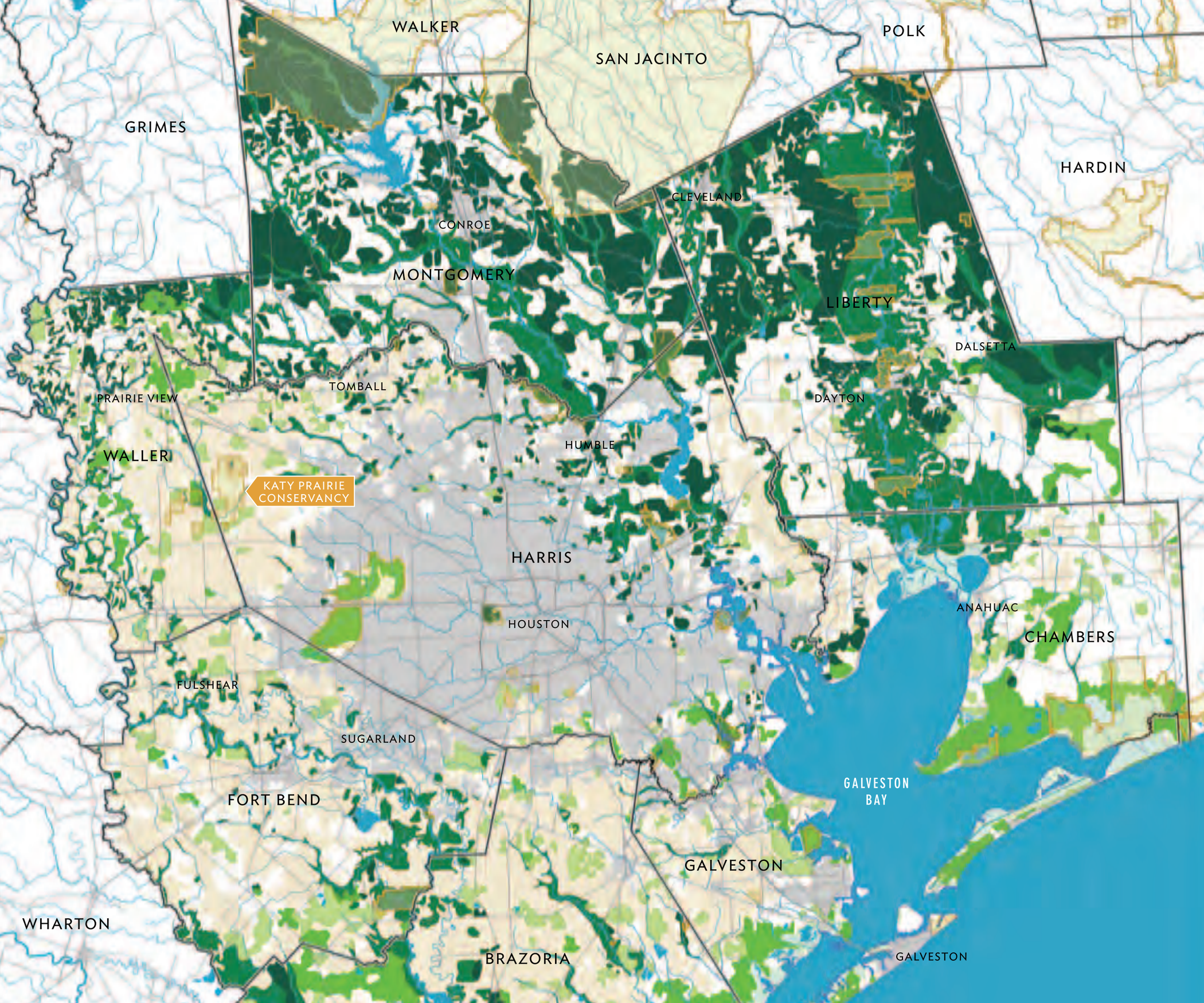
FIG. 3 *Abundant wildflowers bloom at the Deer Park Prairie.*

FIG. 4 *A prairie pothole at the edge of a woodland. A tightly packed mix of habitats is characteristic of many of our natural areas.*

UPLAND FORESTS

FIG. 5 *For some the soaring canopy of pines and hardwoods evoke a spiritual connection to nature.*

FIG. 6 *A native palmetto in the understory of an intact forest is a moment of small-scale beauty.*


WALKER
SAN JACINTO
POLK
GRIMES
HARDIN
CLEVELAND
CONROE
MONTGOMERY
LIBERTY
DALSETTA
TOMBALL
PRAIRIE VIEW
DAYTON
HUMBLE
WALLER
KATY PRAIRIE CONSERVANCY
HARRIS
ANAHUAC
HOUSTON
CHAMBERS
FULSHEAR
SUGARLAND
GALVESTON BAY
FORT BEND
GALVESTON
WHARTON
BRAZORIA
GALVESTON

AGRO-ECOLOGICAL INFRASTRUCTURE OF THE HOUSTON-GALVESTON REGION

BY STEVEN MIKULENCAK

LANDSCAPE FEATURES OF REGIONAL SIGNIFICANCE

- UPLAND FOREST
- BOTTOMLAND FOREST
- COASTAL PRAIRIE – HIGH INTEGRITY
- COASTAL PRAIRIE – MODERATE INTEGRITY
- ESTUARINE WETLANDS
- PRIME FARMLAND SOIL
- URBANIZED AREA
- CONSERVATION ZONES + PARKS

ABOUT THIS MAP

This map shows the remaining significant habitat or natural areas in the greater Houston region. The criteria for "significant" were individual fragments greater than 100 acres and the presence of intact forests, or prairie complexes that have never been plowed or leveled. The map also shows prime farmland, land that has the best combination of biophysical and chemical characteristics for growing food and fiber.

For both prairies and forests, a few large segments make up the vast majority of the overall habitat. Just eight segments, each over 10,000 acres, make up 40 percent of the total remaining prairie. The story is the same for the forests. In general, the larger the habitat segment, the more varied and robust the potential ecology of that segment. Smaller segments, however, can still be very valuable, as they might be strategically located, and many small pieces often have very unique plant assemblages.

Cartographic Production by Steven Mikulencak, AICP
with support from Kirana Pandian

Data represented in this illustration is compiled from the Texas Coastal Watershed Program 2010 Landscape Survey, US Census Bureau, USGS, US Forest Service, US Fish and Wildlife Service, the National Wetland Inventory, Texas Department of Transportation, Texas Parks and Wildlife Department, and the Houston-Galveston Area Council.

N

10 MILES

The surface of the entire upper Gulf Coast of Texas is made up of sediments laid down by rivers. This is the most important point to remember about how this land came to be. Whether the land today is a bottomland that is currently flooded by rivers, or whether the land is higher and no longer flooded, it was all laid down by rivers and was once part of a floodplain. All of these sediments began their trip to the Gulf high in the Rockies eons ago.

The most recent of the sediments that make up our land, the bottomlands along our rivers, bear very distinct scars left by the rivers that laid them down. Looking at an aerial view of any present-day floodplain, it is easy to see that the river has moved around on this surface: there are oxbow lakes, for example, which are easily recognized as former channels of today's river. Over time, the river might even have cut across the same area several times, leaving a rather complex record of channel scars.

Present-day floodplains are only a few thousand years old at most, and some might only be about 500 to 1,000 years old. In contrast, the higher surfaces that most of us live on are at least 30,000 to 50,000 years old, with areas that might be well over 100,000 years old. These higher landscapes started out looking like the Trinity River bottomlands, but a lot could happen over the next 50,000 to 100,000 years. The wind blew, the buffalo roamed and wallowed, and the mastodons stomped across the landscape, reshaping an already complex landscape in new and remarkable ways.

"Potholes" and "pimple mounds" are some of the more interesting features that have evolved on this older landscape. A"prairie pothole and pimple mound complex"consists of depressions which are remnants of ancient river channels, and are about a foot or so below the surrounding landscape, while the pimple mounds are small hillocks (a few hundred square feet to an acre in size), likely wind-blown features formed in dryer eras in the past, and are no higher than about two feet above the surrounding landscape. The overall difference in elevation is not much in this landscape, almost invisible in fact to the untrained eye, but the short-range complexity of this landscape is unsurpassed by just about any landscape in the world. In a matter of inches or a few feet, one can change from an environment inundated and saturated most of the year (the deeper potholes) to a semi-arid micro-environment (the convex, water-shedding surfaces of the pimple mounds), with every gradation in between. This reworked ancient landscape, a palimpsest of these many geomorphic processes writing over each other, is in a sense a "chance melody" wrought by nature—an irreplaceable mosaic of short-range complexity that supports an extremely diverse set of flora and fauna. A simplified diagram can hardly do this landscape justice. The many gradations of lightness and darkness on aerial photos do a better job of revealing the true complexity.

Ancient channel scars are found on paleo meander ridges of the ancestral Brazos and other rivers. These ridges are about 10 feet above the surrounding landscape, and anywhere from one to four miles across. These ridges represent the last courses of these ancestral rivers on this landscape, essentially the rivers and their natural levees.

Potholes and pimple mounds are found both on the prairies and under the forests, but because they are easier to see on the prairie, we mainly call these landscapes *prairie* pothole-pimple mound complexes. It turns out that there are not many forests left on these kinds of landscapes. Just a few patches near Lake Houston are about all that remain.

THE CURSE OF FLAT LAND

The Houston region does not have any grand mountain vistas—no Garden of the Gods, no Yosemite. We do, however, have a landscape of unparalleled diversity. But it is a diversity you can't see unless you have been initiated. To motorists passing by at 70 miles an hour, there is absolutely nothing there.

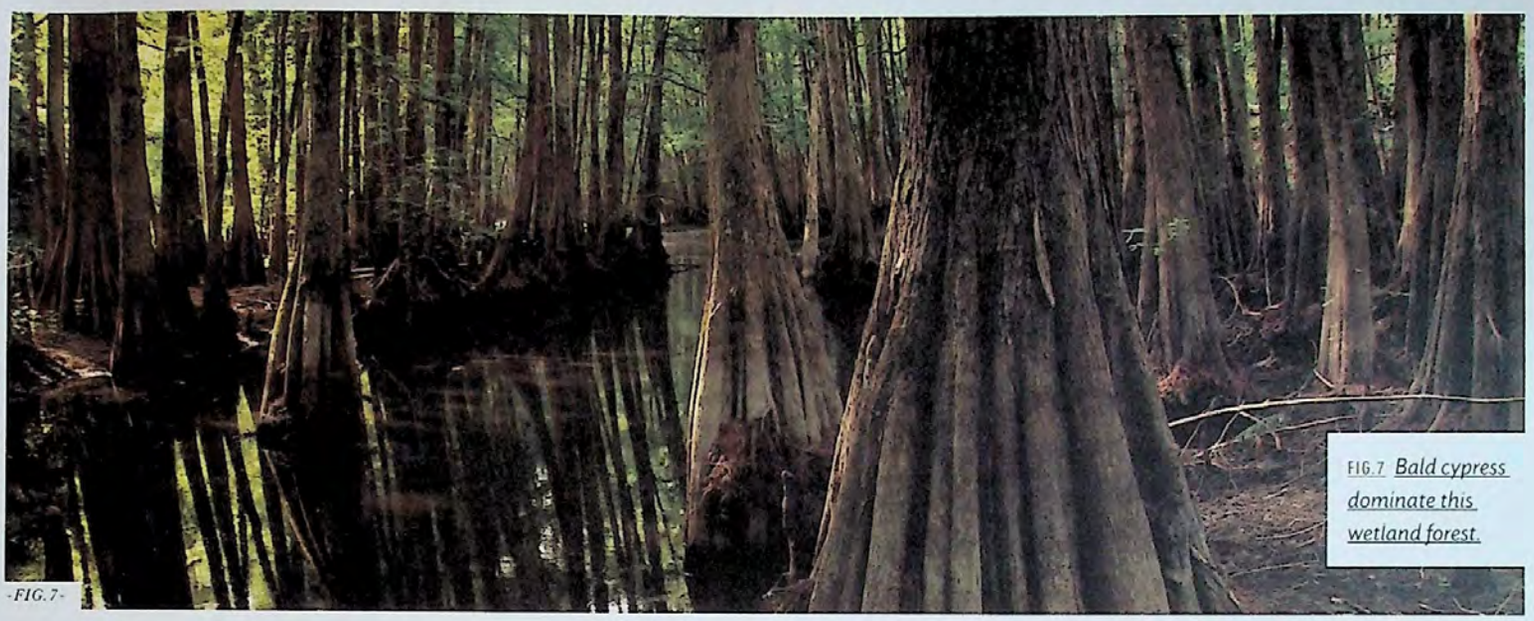
So who mourns at the loss of this landscape? Not very many so far. It is difficult to rally folks to protect a landscape they can't really see, much less understand. There is a beauty on the prairie—it is the beauty of the ocean, the beauty of wide open spaces—but that's difficult to appreciate when the prairie has been reduced to a small patch. Trees have a better time of it: most people can still appreciate the beauty of a small mott (grove) of trees. But for both trees and prairies, we need large unbroken expanses to guarantee functioning ecosystems. Ten-acre patches do not an ecosystem make.

WHAT WE HAVE TODAY—THE ECOLOGIC MAP

NATURAL HABITAT

The vast prairies and forests that greeted the first Anglo settlers almost 200 years ago are long gone, but they are far from *all* gone. Some very large and significant patches remain, but the threat of losing these surviving areas to development is now very high. Some of the very best of what's left on the entire coast is in the urban periphery, an area not yet reached by either sprawl nor intensive row-crop agriculture. This is precisely the area now most under threat in the next few decades.

RIGHT *An interpretation of the pothole-pimple mound complex by artist Sarah Welch.*



-FIG. 7-

FIG. 7 *Bald cypress dominate this wetland forest.*

In conjunction with the Houston-Galveston Area Council, the Texas Coastal Watershed Program—a part of the Texas Sea Grant at Texas A&M and the Texas A&M AgriLife Extension Service—recently undertook the mapping of the significant remaining habitat fragments in the eight counties constituting the greater Houston area. By "significant," we mean habitat patches of 100 acres or greater that have some kind of ecological value. Within the ecological literature, 100 acres is considered a more or less minimum size where some semblance of ecological integrity can be maintained. Limiting our mapping to patches greater than 100 acres allowed us to complete the inventory with the resources we had at hand and in a reasonable time. The map is a major step forward in getting a handle on the remaining ecological resources in the region. Still, it should be recognized that no claims of 100 percent accuracy are made for this map, particularly for including every one of the smaller patches. Although it is unlikely that many 1,000-acre expanses were missed, some 100- and 200-acre patches here and there could easily have been left out, as well as the occasional patches of less than 100 acres with unusually intact flora that merit preservation as parks or educational sites.

The map shows the result of the project, the "agroecological infrastructure" of the eight-county region. Habitat patches were outlined on high-quality aerial photography, mainly from Google Earth, and then transferred to a digital geographic information system for the final cartography and analysis. Areas of prime farmland were derived from the Natural Resources Conservation Service soil survey database. FEMA floodplain lines were used to differentiate bottomland from upland forests. Salt marshes were taken from the National Wetlands Inventory.

Houston is in a unique area: we sit astride an "ecotone," a transition zone between two different ecological types or biomes. Transition zones are where things get interesting, whether ecologically or culturally. *Culturally*, we are in the transition zone between the South and the West. There is an interesting commingling of both, and emergent features occur here that belong to neither. So, too, *ecologically*. We are

-FIG. 8-

SALT MARSHES

FIG. 8 *Salt marshes provide critical habitat for virtually every commercial and recreational fish and shellfish species at some stage of their development.*

× what we can do.

We can rise to the occasion—we do indeed have it in us. But we will have to learn the song of our land. We will have to teach it to our neighbors. Our teachers will have to teach it to our children. We will all have to learn that our place, this place, is sacred ground: that it is special in its own right, but that most of all it is special because it is *our* place.

(1) Recognize what we have. There is extremely valuable land, both natural habitat areas and farmlands, still worth saving. We need to be able to articulate the value of what is left. How else will anyone know?

(2) Find ways to save the best of what's left. Mitigation of filled or developed wetlands is one of the best mechanisms we have. The US Clean Water Act requires that wetlands filled by development be replaced by created wetlands or by preserving and restoring other wetlands, but the U.S. Army Corps of Engineers considers most of our prairie pothole wetlands as well as the upland forested wetlands to be "closed depressions," with no connections to state or federal waters, and therefore outside of their jurisdiction. This in spite of two separate, independent studies recently completed by Baylor and Texas A&M Universities demonstrating a very significant nexus between these kinds of wetlands and traditional navigable waters. During a full-throttle economy such as Houston enjoyed before the bust, we should be able to preserve the equivalent of an Anahuac National Wildlife Reserve every year if most developed wetlands were mitigated through the preservation and enhancement of existing wetlands.

(3) Study other methods of land conservation. For example, the transfer of development rights, carbon trading, and impact fees. Any of the methods would require imaginative use of available legal structures (see point 6 below). Not all land conservation requires land purchase. Land owners can be provided with incentives and paid for conservation easements.

(4) Name the prairies and forests. Everybody knows the name of just one prairie—the Katy Prairie. All the large prairies were once known by name. Naming specific prairies and forests helps make them part of our consciousness and more likely to be treasured and preserved.

(5) Build our communities in ways that honor what we must take of nature. Walkable, built-to-last, and "livable" neighborhoods are best for us—and best for the nature that surrounds us. We could take care of every one of the four million or so people coming our way in the next 30 to 40 years with infill development, and the result would be a much more interesting and vibrant city than we have today. The average density would only be about that of a single-family detached home on small lots. And we would have all the farmland and natural areas we have today to boot. We would have a walkable city, places in nature to enjoy recreation, and food from nearby farms. This is an easily attainable vision if we can come together on the essentials.

(6) Use our imagination. It's what we need most. Fortunately, this is something that Houston has always had. It is not true that we are just a laissez-faire city with no government intervention anywhere for anything. One simple example is our shift from groundwater to surface water for public use. This shift basically required that we abandon the doctrine of the rule of capture—which mainly means drill for water at will with no regard for the effect of drawdown on neighbors—and make a massive public investment in infrastructure for surface distribution of lake water. That was a shift completely out of character with a totally laissez-faire culture. We can do it again.

located where the forest meets the prairie. It is a zone of incredible biodiversity, where boundaries shift back and forth over time. We are also located where freshwater meets the sea. These perpendicular axes of diversity are what make this such an interesting place.

At first glance, it should be obvious from the map that some very significant habitat remains in the area, in spite of all that has been lost. These large patches are very valuable ecologically, and they function, or at least they can function, as healthy coastal ecosystems. The larger the patch, the more valuable it is. Again, 100 acres is the *minimum* size for ecological integrity. A fully functioning prairie capable of supporting the full range of wildlife once found here would likely require tens to hundreds of thousands of acres of unbroken prairie expanses. These large expanses can no longer be found in our area, but there are still some substantial prairie patches that comprise several tens of thousands of acres. There are nearly 200,000 acres of 1,000 to 10,000-acre patches, and an equal acreage of greater than 10,000-acre patches. At best, only about 25 percent of these larger patches are currently protected lands. These large patches are the "arks" to a sustainable future that we must save now. We know so very little about prairie or forest ecology, and it is clear that much of what we need to know to develop a deeper form of sustainability in the long run might be found in these natural areas. What we don't know about these areas far exceeds what we do know. It is imperative, then, that we have large functioning areas to study in the future.

The recently rescued 50-acre Deer Park prairie is miniscule compared with these larger prairie tracts. The tract is small, but the remnant vegetation is spectacular. Some have complained that the $4 million raised to save this remnant could have saved well over a thousand acres in the periphery of Houston. But the fact that public attention was drawn to the plight of this prairie and that as much money was raised perhaps suggests that attitudes about conservation of natural areas may be shifting. We will need some major shifts, and as much as $1 billion, to ensure our grandchildren can still experience the prairies and forests in something close to their original state.

Notice the very large and rich areas of forest across the north and northwest of the Houston area. Most under threat are the forests of Montgomery County, a very fast-growing county where we can pretty much write off most of the upland forests if the status quo there remains in place. The bottomland forests are under less threat just because they are less easily developed, but the ecological functionality of the system depends on the adjacency of different woodland types, and development seems to increasingly find its way into the margins of the bottomlands. There are still some very high-quality forest patches, such as the area along Lake Creek, but there is no plan in place by any agency or jurisdiction to save this or any other forest.

Another very important area for the entire region is the large corridor along the Brazos River on the southeast flank of the greater Houston region. The area has the largest and most diverse representation of all the ecotypes in our region. The Brazos River itself acts as a connecting element that ties these pieces together, linking them to smaller but still significant pieces of prairie and woodlands to the north, including the fast-disappearing post-oak savannahs to the extreme north. Of course, the river ultimately joins all this to the Gulf. This southeastern flank is in many ways the crown jewel of the entire Houston habitat area. But some of the very best pieces of this complex ecosystem will soon be threatened as the Grand Parkway makes its way through the area. In particular, the proposed highway threatens one of the largest extant prairie pieces, what we call the Damon Prairie. No doubt its memory will be preserved in the name of some subdivision carved from this prairie. And perhaps a few native prairie plants incorporated into the landscapes of the suburban yards will help convince the residents that their development was really "low impact" after all.

IF THE OIL ECONOMY REMAINS STRONG FOREVER, AND WE NEVER EXPERIENCE ANY SHORTAGES OF GASOLINE OR OTHER PETROLEUM PRODUCTS WITH THEIR ATTENDANT PRICE SHOCKS, AND AS LONG AS THERE IS ALWAYS A "SOMEWHERE ELSE" THAT OUR FOOD COMES FROM, THEN THERE IS PROBABLY NOTHING TO WORRY ABOUT.

FARMLAND

Prime farmland is what soil scientists call "good dirt," which is what the original settlers called the soil that brought people here—mainly the black coastal prairie soils, but also the friable loamy soils of the prairies, such as the Katy fine sandy loam.

Prime farmland is soil with the fewest limitations in terms of growing crops. It is friable, or easy to crumble, and it holds nutrients and water just loosely enough to make them readily available for plants. In other words, this soil is worth more than its weight in gold.

In terms of place-based sustainability, prime farmland is what we really need a lot of. We were endowed with a lot of this kind of farmland at the outset. Unfortunately, we have decided to grow our city in exactly the direction where the very best farmland is, i.e., to the west. We are paving over our most valuable resource at an unprecedented rate. On the other hand, if we think it might be important to have some high-quality farmland nearby someday in the future, then we might need to think about how we value land today.

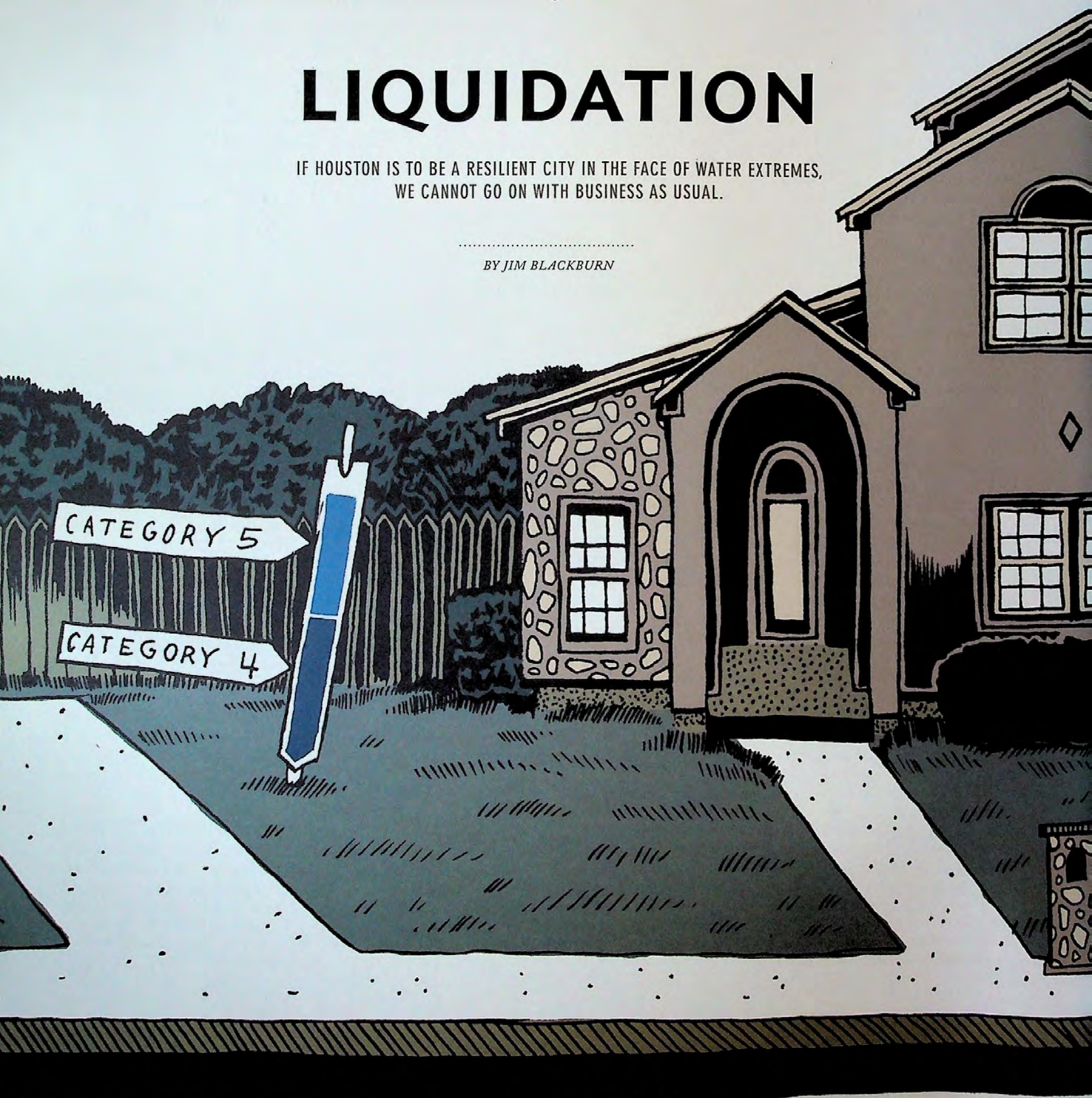
The future value for land, farmland, or natural lands, unfortunately, is always "discounted" for those strictly interested in making money off the land. The value of the land today is always greater than the value tomorrow (unless of course a large roadway like the Grand Parkway is about to come near your land). The discount rate is about the only calculus we allow for thinking about the land. So a strip mall will always be a much "higher use" than a farm, and the discount rate tells us that it is better to cash in sooner than later. Perhaps the real discount rate, the sustainable discount rate, should be less than one—i.e., land will have a higher value in the future. Place-based sustainability for our grandchildren requires that we set a very high value on the future value of both natural areas and farmland, because it is quite likely we will need those kind of areas even more in the future.

Houston is a place built on imagination. We imagined a space center on the open prairie, and up it sprang. We imagined a medical center without parallel, and it was built. We imagined a light rail system, and built it against all odds. Must our imagination be limited to the built environment? Can we not also imagine intact prairies, forests and farmland surrounding cities and towns of this region? Can we engage the same political will that built Houston to save and improve the vast green infrastructure that still surrounds us? Will Houston be worth living in if we can't?

LIQUIDATION

IF HOUSTON IS TO BE A RESILIENT CITY IN THE FACE OF WATER EXTREMES, WE CANNOT GO ON WITH BUSINESS AS USUAL.

BY JIM BLACKBURN



THE FUTURE OF THE CITY OF HOUSTON MIGHT BE MORE AFFECTED BY EXTREME WEATHER EVENTS THAN BY ANY OTHER FACTOR.

The impacts of these extremes are well known but not well addressed. Our ability to compete and survive in the harsh natural environment and competitive economic climate of the 21st century will rest on how we address these challenges.

As we learned in 2011, drought is a serious worry. Though we should plan for and anticipate constricted water supply and availability, we are not as vulnerable as many other areas of Texas. Our Achilles heel is flooding.

Flooding in our part of the world comes from two major sources: major rainstorms associated with tropical storms or cold fronts, and the surge tide associated with hurricanes. These two sources of water—one coming from the sky and the other from the Gulf— are major threats to our well-being.

Houston will be severely and perhaps permanently affected if we don't address our known problems. All of the issues discussed below have solutions, but these solutions require that action be taken—that things be done differently. Some of the incentive for these changes will have to come through litigation simply because responsible officials will not otherwise step up and do what needs to be done.

STORM SIZE AND PROBABILITY

A key issue that has prevented effective planning and response to flooding has been our denial about the size of storms that can or should be anticipated. The 100-year recurrence rainfall standard used for most federal flood insurance maps is 12 or 13 inches in 24 hours, depending upon where one is located within Harris County. However, several rainstorms in the last 30 years have exceeded 20 inches in 24 hours, including tropical storms Claudette and Allison. At different places in Harris Country, we have also seen multiple smaller rainfalls dump more than 13 inches in 24 hours (Table 1). No wonder we hear all the time that we have just experienced a 100-year rainfall. The 100-year rainfall we are using is essentially meaningless from a property protection and integrity standpoint.

If you are moving to Houston from another part of the United States or the world, you would be much better advised to use the 500-year flood plain based upon 19 inches of rain in 24 hours as a reasonable worst-case flood prospect, rather than the regulatory 100-year flood plain. As shown in Figure 1, if we relied upon the 500-year flood plain as a standard, over 400,000 acres would be identified as a hazard zone, representing 38 percent of Harris County.

The same lack of realistic information distorts assessments of hurricane surge tide risk. Most existing flood plain maps do not show the extent of flooding that would be expected from a reasonable worst-case hurricane. Hal Needham of Louisiana State University has estimated—based on historic storms—that those living on the upper Texas coast fall into a very high risk zone, with a 100-year hurricane surge estimated to reach about 20 feet above sea level from where the coastline meets the Gulf of Mexico. Due to the magnifying effects of bays, a 20-foot surge at the coast could translate into a 23- to 25-foot surge in the upper part of Galveston Bay and the Houston Ship Channel, depending upon exact point of landfall. A 20-foot surge event on the Clear Lake area of Harris County would lead to depths of inundation reaching 10-12 feet across much of the developed area.

DATE	STORM	24-HOUR RAINFALL	AFFECTED WATERSHEDS
JULY 79	CLAUDETTE	43"	CLEAR CREEK (30"+)
JUNE 01	ALLISON	28"	GREENS BAYOU (28") HUNTING BAYOU (22") CYPRESS CREEK (18")
OCTOBER 94		22"	SAN JACINTO (22") SPRING CREEK (22") CLEAR CREEK (18")

TABLE 1 *Severe storms in the Houston area in the last 35 years (according to the Tropical Storm Allison Recovery Project, a 500-year storm equals 19").*
Compiled by Larry Dunbar, P.E.

Recently, the Federal Emergency Management Agency (FEMA) released new 100-year flood plain maps for many of our coastal communities in Harris County, such as LaPorte, Shoreacres, and Seabrook. These maps show a proposed 100-year surge elevation of approximately 17 feet, rather than the 20 feet that might be expected from Needham's 100-year projection, which is based upon the 1900 Galveston hurricane.

It is worth pausing a moment to reflect on the relationship of Houston and Harris County with the National Flood Insurance Program. Many Houstonians decry the federal government in their political rhetoric, but our collective hands are out when we experience a major flood. We receive federal disaster relief, and until recently, those with flood damage have benefited from federally subsidized flood insurance payments. However, the Biggert-Waters Flood Insurance Reform Act of 2012 requires that flood insurance premiums be based upon risk, meaning that previously subsidized insurance rates will be increasing substantially for those within the 100-year flood plain. As we get the flood plains more correctly defined and move to an actuarial basis for flood insurance, we will see a major correction in the signals that the market sends about flood risk.

Insurance in riskier sites should be more expensive. We should support "full-cost pricing" of flood insurance and let the market begin to play a role in our handling of flooding issues. Many Houstonians state that they believe in the market system, so let's put our policies where our rhetoric is. That would be a good start to honestly addressing our problems.

CURRENT PROBLEM AREAS

The Houston region has many flood problems and many potential solutions. But in order to address them, we need to be honest about the risk and take collective action before we are dealt a blow from which recovery will be difficult, if not impossible.

✱ ADDICKS AND BARKER DAMS

500-year flood plain of Harris County.
Map prepared by Bryan Carlile of Beck Geodetix.

Houston Ship Channel

Consider the Houston Ship Channel. The 20 miles or so between Loop 610 East and the State Highway 146 Fred Hartman Bridges crossing the channel contain one of most concentrated refining and chemical plant agglomerations in the world. This Ship Channel industrial complex generates over 140,000 direct and indirect jobs, represents a capital investment of around $60 billion, and is the economic engine of the Houston region if not the United States. If this complex were to be crippled by a major storm, all citizens of our region and of the larger nation would feel the economic impact.

So how vulnerable is the Ship Channel complex? Generally speaking, the facilities along the Ship Channel are not protected from flooding beyond the currently mapped flood plain elevation of about 14 to 15 feet. Work completed at the SSPEED Center at Rice University modeled a reasonable worst-case storm as generating a surge of approximately 25 feet. This storm would inundate portions of over 100 facilities and would represent a direct threat to about 1,400 storage tanks of various sizes that line the channel.

If such a surge were to occur, it would likely generate one of the worst environmental disasters ever experienced in the United States. A single tank that was lifted off its foundations during Hurricane Katrina caused a major evacuation and buyout. Galveston Bay would suffer major ecological damage and would likely become a hazardous materials disaster zone. The ecological damage easily could lead to curtailment of recreational and commercial fishing as well as signaling the end of bay-oriented development.

The economic damage would be even greater. When the Invista plant in Orange, Texas, was flooded by Hurricane Ike in 2008, it was shut down for months. The flooding projected along the channel would be much more severe than that which struck Invista and could lead to damages so substantial that reconstruction might not occur for years if ever. Overnight, our economic engine could be extinguished along with the ecological health of Galveston Bay.

This disaster can be averted by pursuing a relatively straightforward solution. High ground exists on both sides of the Ship Channel near the Fred Hartman Bridge. Preliminary engineering evaluations indicate that it should be possible to build a levee and gate structure that the SSPEED Center calls the "Centennial Gate." This gate could span the Ship Channel and protect inland assets, including Houston residential areas along with refineries and chemical plants, for a cost of about $2 billion. Such a project could be designed by local engineering firms, permitted by the U.S. Army Corps of Engineers, and financed by creative local bond funding, with scheduled completion in less than five years once the decision to proceed is made. We should make this commitment as soon as possible.

Addicks and Barker Reservoirs

The Addicks and Barker Reservoirs lie on either side of Interstate 10 West. Addicks is on the north, and Barker is on the south; Highway 6 runs just east of Barker and through the west side of Addicks. These huge detention ponds were built for flood control in the late 1940s and early 1950s to protect Downtown Houston and Buffalo Bayou neighborhoods from flooding. Without doubt, these are the best flood control projects ever built in Houston, but they are currently in danger of failing and now represent a major risk to those living along Buffalo Bayou.

Documents released by the U.S. Army Corps of Engineers, the agency responsible for constructing and maintaining Addicks and Barker Reservoirs, rate them today as being at risk for "catastrophic failure." This potential failure is due to voids within the levees that make them susceptible to collapse. If either of these dams were to collapse after the reservoirs have

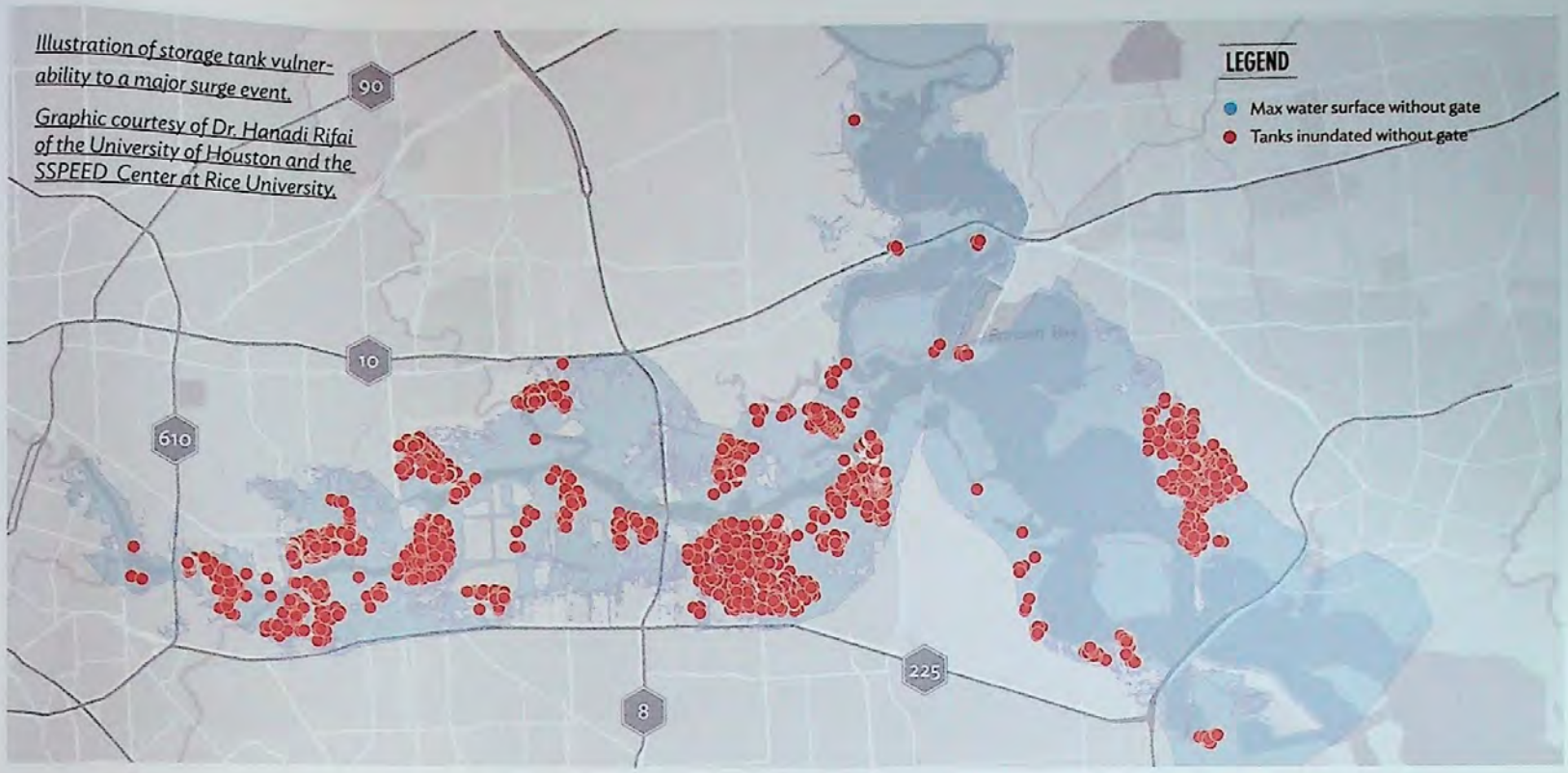


Illustration of storage tank vulnerability to a major surge event.

Graphic courtesy of Dr. Hanadi Rifai of the University of Houston and the SSPEED Center at Rice University.

been filled with rainfall from one of our huge rainstorms, a flood of Biblical proportions would spread throughout much of the energy corridor and the Memorial Drive area, extending all the way Downtown.

The Corps is aware of this problem and is taking both short-term and long-term measures to address it. However, we as a community have failed to recognize the implications of these "fixes" or the reality of the amount of time that will be required to remedy these problems.

Though the situation with Addicks and Barker is complicated, suffice it to say that the Corps is worried enough about the potential for dam failure that they have changed the operational plans for the reservoirs to allow much more water to be released. Essentially, until these reservoirs are repaired, we no longer have the full capacity of Addicks and Barker available, meaning that all of those living downstream are at much greater risk than was the case ten years ago. Yet our local flood control district and various elected officials are acting as if this serious situation does not exist.

Recently, Federal District Judge Keith Ellison ruled in favor of the Sierra Club in a suit brought in Houston federal court arguing that the Corps of Engineers had to fully disclose the impacts of development in the Katy Prairie upon the operations of Addicks and Barker Reservoirs. Although Judge Ellison chose not to enjoin construction of the Grand Parkway, he ruled that the development in Harris County west of the Addicks Reservoir had a "cumulative" effect on Addicks and must be fully understood and disclosed by the Corps in environmental assessment documentation.

Another major problem in west Harris County is the action (or inaction) of Harris County and the Harris County Flood Control District (HCFCD). The rules of the HCFCD require detention ponding, but specify that it be able to hold only the storm water accumulated in 24 hours. Addicks is designed to hold the rainfall from huge storms occurring over multiple days, and detention ponding is not enough to supplement it as flood protection. In fact, one potential conclusion of the Corps's environmental assessment may be that current Harris County policy will worsen the existing operational problems of Addicks Reservoir.

Here, the solution is simple. The Katy Prairie when left undeveloped is a wonderful sponge full of natural wetlands. Consistent with an economic view of the natural system and the risk of its development, we should—as a community—consider paying landowners to maintain these prairie wetlands. They are worth more to us in holding floodwaters than they are as sites for development. We are not limited in land for new development. We are, however, limited in our options to protect the Addicks and Barker Reservoirs, and downstream.

INCREASING FLOOD PLAINS, BUYOUTS, AND LITIGATION

The flood plains of many of our bayous and creeks have grown substantially over the last two decades. Over that period of time, more than 35,000 acres that previously were not shown to be in the 100-year flood plain have been added to that danger zone. Many homes that were built outside the 100-year flood plain in reliance on those flood plain maps are now shown to, and in many cases actually do, flood.

The problem of Houston's growing flood plains has been known for decades, largely based upon the seminal work of Don Van Sickle and Dr. Phil Bedient on Brays Bayou. Channelized in the 1950s to accommodate a 200-year storm and widened over the last decade at a $450 million cost, Brays Bayou today can barely hold the rainfall of a 10-year storm. Our failure to address the problem of development impacts upon our bayous can be seen in the analysis of runoff per acre from undeveloped and developed watersheds (See Table 2).

One potential location of the proposed Centennial Gate. Graphic courtesy of Tom Colbert, University of Houston and SSPEED Center.

UNDEVELOPED	RUNOFF *per acre*
Little Cypress Creek	0.2 – 0.3 cfs/acre
Upper Cypress Creek	0.2 – 0.3
Clear Creek	0.1 – 0.3
DEVELOPED	
Armand	0.8 – 0.9 cfs/acre
Brays	0.6 – 0.8
Greens	0.6 – 0.8
White Oak	0.6 – 1.0
Lower Cypress	0.7 – 0.9

TABLE 02 *Comparative analysis of runoff per acre in undeveloped and developed bayous and creeks in Harris County. Compiled by Larry Dunbar, P.E.*

This comparison is important. It shows that as land in Harris County has been developed, storm water runoff per acre has increased. Our natural landscape is flat and interspersed with wetlands that can hold significant volumes of rainwater. Developed areas, however, are full of concrete, sloped yards, and highly efficient storm sewers and drainage ditches that push the water off of the areas. And we push it downstream.

Interestingly, the development requirements of the HCFCD allow 1-2 cubic feet per second (cfs) of storm water to be released per developed acre after the use of detention ponding. This is almost 10 times greater than natural runoff rates. One might reasonably ask: "What kind of regulation is this?" The answer is: "Houston-style regulation." A pond is required, but it is not nearly large enough to do the job of reducing development impacts. As such, we are reducing development costs but increasing downstream damages and flood insurance payments while also reducing downstream property values.

The bottom line is that our flood plains are growing, as discussed earlier, and these expanding flood plains translate into huge flood damages. Over the last two decades, the city of Houston and Harris County have been among the largest claimants of recurrent flood insurance payments in the country. Over that time, both the federal government and the Flood Control District have decided that the buyout of homes experiencing recurring flood damages makes more financial sense than allowing them to continue flooding and continue making flood insurance claims.

To date, it is difficult to get an accounting of the total number of homes that have been bought out, but several hundred homes have been bought out on White Oak, Greens, and Brays Bayous. This is understandable, given the significant home flooding that exists along these bayous and the predictability of this result.

As a community, perhaps we should look at buyouts more strategically. We know of many areas that we can predict are going to flood again and again—it is just a question of when. We should become much more proactive with regard to setting aside monies for buyouts and make acquisition of flood-prone homes a major aspect of our flood planning.

Houston can become resilient in the face of flooding, but it will require removing homes and re-establishing flood plains and green space. Eventually, Houston and Harris County might end up with a bayou green space system acquired by repurchasing homes. It is expensive. Regulation would have been cheaper. But on a cosmic level, such a result seems like a perfectly "Houston" concept given our disdain for effective regulation and our affinity for development.

On the other hand, many choose to characterize this increase in the delineation of flood plains as either a "taking" or "damaging" of private property in violation of the 14th Amendment of the U.S. Constitution as well as the Texas Constitution; others view it as an illegal seizure in violation

The elevations shown on this figure are an approximate indication of inundation risk from a storm surge in the 20-foot range. Also shown are population, employment, and land values in these various elevation zones. Image by Thomas Colbert and Fangyi Lu, SSPEED Center UH.

DEPTH	POPULATION	JOB OPPORTUNITIES	LAND VALUES (IN DOLLARS)
<5 feet	10,000	12,600	352.5 million
<10 feet	32,000	25,400	1.9 billion
<15 feet	90,000	43,800	7.3 billion
<20 feet	163,400	60,000	7.7 billion

A 20-foot risk zone that is mostly underveloped can be turned into an economically useful buffer that protects the region. Image by Meigan Weintraut.

of the Fourth Amendment. The Texas constitutional issues regarding damaging and taking of private property due to downstream flooding impacts from Harris County policies and actions have been raised in a case involving flooding on White Oak Bayou that has just been briefed to the Texas Supreme Court. There has also been investigation of similar litigation due to flooding adjacent to TIRZ 17 and Memorial City in West Houston as well as other areas. It is worth noting that under the litigation scenario, compensation might be required by the court without a buyout, making the buyout alternative seem all the more reasonable.

CLEAR LAKE AND SURGE FLOODING

The Clear Lake area is incredibly vulnerable to hurricane storm surge flooding. Here, the major problem is faulty information in the flood plain maps. The flood plain maps currently in effect do not give any warning to a potential buyer of the extent of potential surge flooding. Only now are these maps being revised to include surge flood elevations, and the proposed maps stop short of indicating a reasonable worst-case surge event.

Harris County Precinct 2 attempted to give such warning to residents of the Clear Lake area by placing signs at intersections showing the extent of surge flooding that could be expected from a Category 4 and a Category 5 storm (as depicted in the opening illustration). This excellent informational device was immediately attacked by real estate agents and developers, however, and the signs were removed due to public outcry. This example is a sad but true commentary on our priorities as a community. We need to get better information to our citizens, particularly those moving into our coastal area from the Midwest, for example, with little experience in hurricanes and storm surge.

THESE LOW-LYING LANDS SERVE A TREMENDOUS FUNCTION IN OUR REGION BY ABSORBING STORM SURGE AND STORING IT, RELEASING IT BACK OVER MANY DAYS. MOST IMPORTANTLY, THESE HIGHLY PRODUCTIVE ECOLOGICAL SYSTEMS ARE NOT DESTROYED BY FLOODING. INSTEAD, THEIR STRUCTURE AND FUNCTION ALLOWS THEM TO SURVIVE INUNDATION. THEY ARE ABSOLUTELY RESILIENT.

In our society, we seem to endlessly debate the role of government. It would seem that an obvious role of government would be to make high-quality, accurate information available to help people make smart market transactions. It seems negligent for government to stand by doing nothing while people are moving into a hazard zone from which they might not be able to escape under certain flooding situations, yet that is exactly what is happening in southeastern Harris County today.

The risk for those buying homes or living in the low-lying areas is two-fold – the actual surge hazard in terms of property damage and the inability to evacuate to a safe location. Today, approximately 1.5 million persons live in the hurricane evacuation zones in Chambers, Harris, Galveston, and Matagorda Counties. The Houston-Galveston Area Council (HGAC) has projected that another 800,000 persons will move into these low-lying areas by 2035. HGAC has also projected that we could evacuate only about 1 million people in 36 hours from these areas under perfect conditions.

These facts show that we are heading for an unprecedented disaster in the developed low-lying portions of the coast. Landowners have a right to develop. However, they do not have a right to raid the public treasury, nor do they have the right to place innocent homebuyers into harm's way without information. As a community, we know that this situation exists, but we do nothing about it.

BUFFER ZONES AND AN ECONOMY FOR THE FUTURE

Much of the low-lying land in Chambers, Galveston, Brazoria, and Matagorda counties is not currently developed. Of the million acres below the 20-foot contour line along the coast in these four counties, over 200,000 are currently preserved as part of the National Wildlife Refuge System, as Texas state parks or wildlife management areas, county parks, or holdings of non-governmental organization land. Much of the remaining acreage is owned by private ranchers and farmers.

These low-lying lands serve a tremendous function in our region by absorbing storm surge and storing it, releasing it back over many days. Most importantly, these highly productive ecological systems are not destroyed by flooding. Instead, their structure and function allows them to survive inundation. They are absolutely resilient.

At the SSPEED Center at Rice, we have been working on ways to conceptualize and implement an economy that mimics the resilience of this natural system. Better yet, we are trying to structure an economy that is based on these resilient ecosystems. The prospects are exciting.

One idea is to capitalize on the natural value of these low-lying lands through better access and eco-tourism. To this end, the creation of the Lone Star Coastal National Recreation Area as a unit of the National Park System has been proposed. This idea is currently being championed by Houston businessman John Nau, former Secretary of State James Baker, and the National Parks Conservation Association. Various committees have been formed to support this concept, which may reach Congress in the near future.

A second idea is to create a system within which to buy and sell the "innate value" of our coastal wetlands, prairies, and forests. The fact that natural systems have innate values that can be measured in dollar benefits to society has been discussed for years. Nevertheless, these discussions have largely been theoretical, and landowners have seldom been able to realize a dollar value for preserving and nurturing natural ecosystems.

That problem may be on the brink of a solution. As sustainability becomes a larger part of its public image, corporate America is becoming more and more concerned about "footprints" of different types, including carbon, water, and ecological footprints. Many of these corporations are now spending money to offset their footprint, buying the rights to natural systems or values from natural systems, rather than the land itself.

At the SSPEED Center, we are proposing to create an ecological services exchange across the low-lying areas of the four coastal counties to connect a willing buyer with a willing seller in transactions involving natural ecological services. In this manner, our farmers and ranchers could be paid for restoring prairies, coastal marshes, and forests as carbon sinks or for other value these restorations provide.

We know that these areas will flood sooner or later. If we have developed an economic system that can survive inundation, we will be far ahead.

CONCLUSION

As a community, we have failed so far to take on the hard issues of flooding. If this attitude does not change and if we do not find acceptable means to address these problems in creative ways, then Houston's future will remain under a cloud. C

SAVING GRACE

A SMALL EXPERIMENT BY TWO ARCHITECTURE STUDENTS LED TO A BIG STRUGGLE FOR THEIR NEIGHBORHOOOD

RAJ MANKAD

The CES Environmental Systems site is easy to miss. The small building and gate at the front do not announce themselves as villainous. "Environmental Systems" sounds vaguely green and ecological, after all, like a windmill factory. But when I turn on Grace Lane, which runs to the side of the deep CES lot, the fumes hit me. They don't burn my throat exactly. They are not sulphuric. They are not like sewage or the wet, flatulent smell of paper mills. It's more as if I'm breathing inside an inflatable air mattress.

Grace Lane itself is a narrow street of single-family homes built in the 1930s and '40s interspersed with small churches, an apartment complex, vacant lots, and newer homes. In the late 1960s, the area flipped from being exclusively working class and White to predominantly Black.

Near the end of Grace Lane is something unexpected: three contemporary structures set in a lush garden dotted with abstract sculptures. The concrete and steel buildings are home to Mark Schatz and Anne Eamon, and the offices for their firm, m+a architecture studio.

The front building is only 900 square feet in area with a one-car garage on the bottom and a roof that curves into the shade of the pecan trees. Anne answers the door wearing her baby in a sling. She has the no-makeup, educated look of someone you would see in a Whole Foods parking lot. She leads me up the stairs, which is topped by a "sky garden" with carefully placed views of the trees. The plan for the house is simple. It is a one-bedroom home. But, as Mark later tells me, "it has a lot of clipped out corners, changes in height, changes in materials, so it is almost like a jewel box."

Mark joins us. He wears a gray turtleneck and black pants, and holds his frame bolt straight. His hair pokes out in different directions. He does the talking mostly at first. Anne seems to channel her energy into him. She shifts or interjects with a "well" or "I'm not sure it happened in that order," and Mark corrects himself. They are in tight sync.

On July 7, 2009, Mark saw a man pulled from a CES building with 70 percent of his body covered in third-degree burns. Mark shows me the "pictures I'm not happy I took." He shot them from his rooftop deck with a perfect bird's-eye view of CES. He shot fast. As he taps on his keyboard, the images turn into a stop-action movie.

"You can see I'm shaking," he says, but Mark doesn't appear to be shaking at all. During the many hours I interview him, he always seems steady and measured. "It sounds like pulp fiction, which is why I'm so focused on the documented facts," Mark says. He wants to come across as normal. But for Mark, I realize, there is no normal. There never has been normal.

"THEY HAD NO WAY OUT. THEY HAD NO RESOURCES. THEY HAD NO FINANCES. THEY HAD NO NOTHING."

"More David Lynch than Norman Rockwell," Mark says about his childhood. His father was a quintessential Houston man—an oil company statistician turned real estate speculator who moved the family upwards of 60 times. Mark remembers his father driving him in a pickup from job site to job site, and that the carpenters and plumbers hired by his father doubled as babysitters. The houses they lived in were themselves fixer-uppers that Mark's family then collectively flipped.

When I ask when he went to college, Mark smiles and replies that he was at the University of Houston "in the '90s." As a freshman, he took architecture courses, thinking they would focus on the details and practice of construction, which he already knew well. "I thought architecture was about building," he says. Instead, he experienced an "awakening" to architecture as "a multidimensional social and political enterprise." Like a true convert, Mark embraced the idealism of his professors to an extreme, calling his student self "highly combative."

Anne, born in 1972, describes her childhood as very much a Norman Rockwell scene. Her mother taught music classes and exposed her to the arts by enrolling her in classes at the Museum of Fine Arts, Houston. She gravitated to architecture because it combined the arts with analytical rigor and mathematics.

Mark and Anne first crossed paths in a class taught by John Zemanek, who in the 1970s helped pioneer courses that took architecture studios into poor communities. After six months of dates to museum exhibitions and lectures, and after making furniture together, Mark and Anne bought the land on Grace Lane through an auction in 1997.

They found the three contiguous 50-foot-by-100-foot lots in the newspaper. It was a property of the U.S. Department of Housing and Urban Development (HUD). The original house had burned down, leaving a vacant lot shaded by mature trees. They thought the proximity to the University of Houston lent itself to student housing.

"It was pretty quiet, being a dead-end street. There was really no activity," Mark says. The industrial lot behind the property was scarcely used. Occasional trucks were washed and rinsed back there.

They paid all of $2,350 for the land. That comes to 50 cents per square foot.

As for construction costs, they used a student loan.

"We had figured out how to pay [for classes] because [the loan payout] had happened after tuition was due," Anne explains.

Mark says that the student loan "got around the whole mortgage industry." Without an attached garage, a fireplace, or any of the other "comparables" that loan officers use to evaluate the potential value of projects, the experimental one-bedroom house that Mark and Anne designed as students would never have received a loan. In addition to the unconventional design, the street was in a former "redline neighborhood." Once Blacks had moved in during the late 1960s, property values dropped, insurance companies refused to back loans, and Whites fled.

Their financial workaround freed them to pursue their ideals. "We believed that it was your duty to act the way you talk about design and social constructs and architecture," Anne says. "Do what you say."

Mark concurs. "That's something that bothered me a lot when I was a student at UH. They talked one way, but the way they lived didn't line up with the rhetoric."

"This leads to many problems," Anne says dryly about their insistence to walk the walk.

In 1993, Mark had attended a lecture by Samuel Mockbee and another by Glenn Murcutt, both organized by the Rice Design Alliance. The lectures fanned Mark's idealistic flames. Mockbee, who died at 57 in 2001, is a legend among idealistic architects for his co-founding and leadership of the Auburn University Rural Studio program in Hale County, Alabama.

"The great thing about Mockbee that was so compelling to me as a student was this idea that your contribution doesn't have to be the commitment to the Big Idea," Mark says. "It could be the commitment to the smaller thing, and if everybody committed to the smaller thing, by the process of accretion, it adds up to a bigger thing."

"An even more painful idealism," Anne quips while their baby sleeps on her shoulder.

The two newlywed students set to work building their first house on Grace Lane with their own hands. The house was drawn in 1997, and the concrete foundation was poured in the fall of that year. By spring 1998, they had a wood frame. By summer 1999, once the A/C and Sheetrock were installed, they moved in. Meanwhile, one of Mark's instructors hired him straight out of class, and Anne ultimately worked for the same firm. They came home at night to an incomplete house, and installed light fixtures and cabinets before going to bed.

In 2003, Mark passed the Architecture Registration Exam. Once he received his license, the house became eligible for an award offered by the Houston chapter of the American Institute of Architects (AIA Houston) and it won. *Cite* had already featured the house on a cover in 2002. *Dwell* covered the house in January 2005.

"Suddenly, we got all this exposure for this thing we were doing on the side," Mark says. "We thought maybe now is the time to start our practice." Mark quit his job, and in Spring 2005 they started the design for the studio.

PHOTO JACK THOMPSON

ABOVE *CES Environmental fence line from m+a architecture.*

PHOTO JACK THOMPSON

And it is in that studio that Mark shows me the permit application filed by CES in 2003. He spreads out official documents, photocopies of city reports in Courier font with key lines of text highlighted in yellow.

A trucking company owned the site behind Mark and Anne's property. In the early 2000s, the land was bought by CES Environmental, which filed for new permits to process various kinds of chemical waste. An official letter was sent to all of the residents in the vicinity.

"We were the only people who filed against the permit," Mark says. They drew on their training in architecture school and carried out a basic site analysis. They pointed out to the state that within 100 feet of the site were two church schools and a Head Start program. Within 1,000 feet was a public elementary school. Furthermore, at the time, the site was not properly graded. The parking lot drained into the neighborhood.

The permit application was handled through the Texas Railroad Commission—this was before the creation of the Texas Commission on Environmental Quality (TCEQ). The permit was delayed by Mark's and Anne's objections, but was eventually approved.

Initially in 2004, only eight to 10 men would be working on site, "grubby-looking dudes washing out trucks or driving forklifts." The company operated on a very small scale. In 2005, however, activity at CES picked up. A tank farm and processing facility were built. The number of employees jumped to approximately 30. "The truck traffic got insane," Mark says. "There was one truck every 10 to 15 minutes." The noise became a major nuisance. Trucks rumbled in and out as late as 3 a.m.

> "THAT'S OUR PIECE [OF THE PUZZLE.] WE PUT OUR INFORMATION TOGETHER AND DESTROY THE CES ILLUSION."

Mark and Anne wondered what they had been thinking to build in that part of town. They had only just begun launching their firm from the site, starting the studio design coincidentally with the CES construction in March 2005. They could have cut and run without losing money. Or they could have hit the pause button. Instead, they doubled down.

At this point in the story, Mark's reserve breaks, and he says, "It made us so incredibly angry in talking to our neighbors who didn't have that kind of opportunity. Basically, they had this blight that moved into the neighborhood, and they were stuck. They had no way out. They had no resources. They had no finances. They had no nothing. I think that was kind of the challenge and response. For good and bad, I'm one of those people who, when confronted with a crisis, my first response is to strike back."

In December 2006, Mark and Anne saw police at CES.

"I went to the building department and did an open records request,"

Mark says. "When I got to the end of the stack, [I find] this." He points to a photocopy with four lines highlighted that read:

> "12/13/2006 284* ASSIST HPD MAJOR OFFENDERS INV. ED RUTLAND ON WARRANT TO SEARCH PROPERTY FOR ILLEGAL DUMPING. FOUND PIPES GOING INTO THE GROUND FROM THE CHEMICAL WASTE TREATMENT BUILDING. IT IS UNKNOWN WHERE THESE PIPES GO TO. FURTHER INVESTIGATION IS BEING DONE AT THIS TIME BY COH WASTEWATER, TECQ, AND EPA. IT IS BELIEVED THAT THESE LINES DISCHARGE INTO THE SANITARY SEWER."

Subsequent testing using a dye and a camera determined that the company was dumping waste directly into the city's sewage system.

"I start calling all the city agencies," Mark says. "None of the agencies know what the others are doing. That's our piece [of the puzzle]. We put information together and destroy the CES illusion."

In 2008, just before Hurricane Ike hit Houston, Mark obtained key documents from the Wastewater Department. In one account written on City of Houston letterhead, dated Feb. 9, 2007, the Department of Public Works and Engineering details the levels of oil and grease, zinc, 2-butanone, acetone, and phenol found in the sewage water downstream from CES. These chemicals, it notes, "could endanger the health and safety of the City's workers in the collection system" and "caused the City to violate its discharge permit from the Texas Commission on Environmental Quality." In other words, CES forced the City into violation of state and federal clean water standards. The City's facilities could not handle the contaminants illegally dumped by CES.

After CES was caught dumping and tampering with the monitor, they resorted to diluting all the contaminants they poured into the City system. As a result, their water usage skyrocketed. CES was authorized to use 3,692 gallons of water per day. Between December 2006 and January 2007, CES discharged 216,000 gallons of water per day. As a result, the City's sewer system overflowed downstream.

CES escaped with a $261,133.32 fine, a fraction of the cost to City taxpayers for the water alone. The real cost is beyond estimation. For all the press CES received in later years, no newspaper or broadcast reported on the period of its dumping operations from 2003 to 2007, which was likely the most damaging to public health and ecology in the Houston region.

The quality of life issues that did receive press attention came up after the City figured out that CES had dumped chemicals straight into the sewers. Prevented from continuing that illegal practice, CES began to truly process chemical waste in 2007. Matt Bowman, one of the owners of CES, took over management.

"This is when the story gets really sad," Mark says.

The smells became so sickening that the couple could not go outside. Anne and Mark's new live-work spaces were tightly sealed, so when they were inside, they didn't notice. The older houses around them were porous, however. Judy Jones, who Mark describes as having been "pushed over the edge" by the horrible smell, gave quote after quote to the *Houston Chronicle* about the effect of the smell on her health. In an Oct. 7, 2008, article in the *Chronicle*, Jones says, "There's no escape," and complains of headaches, eye irritation, and stomach cramps.

Despite the growing opposition from the neighborhoods and its history of dumping toxic chemicals directly into the sewage system, CES received an expanded permit from Texas. It took advantage of the loophole that once the state approves an initial permit, the public has no way to intervene in the expansion. As a result, polluting companies in Texas can bait and switch neighborhoods during periods of public comment by applying for small-scale operations and dramatically increasing the scope of the work later on.

In October 2008, television cameras covered protests by neighbors. New Black Panther Party leader Quanell X was called in by residents of Grace Lane, and he lent his instant media-circus-generating power to their protests. Residents alleged that CES had instructed their employees in hard hats to block driveways with trucks and videotape neighborhood meetings.

Around that time, Mark met with the Fire Marshal, who was dismissive until he saw Mark's maps showing the setbacks required by City fire

codes. In response, water barrels were placed to keep trucks from backing up beyond the required setbacks. And given what happened subsequently, the enforcement of those codes may well have saved lives.

"I was outside in the yard," Mark says about the first explosion, which took place on Oct. 2, 2008. His University of Houston architecture class was scheduled for a visit to the studio and house. Another explosion on Saturday, Dec. 6, 2008, broke windows and left chunks of metal everywhere, including an enormous triangular piece of metal, about four feet in length, stuck in the ground like a Dorito in dip. After a third explosion Dec. 16, Mark dialed 911 and added a call to OSHA for good measure.

On Dec. 30, 2008, Mark presented the collected findings from various city departments to City Council in the form of bound books. These made it painfully clear that the City had failed to speak to itself. To compensate, in the generalist and totalizing tradition of architects, Mark and Anne connected the dots for the Mayor and City Council. They brought together air quality studies, sewage investigations, safety violations, and fire codes.

After that meeting, City Councilmembers Jolanda Jones, Wanda Adams, and Ada Edwards; State Representative Garnet Coleman; Mayor Bill White; and two persistent city attorneys helped force the State of Texas to make an about-face. Officials went from granting CES ever more expansive permits to investigating and prosecuting the company. The City also sued CES and settled with the company for $102,000. Mark and Anne had the sense that the situation would improve.

"What the f*** now?" Mark said when he heard an explosion from his desk. It was July 7, 2009, and this was the fourth explosion in less than a year. He looked through a back window. Then he went to the "tea room," his third-floor room with access to the roof of the other house. He called 911 once again.

In the first photograph he took of the scene unfolding below him, shot like all the rest with the eye of an architect, perfectly framing the site, the tank farm is to the left, and a worker races from the right to the warehouse, which has a smoking hole blown through the roof. In a subsequent photo, oxygen tanks are wheeled in. Then the oxygen tanks fall over. Then a forklift shows up, and a crew starts setting the oxygen tanks upright. All this time, while they go through this Three Stooges routine, their co-worker is lying inside the warehouse covered in burns. You can see the back of a metal cylindrical tanker truck in the photos. They learn later that the fatally burned worker had opened the hatch on the tanker and switched on his flashlight to peer in. A spark from the flashlight set off a flash fire. No one is sure if the tanker was mislabeled, but if it had been correctly labeled, the worker would have known to take the proper precautions and keep his flashlight off. We may never know what exactly happened in that fatal explosion on Grace Lane. Investigations focused on two other tragedies.

"You know they had a fatality in Port Arthur," a former CES employee told Mark and Anne, giving them a copy of the funeral program. The very existence of a Port Arthur facility was news to Mark and Anne. The cover of the funeral program reads, "In Loving Memory, Joey W. Sutter, July 4, 1972—December 18, 2008." Given that he was born on the Fourth of July, it's hard not to ask whether Sutter's death carries a larger message about the failures of our city and nation to live up to our great ideals of equal opportunity and fairness. At the age of 36, Mr. Sutter had several children and a grandson. According to the Port Arthur coroner, he died due to exposure to hydrogen sulfide.

In August 2009, the EPA raided the CES facilities behind Grace Lane and in Port Arthur on the same day. During the raid itself, a container burst into flames at Grace Lance, forcing an evacuation of the facility. All residents on Grace Lane had to stay indoors. Subsequently, the City forcibly cut the water supply. CES attempted to continue operations by trucking in water, but ultimately filed for bankruptcy. The bank that owned the company's debt declined reorganization and opted for liquidation. In July 2012, the Department of Justice charged Matthew Bowman with conspiracy to illegally transport hazardous materials. The 13-count indictment describes a scheme in which hazardous materials were transported with false documents and no placards, resulting in the death of two employees at the Port Arthur facility, Joey Sutter and Charles Sittig. Initially, Bowman contested the charges, but in May 2013 he pleaded guilty and received a one-year prison term and $5,000 fine.

One could argue that m+a architecture and CES Environmental are manifestations of the same phenomenon—the unzoned, cheap land, entrepreneurial "spirit" of Houston. The two great energies of Houston, the free-spirited artists and the free-market capitalists, here collided. They were neighbors, not by accident, but because they feed from the same trough.

Bowman did pay a visit to m+a architecture once. Mark says that Bowman accused him of "orchestrating a vast conspiracy" involving the Black Panthers, the Mayor's Office, City Council, TCEQ, the EPA, the Texas Attorney General, METRO, and various civic club organizations, in addition to other City departments like Health and Human Services, Water, and Wastewater. As absurd as Bowman's accusation is, it does point to exactly why architects have the potential to be super-citizens with the capacity to train others to empower whole communities.

Mark's and Anne's architecture practice survived the CES struggle and the recession. Things are looking up. The 2011 AIA Architecture Tour featured two houses of their design, a third tiny house for their village and a mansion in River Oaks. Mark was named the 2011 Ben Brewer Young Architect by the AIA Houston. In 2013, Mark received the award for Young Professional Achievement in honor of William W. Caudill from the Texas Society of Architects.

Those well-deserved awards raise a couple of questions. One is the problem of AIA awards only going to one person in a couple. (The recent petition calling on the Pritzker Prize to be given retroactively to Denise Scott Brown for her work with Robert Venturi did bring attention to the need for rule changes.) In addition, when these honors were bestowed on Mark, the struggle against CES was not part of the portfolio. Instead of cropping the defunct mini-refinery from the photo of Mark and Anne in front of their studio and house, let us include it—and call in the neighbors, too.

In Houston, whether we are artists or engineers, plumbers or architects, our daily bread is oil. The extraction and processing of hydrocarbons is still *the* industry. And that industry generates waste, which has to end up somewhere. CES apparently "processed" a variety of unfamiliar and scary-sounding chemicals, but there was one form of waste with a perfectly prosaic name—"motor oil." In other words, CES isn't someone else's problem. Who doesn't generate used motor oil? We are all in this together as generators of waste, as neighbors breathing the same air and drinking the same water, and as neighbors to those on the industrial fence line.

Changes in Austin could help prevent more tragedies, but until then there are the lessons of small idealism to be learned from a lane called Grace. C

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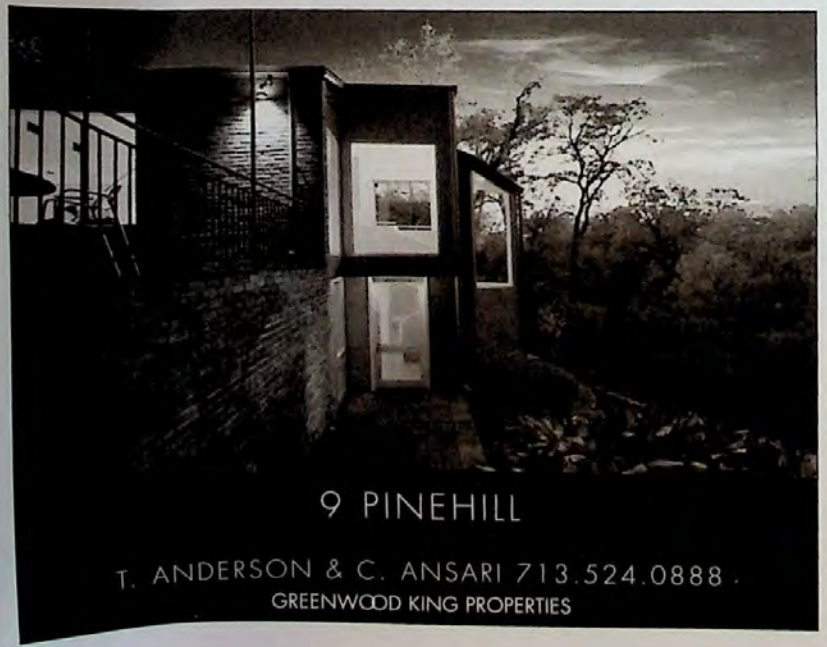

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BY ERIC BERGER

NEVER CRITICIZE AN ASTRONAUT AND OTHER LESSONS FROM THE CLIMATE WARS

I began writing the SciGuy blog for the *Houston Chronicle*'s web site, covering everything from nanometers to parsecs, in June 2005. This was an interesting time for climate change, because just a few months later the movie *An Inconvenient Truth* hit theaters. During the summer of 2006, I took nine readers—three people who professed to be skeptics, three people who professed to be neutral, and three who fully accepted the science—to the movie and held a roundtable afterward. (Now this is anecdotal, of course, but I had a much more difficult time finding the believers than I did the skeptics.) At the time, climate change was not an overtly partisan issue, but when I sat down with the readers after watching the film, what one of the professed skeptics, Matt Bramanti, said at the time strikes me as being eerily prophetic.

"The fact that Al Gore identified the movie so closely with himself—I think it's more about him, to him, than it is about global warming," Bramanti said. "The polarization really hammers away at the effectiveness."

That polarization has made the coverage of climate change for Houston's major newspaper, which I have undertaken during the last decade, a maddening, and at times carnivalesque, undertaking.

Houston is a city that has, in many ways, embraced climate-change skepticism. The city's most well-known TV meteorologist, former National Hurricane Center director and former chief meteorologist of Channel 11 Neil Frank, openly denies climate change. What is perhaps the city's largest scientific group, the Houston Geological Society, regularly holds luncheons with speakers skeptical of climate change. In February 2013, for example, petroleum geologist Bob Shoup gave a talk that he promoted as follows: "Predictions for the future have been dire, bordering on catastrophic. We'll examine the predictions versus the reality. Finally, we'll close with a look at history to see if we are better off with a warm or cold climate."

Based upon polling data, however, the city of Houston does not appear to be too far out of step with public attitudes toward climate change. Between 2006 and 2012, the Houston Area Survey, a long-running project by Rice University sociologist Stephen L. Klineberg, sampled the attitudes of Houstonians four times. In 2006, he found that over 79.4 percent of respondents considered the threat of global warming to be "very" or "somewhat" serious. In 2012, the number softened a bit to 73.5. Nationally, Gallup found a similar trend during the last decade, with 58 percent of Americans having a "great deal" or "fair amount" of worry about climate change. Although the polls used slightly different methodologies and asked different questions, I believe this provides reasonable evidence that overall, despite their location in the oil patch, Houstonians share similar views about climate change to those of Americans in general.

What is notable is that the trend during the last decade of declining public perception of climate change as a threat is not nearly as dramatic or visible as the increasing polarization and nastier tenor of the climate change discussion, of which I have been a firsthand witness.

An Inconvenient Truth was not a box office smash—it grossed $24 million—but the injection of climate change into the film medium helped push global warming more broadly into the public consciousness, and because Gore was the star of the film, he became its principal public advocate in the public mind. As Gore became the public spokesman for climate change, the issue became ever more partisan. Of course, Gore does not deserve all of the blame for this. More than a decade ago, Republican pollster Frank Luntz authored a memo that outlined a strategy for opponents of regulations on greenhouse gas emissions, arguing they should discredit the science so the public wouldn't demand action on climate change and would continue to think there was a scientific controversy around the subject.

"I think, in a sense, Al Gore and *An Inconvenient Truth* played, perhaps unwittingly, right into the hand of those looking to polarize the public as a pathway to maintaining the status quo," Penn State University climate scientist Michael Mann, a climate wars veteran, told me in an interview. "Here comes a partisan political figure. They recognized that if they could make him the face of climate change, it would indeed aid them in their strategy."

Invariably, a blog entry on climate change will draw out comments opining that Al Gore is fat, that he didn't invent the Internet, and that this whole espousing of climate change thing must be similarly fraudulent. Probably 70 or 80 percent of the comments on the climate change blog entries I write have a skeptical or denialist viewpoint.

The biggest challenge for me, in responding to readers in this deeply polarized context, is that the science itself is complex. For example, though the Arctic sea ice you always hear about has undergone a stark decline, the Antarctic ice extent has increased over the last 30 years. How can that be happening in a warming world? The theories out there are complicated. Furthermore, over the last 15 years, global temperature trends have been essentially flat. Why at a time when our rate of greenhouse gas emissions are accelerating, are planet temperatures not accelerating too? The prevailing theory is that much of the heat is going into the oceans, but the climate models didn't predict that this would happen. These are difficult things for a science reporter to explain to a broader public.

Of late, climate change denial in Houston has taken yet another odd turn. About four dozen former NASA astronauts, engineers, and scientists, under the rubric The Right Climate Stuff, issued an "Anthropogenic Global Warming Science Assessment" report in April. The group concluded, among other things, "The scientific progress on this issue has been corrupted by political and special interest influences that determine where our research dollars get spent."

In a blog post on the development, I pointed out that while these Houstonians were unquestionably heroes, what they were not is climate scientists. The response from the Houston public was swift and, at times, angry.

"It is always fun to read AGW true believers express their conspiracy kook/magical thinking," commented "hunter," whose sentiment was shared by many others.

The take-home messages for me from all of this are: (1) Al Gore has indeed grown fat since 2000, (2) Houstonians who don't believe in climate change must have become more vocal than those who do not because polling indicates the deniers are in the minority, and (3) never, ever even obliquely criticize an astronaut in Houston. We're divided on climate change, but we love our spacefarers.

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