



AMERICAN SOCIETY OF HIGHWAY ENGINEERS

National Project of the Year Award

OFFICIAL ENTRY FORM

AWARD CATEGORY (Check One): Under \$20 Million Over \$20 Million

SPONSORING REGION (Check One):

- | | | |
|---------------------------------------|---|---|
| <input type="checkbox"/> Northeast | <input type="checkbox"/> Great Lakes | <input type="checkbox"/> Northwest |
| <input type="checkbox"/> Mid-Atlantic | <input type="checkbox"/> North Central | <input type="checkbox"/> Rocky Mountain |
| <input type="checkbox"/> Southeast | <input checked="" type="checkbox"/> South Central | <input type="checkbox"/> Southwest |

CONTACT INFORMATION FOR SPONSORING REGION:

Primary Contact Name: Scott Jordon **ASHE Region Position:** National Director - SE Region
Phone (Office): 770-321-3936 **phone (Mobile):** 404-970-2040 **E-Mail Address:** sjordan@seengineering.com

Secondary Contact Name: Holly Painter **ASHE Region Position:** Regional Sectional Secretary
Phone (Office): 470-286-1207 **Phone (Mobile):** 850-341-0905 **E-Mail Address:** Holly.Painter@kci.com

PROJECT INFORMATION (From Section Entry):

ENTERING AGENCY/COMPANY'S NAME: BGE Inc.
PROJECT NAME: Judge Jodie Stavinoha Bridge **TYPE:** Bridges
PROJECT LOCATION: SH 99 (Grand Parkway) at Brazos River
CITY: City of Sugar Land **COUNTY:** Fort Bend
CONSTRUCTION COST: \$14,280,000 **BUDGETED CONSTRUCTION COST:** \$14,780,000
PROJECT COMPLETION DATE: April 2018

PROJECT OWNER: Fort Bend Grand Parkway Toll Road Authority
STREET ADDRESS: 1950 Lockwood Bypass
CITY: Thompsons **STATE:** TX **ZIP:** 77469
PHONE: 281-201-4301 **FAX:** _____
CONTACT PERSON: Mike Stone
E-MAIL ADDRESS: MikeStone@MikeStoneAssociates.com

PROJECT DESIGN FIRM: BGE, Inc.
STREET ADDRESS: 10777 Westheimer Suite 400
CITY: Houston **STATE:** TX **ZIP:** 77042
PHONE: 281-558-8700 **FAX:** _____
CONTACT PERSON: Gary Gehbauer
E-MAIL ADDRESS: ggehbauer@bgeinc.com

PRIME CONTRACTOR: NBG Contractors, Inc
STREET ADDRESS: 9702 Synott Road
CITY: Houston **STATE:** TX **ZIP:** 77083
PHONE: 281-495-0842 **FAX:** _____
CONTACT PERSON: David Boehm
E-MAIL ADDRESS: davidb@nbgconstructors.com

Entry Form Completed By: Michelle Florence **Date:** 1/29/19



January 30, 2019

American Society of Highway Engineers

RE: ASHE 2019 National Project of the Year

To whom it may concern,

We commit that at least one representative from the project team will attend the awards luncheon.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Matt Brannen', with a long horizontal flourish extending to the right.

Matt Brannen, PE
Director, Transportation Systems



SAVING THE STAVINOHA BRIDGE

When Hurricane Harvey, the Bridge, and the Brazos Collided

CONSTRUCTION COSTS

Original Construction Estimate	\$14,780,000
Final Cost	\$14,280,000
Construction Cost Savings	\$500,000

PROJECT OVERVIEW

Extreme rainfall events in 2015 and 2016 had accelerated erosion along the Brazos River at the eight-span, 1,200-foot-long Judge Jodie Stavinoha Bridge on SH 99. Located on the southwest side of the Greater Houston region, SH 99 is a major transportation link in Fort Bend County serving more than 25,000 commuters; it crosses the Brazos River just north of IH 69. As a result of these storm events, the north bank of the Brazos had moved 90 feet and was within 40 feet of the bridge’s north abutment, the final support for the bridge’s structure. With the 2017 hurricane season approaching, the Fort Bend Grand Parkway Toll Road Authority began a project to preserve and protect the abutment. Unfortunately, this project was no longer viable when the Brazos became engorged with a record 55.2-foot flood level.

As the area’s residents sought shelter from four days of torrential downpours and fled unprecedented waters levels in the rising river, the Authority’s leaders, BGE engineers, and field crews sprang into action to develop and execute an emergency bridge closure and detour plan.



When the storm waned, the bank of the river was now within 10 feet of the north abutment, rendering the original construction project that began in July, impossible to construct. With time of the essence, the Authority requested a new design to protect and save the bridge.

Within four days of Hurricane Harvey’s departure, BGE began working around the clock to develop conceptual designs.

COMPLEXITY—SAFETY

Hurricane Harvey’s aftermath left challenges for the entire Southeast Texas region. Residents were struggling to assess their properties and begin the arduous task of rebuilding their homes, while the Authority and local agencies were making key decisions regarding public safety and access. Working on a complex structural design project in a region operating in a state of emergency delivered unique challenges, such as limited material, equipment availability, timing, and team communication and coordination.



Following the hurricane, the greater Houston region experienced a shortage of supplies for residents and businesses. This included a lack of available construction materials to repair infrastructure as well as limited travel routes for needed construction equipment and supplies. The BGE structural and construction teams met with the contractor and the client to determine design

alternatives using available equipment rather than mobilizing new equipment to the site. The contractor confirmed that drill rigs onsite could drill up to 10-foot-diameter shafts noted in the selected alternative design. The next hurdle came in obtaining reinforcing steel, typically a long-lead item. BGE coordinated with the contractor to develop expedited drawings showing drill shaft reinforcing details, and they worked together on designing the drill shafts based on available steel bar sizes.

With both equipment and material logistics ironed out, the contractor continued drilling on outside shafts while BGE prepared the design for 10-foot-diameter shafts, further expediting the schedule. Working against the clock, BGE collaborated with the contractor and client before final design work to provide cost-effective and safe solutions that could be implemented quickly. Throughout September and October 2017, BGE held coordination meetings with the contractor every week to make sure that the design met the contractor's needs and the contractor could continue work. In addition, the riverbank continued to erode several feet at a time, causing BGE and the contractor to make project modifications on short notice and constantly assess safety risks. Daily phone calls and use of onsite equipment eliminated additional equipment costs and delays.



NEW APPLICATION OF EXISTING TECHNIQUES/ORIGINALITY/INNOVATION

To be successful, the improvements to protect the bridge's north abutment would need to meet two unusual criteria. First was the need to address how to stabilize the bridge when the ground below the roadway over the north abutment was no longer there.

Second was the need to keep SH 99 open to traffic as much as possible during construction. The magnitude of this challenge was exacerbated by the necessity of working in the middle of the SH 99 roadway.

To minimize roadway demolition, replacement pavement construction, and construction duration, the central element of the new design was large 10-foot-diameter drilled shafts constructed behind the existing abutment (through the road above). These shafts would be constructed deep enough to be cantilevered into stable soil. By eliminating the need for tiebacks farther away from the riverbank, the area of pavement demolition and replacement was reduced to a minimum.

Outside the limits of the roadway approach, drilled shafts with smaller 5.5-foot diameters and shorter lengths would be used with a conventional tieback system since that construction would not interfere with SH 99 traffic flow.

The project team initially considered both "secant pile" (overlapping shaft diameters) and

“tangent pile” (shafts just barely in contact) wall configurations. After considering cost-effectiveness, speed of installation, and flexibility of design, the team chose the tangent pile wall configuration, with smaller shafts to seal any remaining gaps between the main shafts. This technique was 20 percent lower in cost and 50 percent faster to install. The design was also based on limitations of the drilling equipment on the site and had a maximum diameter of 10 feet.

SOCIAL/ ECONOMICS CONSIDERATIONS — AESTHETICS AND SUSTAINABLE FEATURES

The Brazos is an alluvial river that naturally meanders and migrates over time. The processes of bank erosion and meander migration were ongoing before the bridge was constructed and will continue in the future. The more recent rapid erosion of the riverbank was a grave concern for homeowners and residents in the nearby neighborhoods protected by an adjacent levee.

BGE’s design not only protected the bridge’s future stability, but also the adjacent levee. Fort Bend County Levee Improvement District 7 (LID) financially participated in the design that extended the erosion protection structure and provided a tie-in for future use. The design kept the retaining wall along the riverbank instead of parallel with the roadway. These “wings” helped stabilize the



riverbank farther along the river and nearer the levees that are now just feet from the river.

MEETING AND EXCEEDING OWNER'S/ CLIENT'S NEEDS

BGE’s existing client relationship as a trusted consultant to the Authority created an environment of confidence in a time of chaos. In addition to the emergency design to permanently stabilize the bridge, BGE’s role also included close coordination and communication with numerous project partners, including the Authority, Fort Bend County, NBG Constructors (general contractor), A.H. Beck Foundation Company, and the LID.

All designs following Hurricane Harvey were completed under emergency conditions in four weeks versus the typical four months under normal conditions. Even on an expedited schedule, project work for both design and construction was accomplished ahead of schedule.

Lane closures during construction reduced the bridge to one lane, but construction was staggered to keep one lane of the bridge open to aid in hurricane recovery efforts for the region and to keep commerce impacts to a minimum. The construction on the roadway was finished ahead of schedule, minimizing impacts to the traveling public and surrounding neighborhoods. With construction of the remaining drill shaft walls and completion of



tieback assemblies, the project was substantially completed in April 2018, three months early.

Several aspects of the design provided cost savings for this project. BGE selected a tangent pile wall with seal piles as the most cost-effective redesign solution, saving 20 percent over other techniques. In addition, BGE confirmed that this redesign could be implemented using construction equipment already on the site, further reducing equipment and mobilization costs and utilizing materials that were available locally. This design also saved time that would

otherwise have been needed to bring in and mobilize new equipment.

SUMMARY

This project provided an opportunity not only for innovation, but also for the engineering world to show communities how ingenuity, professionalism, and perseverance, even in challenging, rapidly evolving situations, is possible. In saving the Stavinoha Bridge, BGE made a lasting positive impact in the life and economy of the region.



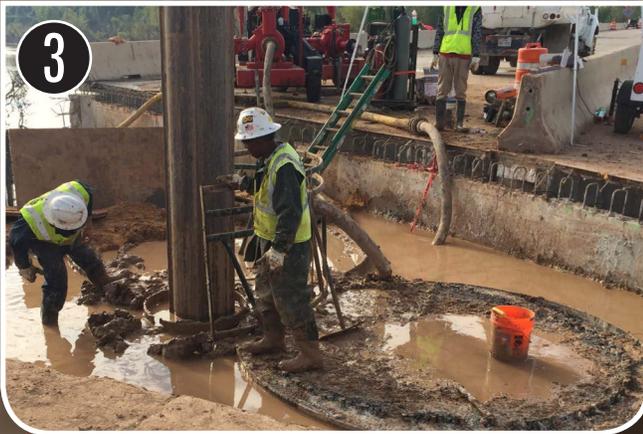
The Brazos River, a major river running through Central Texas to the Gulf Coast on the west side of Houston, reached record flood levels during Hurricane Harvey at the Stavinoha Bridge jobsite.



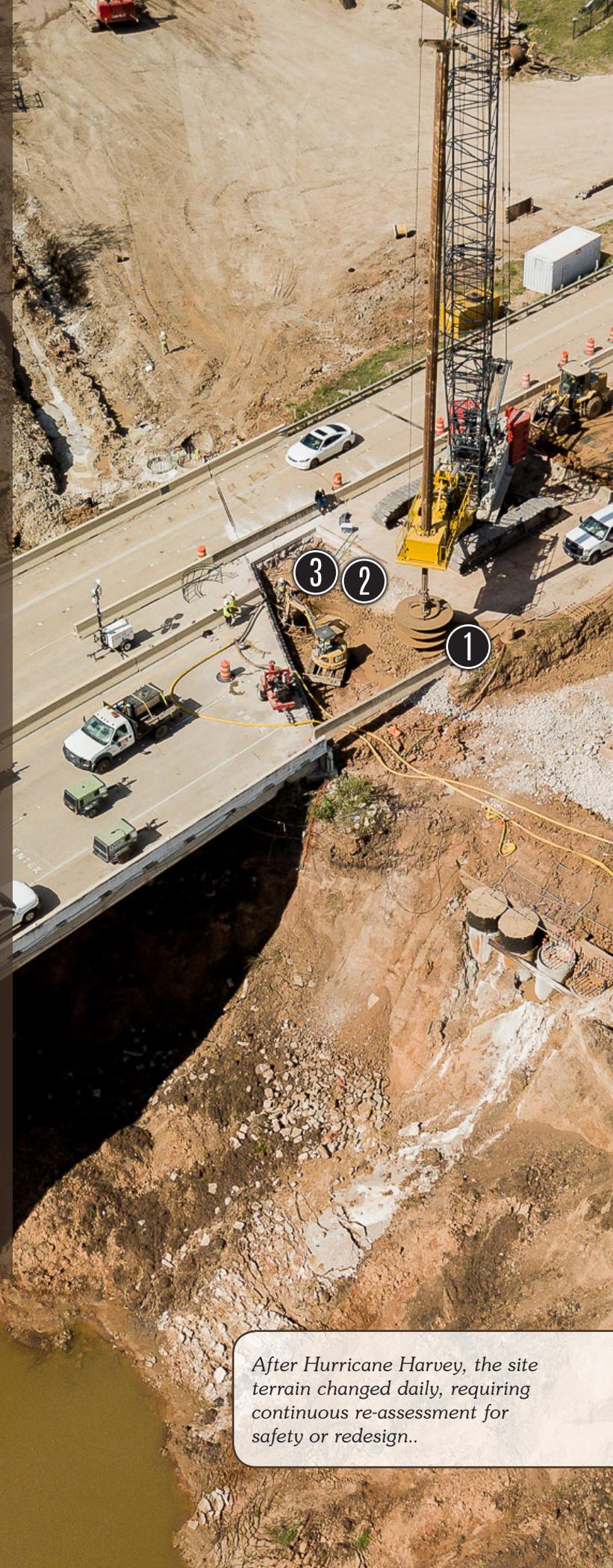
This levee provides flood protection for an adjacent residential area.

Flooded job site

When the Brazos River crested at 55.2 feet on September 1, 2017, 10 feet above flood stage, officials were forced to close the bridge to assess its structural integrity.



1. SH 99 was marked for drill shaft placement before closing SH 99 for construction.
2. Steel casings were inserted into the ground.
3. Construction crews drilled a seal shaft through the roadway.



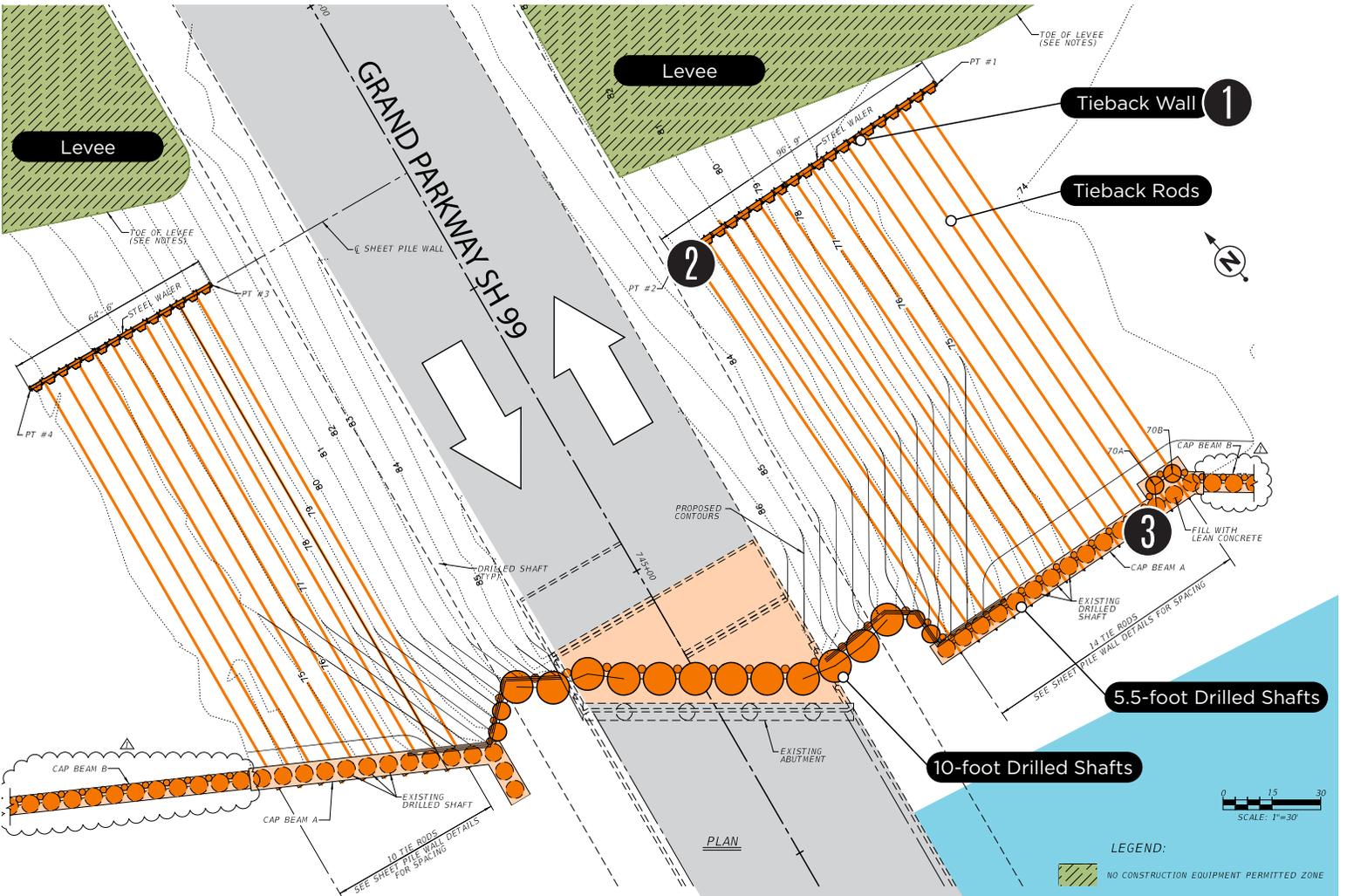
After Hurricane Harvey, the site terrain changed daily, requiring continuous re-assessment for safety or redesign..



1. Steel sheet pile tieback wall

2. Tie rod connections

3. Concrete caps at the river end of the tie rods



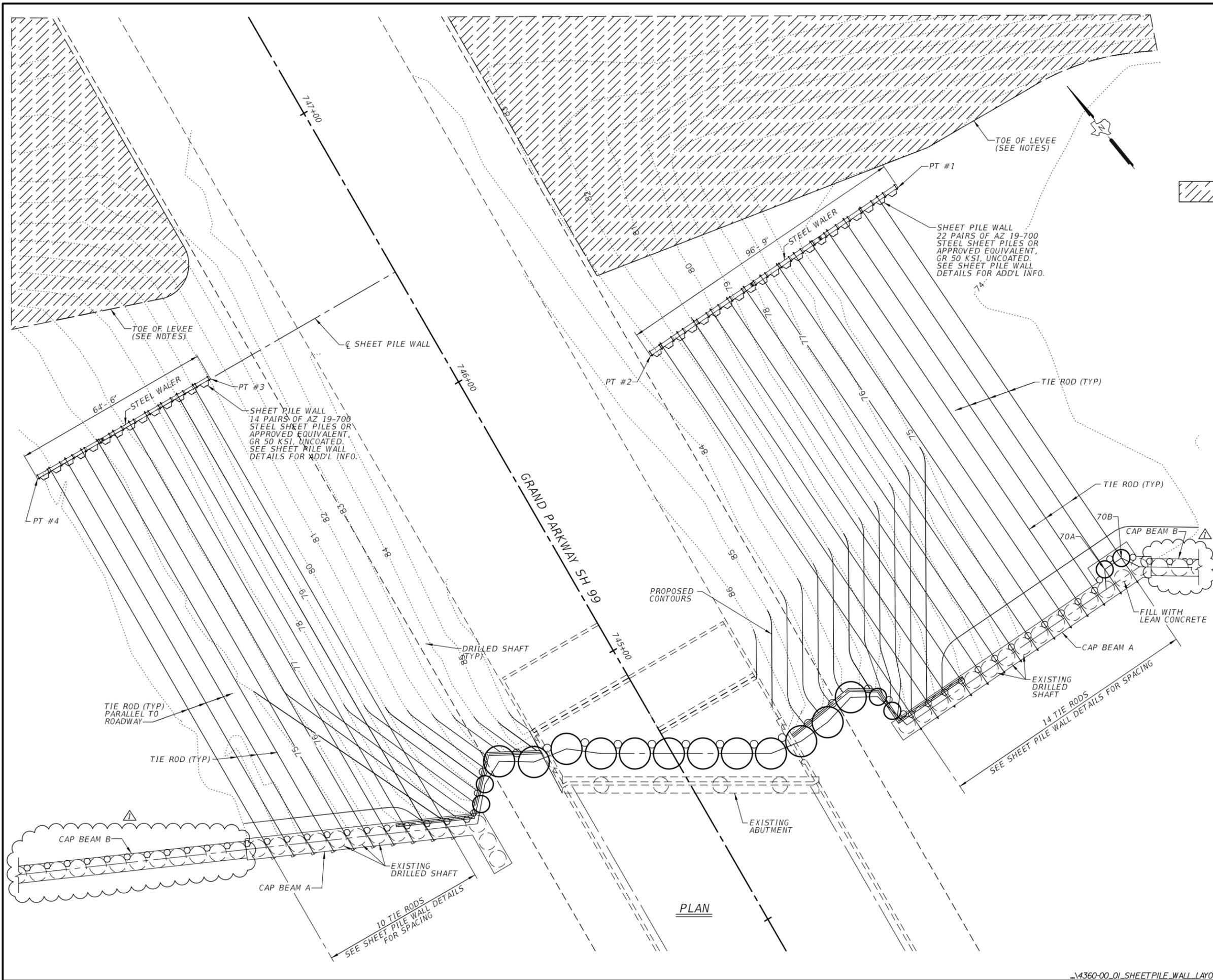
T:\PCSETUP\Platdrv\T\DOT_pdf_gray\scale.plt

4:44:08 PM irafinasek

4:44:08 PM irafinasek

DATE: 2/21/2018

FILE: Y:\BGP\TRA\4360-00_BrazosRiverErosion\03_CADD\Structures\4360-00_01_SHEETPILE_WALL_LAYOUT.DGN



N E COORDINATE TABLE		
SHEET PILE ENDS		
POINT #	NORTHING	EASTING
1	13774826.24	3024370.15
2	13774835.27	3024273.84
3	13774919.32	3024158.82
4	13774929.57	3024095.12

LEGEND:

NO CONSTRUCTION EQUIPMENT PERMITTED ZONE

- NOTES:
1. OFFSET DISTANCE FROM SHEET PILE WALL TO TOE OF LEVEE TO BE CONFIRMED.
 2. NO CONSTRUCTION ACTIVITIES ARE ALLOWED ON THE LEVEE.



NO.	DATE	REVISION	BY
1	01/26	CAP BEAM B ADDITION	WJB



Fort Bend Grand Parkway Toll Road Authority

BGE, Inc.
 10777 Westheimer, Suite 400, Houston, TX 77042
 Tel: 281-558-8700 • www.bgeinc.com
 TBPE Registration No. F-1046

BRAZOS RIVER SH99 DRILLED SHAFT WALL
SHEET PILE WALL PLAN

DRAWN:	HORIZ SCALE:
DESIGNED:	VERT SCALE:
CHECKED:	DATE: 2/21/2018
APPROVED:	SHEET NO: