



*A Golden Past.
A Shining Future.*

COMMUNITY DEVELOPMENT DEPARTMENT
Engineering Division
1725 Reynolds Street, Suite 200, Brunswick, GA 31520
Phone: 912-554-7428 /

August 13, 2019

Josh Noble
Marsh and Shore Management Program Manager
Coastal Resources Division

Subject: Oak Grove Island Cswy. – Culvert Maintenance and Improvement Project
Information to address items requested at the June 2019 committee meeting

Josh,

The permitting request for this project was presented at the June meeting, discussed, and tabled requesting additional information. These are the three areas that additional information was requested:

1. Alternatives presented to the Glynn County Board of Commissioners for the project scope
2. Demonstration of whether or not unreasonable harmful or increased erosion, shoaling of the channels or stagnant areas of water will be created. The meeting discussion focused on the reduced pipe diameter and increased pipe velocity.
3. Project will unreasonably interfere with the conservation of fish, shrimp, oysters, crabs, clams, and other marine life, wildlife or other resources including but not limited to water and oxygen supply. The meeting discussion focused on the increased depth of standing water on the more landward side of the culverts

This written response will provide additional information relative to the above areas. The intention is to provide sufficient information so the committee can feel comfortable voting in favor of allowing the needed maintenance work to move forward.

1. Project alternatives as presented to the Glynn County Board of Commissioners

Recognizing that the existing culverts under Oak Grove Causeway were failing, the Glynn County Board of Commissioners engaged EMC Engineering to prepare a concept report outlining options for repairing these culverts. That work culminated in the *Oak Grove Island Culvert Modifications Report* and dated April 11, 2013. A copy of the report and the most recent action taken by the Glynn County Board of Commissioners relative to this work are included in attachment #1. The item was approved as

presented by the Board of Commissioners at their meeting on April 20, 2019, agenda item number 30 (minutes, item, and report are available at <https://www.glynncounty.org/DocumentCenter/View/57377/042017?bidId=>).

The intention of the alternatives analysis was to provide the County with options on how the culverts could be addressed by comparing solutions with an expected longer service life to those with expected shorter service lives. The reasoning for selecting option #3 in the report (the option as presented to the Committee for their consideration) is outlined in the memo to the Board of Commissioners dated April 4, 2017.

2. Demonstration of whether or not unreasonable harmful or increased erosion, shoaling of the channels or stagnant areas of water will be created. The meeting discussion focused on the reduced pipe diameter and increased pipe velocity

This project seeks to repair the drainage existing infrastructure currently in place under Oak Grove Causeway. One of the major causes of failure in the existing system is joint failure of the concrete pipe sections that allows ground water to exchange with the tidal water in the pipe, water movement also carries soil from around the joints into the pipe causing failure in the road and shoulder above. The plan to address this failure by lining the existing 48-inch diameter concrete pipes with a continuous “plastic pipe”; thereby eliminating the joints. In order to accomplish this, the resulting final pipe diameter will be smaller than the current pipe diameter.

Given the size of the common marine life the area, the reduction in pipe diameter should not be impactful to their ability to use the pipes to cross under the roadway. Special Condition #2 as presented in the permit requires mitigating measures be installed with the project to exclude manatees from access to the pipes. This will also exclude large wildlife from accessing the pipes to an extent greater than the pipe size reduction will.

The calculations in Appendix 2 includes plans for the project and calculations of the expected water velocity at the pipe end now and when the pipes are lined. The calculations show an increase in water velocity at the end of the pipe of 25% (8.55 to 10.67 feet per second). This is representative of the one pipe that does not have a flapper type tide check valve, the increase is expected to be less at the pipe ends with the check valve since the valves effect of slowing the water velocity is more pronounced with higher velocities.

Erosion caused by Pipe end velocity increases will be mitigated by the installation of additional rock at the pipe ends to provide for scour control and velocity dissipation. The rock size and pad dimensions are taken from the design nomograph and incorporated in the plan (see nomograph and plans in Appendix 2)

The tidal area upstream from the culvert crossings currently has areas where shoaling is occurring in the flow areas. Repairing the existing culverts is not expected to have an effect on the shoaling. Flows in the creek lines should remain generally the same with a small increase in the permanently wetted area due to the project raising the invert of the pipes. Appendix 3 includes aerial photos showing the area with standing water at dead low and at 2-inches above dead low. The area of standing water changes slightly, however this minor change in water elevation should not alter the shoaling patterns currently in place.

3. Project will unreasonably interfere with the conservation of fish, shrimp, oysters, crabs, clams, and other marine life, wildlife or other resources including but not limited to water and oxygen supply. The meeting discussion focused on the increased depth of standing water on the more landward side of the culverts

As described above, this project includes lining the existing pipes and thereby raising the invert of the pipes by approximately 3-inches. This alteration in the pipe invert will result in more water being held in the area upstream from the culverts. Appendix 3 includes aerial photos of the area of trapped water and the mud flat creek lines at low tide and at low tide plus 2-inches. A comparison of the wetted area indicates that the area that will be changed to permanently wetted is very small relative to the basin area. Further, this converted area will provide additional habitat for the fish and other animals that currently live in the waters held above the culverts. Non Marine animals in the area (i.e., wading birds, birds of prey,...) should benefit from the slightly increased habitat for the marine wildlife.

Appendix 3 also include topographic information for the area upstream of the culverts and for the larger basin. The topo info indicates that the area directly upstream of the culverts is the lowest in the system upstream from the culverts. Therefore any increase in wetted area due to the alteration in culvert inverts will be limited to the area directly upstream from the culverts.

I look forward to presenting this additional information to the Committee at their August 23, 2019 meeting.

Sincerely,

R. Paul Andrews, P.E., County Engineer
Glynn County - Community Development Department



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Grove Island Causeway- Culvert Maintenance and Improvement Project

Appendix 1

- Minutes from Board of Commissioner meeting
- Item for project approval
- Alternatives Report for Project

MINUTES
REGULAR MEETING
GLYNN COUNTY BOARD OF COMMISSIONERS
HISTORIC GLYNN COUNTY COURTHOUSE
701 "G" STREET, 2ND FLOOR, COMMISSIONERS' MEETING CHAMBERS
THURSDAY, APRIL 20, 2017 AT 6:00 PM

PRESENT: Bill Brunson, Chairman, District 4
Michael Browning, Vice Chairman, District 1
Peter Murphy, Commissioner, District 2
Richard Strickland, Commissioner, District 3
Allen Booker, Commissioner, District 5
Mark Stambaugh, Commissioner, At Large Post 1
Bob Coleman, Commissioner, At Large Post 2

ALSO PRESENT: Alan Ours, County Manager
Aaron Mumford, County Attorney
Cindee Overstreet, County Clerk

INVOCATION AND PLEDGE

PUBLIC COMMENT PERIOD

Justin Henshaw spoke regarding concessions on the beach.
Julian Smith spoke regarding the Board's occasional deferral of public hearing items.

COMMISSION PRESENTATIONS AND ANNOUNCEMENTS

A motion was made by Commissioner Browning and seconded by Commissioner Coleman to remove item 2 from the agenda to allow the Board additional time to review the bylaws. The motion carried unanimously.

CONSENT AGENDA – General Business

1. Approved the minutes of the special called meeting held March 21, 2017, and the regular meeting held April 6, 2017, subject to any necessary corrections. (C. Overstreet)
- ~~2.~~ Adopt the bylaws creating the Revenue Committee for Glynn County.
This item was removed from the agenda at the beginning of the meeting.
3. Accept the FEMA-4284-DR-GA Hurricane Matthew Post Disaster reimbursement agreements, subject to review by the County Attorney, and replace funding that was incurred due to Hurricane Matthew to the General Fund Committed Funds for the Revenue Stabilization Fund. REPORT
4. Approve the submittal of the Georgia Department of Natural Resources (DNR) Shore Protection Permit to allow the fishing pier at Gould's Inlet to be converted into a beach crossover providing safe access across the sandbar. REPORT
5. Recognize the sublease agreement between Brunswick and Glynn County Development Authority and Gulfstream Aerospace Corporation for property at the Brunswick-Golden Isles Airport. REPORT
6. Award the contract to McKesson for ambulance billing services and technology upgrades to include ImageTrends Elite software, Atlas AVL System and authorize the Fire Department to purchase 23 Surface Pro Computers (5 for EMS and 18 for Fire) at a cost of \$32,350 and 6 memory upgrades for EMS at a cost of \$1,200 for a total cost of \$33,550 with funding to be provided by the FY17 Fire/EMS Department Approved Budgets. REPORT

CONSENT AGENDA – Finance Committee

7. Declare certain unusable items as surplus and approve disposing of those items in the best interest of the County. (V. McClinton) (FC Vote: 3-0) REPORT

8. Authorize Glynn County to invest county funds in Georgia Fund 1, a local government investment pool. (T. Miller) (FC Vote: 3-0) REPORT
9. Approve the Memorandum of Understanding with Coastal Outreach Soccer for use of the soccer/football field at Howard Coffin Park which falls under the County's management. (J. Powell) (FC Vote: 3-0) REPORT
10. Approve the Concession License Agreement with Timothy Holder, TNR Investments, LLC, dba Sunset Slush of SSI to allow concession sales at Massengale Park concession site #1 and on the beach in the total amount of \$4,509. (J. Powell) (FC Vote: 3-0) REPORT
11. Approve the Concession License Agreement with Pelican's Snoballs of Brunswick, LLC as the concession operator at Massengale Park concession site #2 in the total amount of \$3,850. (J. Powell) (FC Vote: 3-0) REPORT
12. Accept the settlement offer for Police Department unit 2593, a Ford Crown Vic in the amount of \$7,046.47. (K. Munoz-Strickland) (FC Vote: 3-0) REPORT
13. Approve increasing the FY17 Clerk of State Court's General Fund revenue and expenditures budget by \$1,042. (V. McClinton) (FC Vote: 3-0) REPORT
14. Approve increasing the FY17 Juvenile Service Funds revenue and expenditures budget by \$3,000. (V. McClinton) (FC Vote: 3-0) REPORT
15. Approve increasing the FY17 Auction Sales Revenue and Auction Fees Expenditures budgets by \$2,600 each to account for the increase in sales and related fees with funds to be provided by the sale of surplus equipment revenue in the General Fund. (V. McClinton) (FC Vote: 3-0) REPORT
16. Approve Real Property corrections to the digest as recommended by the Board of Assessors and the Chief Appraiser at their Thursday, March 2, 2017 meeting, with clarification that this does not approve a tax refund. (R. Glisson) (FC Vote: 3-0) REPORT
17. Approve the Real and Personal Property corrections to the digest as recommended by the Board of Assessors and the Chief Appraiser at their Thursday, March 16, 2017, meeting, with clarification that this does not approve a tax refund. (R. Glisson) (FC Vote: 3-0) REPORT
18. Approve the upgrade of the Contract for Services with Emergency Communication Network (CodeRed) at a one-time fee of \$6,375 to provide for the communication of essential information to ensure the safety and preparedness of citizens during threatening situations with funding to be provided by the E911 fund budget and authorize the issuance of a solicitation for these services in FY18. (C. Richardson) (FC Vote: 3-0) REPORT
19. Authorize staff to solicit bids for Engineering Services for the Preliminary Engineering Phase of the Harry Driggers Boulevard Pedestrian Path, Phase II project with funding to be provided by SPLOST 5- Sidewalks and Bike Paths. (P. Andrews) (FC Vote: 3-0) REPORT
20. Authorize staff to issue a purchase order for a 2017 Ford Focus SE Hatchback from Allan Vigil Ford in Morrow, GA for \$17,734 using State Contract with funding to be provided by the FY17 Capital Projects Fund savings from other projects. (T. Miller) (FC Vote: 3-0) REPORT 9999-SPD- ES40199373-002
21. Authorize staff not to renew the agreement between Glynn County and Q-Public for the Integrated Damage Assessment Model (IDA). (B. Nyers) (FC Vote: 3-0) REPORT
22. Approve the issuance of a purchase order to Dell for the Phase II storage attachment for the Spillman System in the amount of \$57,189.17 with funding to be provided by the FY17 E911 Operating Budget. (J. Catron) REPORT
23. Approve payment in the amount of \$54,022.11 to cover the repair expenses for Fire Ladder Truck 1 to Ten-8 in Forsyth, Georgia with funding provided by Fire Protection Budget. (D. Austin) (FC Vote: 3-0) REPORT
24. Exercise a fourth option year extension option for right-of-way mowing and landscaping services to Coastal Landscape and Design for right-of-way mowing and landscaping services at the Demere/Frederica Roundabout (Task 1) and the Frederica/Lawrence Roundabout (Task 2) in the amount of \$13,310; and to Creative Landscape at Sea Island Road-Demere to Frederica (Task 3) and Lawrence Rd Roundabout to Hampton Point (Task 4) in the amount of \$24,200, with funding total of \$37,510 provided by the FY18 Public Works Operating Budget effective July 1, 2017. (D. Austin) FC Vote: 3-0) REPORT

25. Approve the issuance of a Purchase Order to Appling Motors of Baxley, GA for a Kubota Rough Terrain Vehicle (RTV) 900 for the litter initiatives in the amount of \$13,650 with funding to be provided by the Solid Waste Collection Fund fund balance. (D. Austin) (FC Vote: 3-0) REPORT
26. Approve the issuance of a Purchase Order to Wade Tractor of Griffin, Ga, a State Contract Vendor, for the New Holland TS 6-110 in the amount of \$48,161.64 with funding to be provided by the Capital Projects Fund fund balance. (D. Austin) (FC Vote: 3-0) REPORT
27. Approve the contract with the Georgia Department of Transportation (GDOT) for the mowing of rights-of-way and litter pickup on 22.23 miles of state routes in Glynn County at a reimbursement rate of \$2,625 per mile per year for a total annual reimbursement of \$58,353.75. (D. Austin) (FC Vote: 3-0) REPORT
28. Authorize a one-year extension of the current contract, for the FY17 audit, with KRT, CPAs P.C. for an amount not to exceed \$64,000 with funding to be provided by the FY18 departmental budgets and authorize the issuance of a solicitation for auditing services for FY18 and extension years with the Airport Commission as an option. (T. Miller) (FC Vote: 3-0) REPORT

A motion was made by Commissioner Browning and seconded by Commissioner Stambaugh to approve all items on the consent agenda except item 2 which was removed from the agenda. The motion carried unanimously.

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GENERAL BUSINESS

29. Consider accepting the proposal dated April 12, 2017, by Denise Grabowski, of Symbioscity, for planning support and consultation at a cost not to exceed \$40,000 with funding provided by the FY17 Community Development Department – Planning Division Operating Budget. (P. Thompson) REPORT

A motion was made by Commissioner Strickland and seconded by Commissioner Booker to accept the proposal from Symbioscity for planning support and consultation at a cost not to exceed \$40,000. The motion carried 6-1 with Commissioner Coleman opposed.

30. Consider canceling the existing contract with Underground Excavating for the Oak Grove Island Causeway Pipe Rehabilitation Project; authorizing staff to solicit bids for the work listed as Option 3 in the EMC report; and allocating \$1,189,300 of the SPLOST 5 unallocated funds to SPLOST 5 Drainage rehabilitation and improvements and commit it to this project. (P. Andrews) (FC Vote: 3-0) REPORT

A motion was made by Commissioner Stambaugh and seconded by Commissioner Strickland to cancel the contract with Underground Excavating, authorize staff to solicit bids, and allocate SPLOST 5 funds for the project. The motion carried unanimously.

EXECUTIVE SESSION/POST EXECUTIVE SESSION ACTION

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A motion was made by Commissioner Strickland and seconded by Commissioner Stambaugh to adjourn the meeting. The motion carried unanimously.

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There being no further business, the meeting was adjourned at 6:38 p.m.

Bill Brunson, Chairman
Board of Commissioners
Glynn County, Georgia

Attest:

Cindee S. Overstreet, Clerk



**EMC ENGINEERING
SERVICES, INC.**

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P.O. Box 8101
Savannah, Georgia 31412

Phone (912) 644-3215

Fax (912) 233-4580

E-mail - mark_mobley@emc-eng.com

• **Environmental**

• **Marine**

• **Civil**

April 11, 2013

Glynn County Engineering Services Department
1725 Reynolds Street
Brunswick, Georgia 31520

Attn: Mr. Paul Andrews, P.E.
County Engineer

RE: **OAK GROVE ISLAND CULVERT MODIFICATIONS**
Glynn County, Georgia
EMC Project No. 12-0142

Dear Mr. Andrews:

EMC Engineering Services, Inc. (EMC) is pleased to submit these findings on the problems and solutions to the culverts located on Oak Grove Island Road. Our services were performed in accordance with our proposal dated September 11, 2012.

The problem is that potholes have formed above the roadway culverts in the roadside shoulders. These potholes have been filled with gravel as they happen, but continue to reoccur over time. Of greater concern is the possible loss of soil from beneath the pavement, which could cause its structural failure. The purpose of this report is to determine immediate, short term, and long term solutions to the problem, including the development of conceptual plans and construction cost estimates.

PROJECT INFORMATION

Information on the culverts was obtained from the County and during a site visit in December, 2012. Information provided included contracts executed in May 2000 for the construction of the culverts, one a GDOT County Contract, and the other a construction contract with Owens and Pridgen, Inc. for the work. Also provided by the County was a topographic survey of the culvert crossings prepared in December 2012. The culverts consist of two rows of 48" reinforced concrete pipes in two separate locations on the causeway. The culverts are supported on approximately 30" of stone bedding with steel sheet pile headwalls and wingwalls with concrete caps on each end. The southern end of each of the pipes has a galvanized steel flap gate to restrict tidal flows into the basin to the north of the roadway.

CONDITIONAL SURVEY

Information obtained during a site visit in December was confined to the worst area of potholing, on the westernmost pair of culverts. Some similar potholing has occurred on the eastern culverts, but not nearly to the extent. Information obtained included the extent of corrosion on the sheet pile headwalls, the extent of pipe joint separation, the extent of the potholing in the shoulders, and

the depth of the wash outs at the end of the pipes. The sheet pile corrosion was extensive, particularly in the area immediately surrounding the bottom of the pipes, which reinforced the opinion that settlement has occurred, causing the cracks in the concrete caps. Tidal water was confirmed to be flowing through the rock base of the pipes, causing potential as the cause of some of the potholing. The last two pipe joints in the southern end of the westernmost culvert exhibited significant separation, reinforcing the opinion that this is the primary cause of the potholing. The joints in the adjacent pipe did not exhibit this separation. The magnitude of voids in the shoulders was more extensive than the potholing would indicate. Some of them were being bridged by the overriding material. The direction of some of the voids seem to indicate that the cause may be from the eddies and washouts of the backfill material behind the wingwalls. There is no indication such as settlement or pavement cracking that the voids have extended up under the pavement.

STABILITY EVALUATION

High tide inundates the pipes and surrounding soil. As the tide falls, soils from outside the culvert infiltrate the pipe through the separated joints, causing voids that propagate to the surface to form potholes. This is exasperated with the high velocity in the pipe on the outgoing tide that causes a suction effect on the open joints. Additionally, soil also infiltrates into the rock bedding beneath the pipe as the water flows through it at these high velocities. This high velocity flow also causes turbulence and eddies at the end of the pipe and around the sides of the endwalls. This causes the loss of backfill from behind the wingwalls and undermining beneath the headwall sheet piles.

ALTERNATE CORRECTIVE MEASURES

One immediate solution (Option 1) to the potholing is to keep sediment from entering the pipes through the exterior two joints on the south end of the western most pipe only. This can be accomplished by installing a form (joint seal) inside the pipe against the joint and pressure grouting the joints. Portland cement based grout, with and without special admixtures, is usually adequate and much less expensive than the foaming and chemical grouts. To accomplish this task, flow in the pipe should be temporarily stopped until the grout has sufficient time to set up. Placement of a temporary tide gate on the north end of the pipe would accomplish this.

To alleviate the flow of water through the rock pipe bedding and correct the failing endwalls, a concrete slurry wall would be constructed behind the existing sheet piles on each end of the pipes. This would need to be accomplished during low tide to give the concrete as much time as possible to set. A trench would be excavated below the existing gravel base and a low slump concrete would be placed in the trench up to the top of the existing sheet pile. To keep this new headwall from undermining, the deep holes on the south end of the pipe would be filled with a clay sand material and topped with filter fabric and rip rap up to the invert of the existing pipes.

Another solution (Option 2) would be to excavate down to the pipe, reset the pipe, place concrete bedding under the pipe, and wrap and grout the separated joints. This option would require additional pavement to maintain two-way traffic around the work site or traffic signals on each end of the work site for one-way traffic. If a 1:1 slope is not possible, temporary shoring of the excavation next to the roadway may be required. As with the first, this option would include the construction of concrete slurry walls and rip rap slope at the south end of the pipes.

A more long term solution (Option 3) would be to install a high density polyethylene pipe (HDPE) liner of slightly smaller diameter in the existing concrete pipes and filling the annular space between the pipes with a concrete grout mixture. This would provide a continuous conduit with no

joints to minimize potential separation due to further settlement. A low slump concrete slurry wall would be constructed behind the existing sheet piles on the north of the pipe to eliminate the water flow through the rock pipe bedding. Due to the need for curing of the concrete grout mixture, this option will require the installation of temporary steel sheet pile cofferdams on each end of the pipe.

The HDPE pipe liners would extend approximately 16' further than the ends of the existing pipes to allow for the construction of a rip rap sloped end treatment. A sandy clay fill material would be placed in the washed out holes at the end of the pipe and covered with a filter fabric and rip rap. A cast in place concrete headwall supported on piles would be constructed on the south end to support the installation of the tide gates.

Another long term solution (Option 4) would be to replace the concrete culverts with HDPE pipes. It would include the removal of the existing pipes, tide gates, and headwalls and the installation of new HDPE pipes on a gravel base, a concrete slurry wall, and rip rap slope end treatments. This solution will require the installation of temporary steel sheet pile cofferdams on each end of the pipe to keep the excavation dry. This option would also require stage construction with temporary concrete barriers. Additional pavement would be required to maintain two-way traffic around the work site or traffic signals provided on each end of the work site for one-way traffic. Temporary shoring of the excavation next to the roadway would be required for each stage of the work.

This stage construction would require that the HDPE pipes be constructed in two sections. The two ends of the pipe would be connected with electrofusion sleeves or junction boxes. These sleeved joints would be supported on concrete bedding. Like the previous option, the tide gates would be supported on pile supported concrete headwalls. If this option were chosen, we would recommend the installation of at least one additional pipe or larger pipes to reduce the velocity of the flow through them.

The last option would be to replace the concrete culverts with a concrete box culvert or a bridge. This option would require either stage construction and/or a temporary detour bridge. This option would include the removal of the existing pipes, headwalls, and tide gates and construction of a single 12' x 8' box culvert or a new concrete bridge with concrete barriers and pile bents. A three span concrete bridge measuring approximately 30' wide by 75' long should be capable of providing the opening necessary to convey the tidal flow without increases in velocity. Rip rap slope protection would extend from each of the end bents.

ALTERNATE CONSTRUCTION COST ESTIMATES

Conceptual plans were developed for four of the options describe herein. Construction cost for each of the options were developed by applying typical unit prices for similar type work in the area to quantity estimates for the different units of work. Independent estimates by qualified contractors in this type of work were gathered to check for the accuracy of the estimates. Copies of the conceptual plans and detailed cost estimates are included in the Appendix.

Following is a summary of the estimated construction costs for each option:

- | | |
|-------------|--------------|
| 1. Option 1 | \$ 117,000 |
| 2. Option 2 | \$ 272,000 |
| 3. Option 3 | \$ 531,500 |
| 4. Option 4 | \$ 1,132,300 |

These estimates are for the construction portion of the project only and do not include any costs

for engineering and permitting.

We appreciate the opportunity to provide this letter report to Glynn County.

Sincerely,

J. Mark Mobley, P.E.
Senior Principal

**OAK GROVE ISLAND ROAD CULVERTS
OPINION OF PROBABLE COST- OPTION 1**

Prepared by: EMC Engineering Services, Inc

4/22/2013

Item	Description	Est. Qty.	Unit	Unit Price	Total Price
1	Mobilization and Demobilization	Job	LS		\$ 30,000
2	Temporary Tide Gate Installation	1	EA	\$ 5,000	\$ 5,000
3	Install Joint Seal and Pressure Grout Joints	2	EA	\$ 20,000	\$ 40,000
4	Concrete Slurry Wall	2	EA	\$ 10,000	\$ 20,000
6	Fill Material under Rip Rap	100	CY	\$ 100	\$ 10,000
7	Filter Fabric, Rip-Rap	60	SY	\$ 200	\$ 12,000
TOTAL					\$ 117,000

OAK GROVE ISLAND ROAD CULVERTS
OPINION OF PROBABLE COST- OPTION 2
Prepared by: EMC Engineering Services, Inc

4/22/2013

Item	Description	Est. Qty.	Unit	Unit Price	Total Price
1	Mobilization and Demobilization	Job	LS		\$ 30,000
2	Power Line Relocation	Job	LS		\$ 15,000
3	Lane Shift Pavement	150	SY	\$ 100	\$ 15,000
4	Install/Remove Temporary Concrete Barrier	500	LF	\$ 80	\$ 40,000
5	Temporary Tide Gate Installation	1	EA	\$ 5,000	\$ 5,000
6	Sewer Force Main Bypass/Reinstallation	Job	LS		\$ 20,000
7	Temporary Shoring	70	LF	\$ 1,000	\$ 70,000
8	Excavation	500	CY	\$ 50	\$ 25,000
9	Concrete Pipe Joint Repair	2	EA	\$ 5,000	\$ 10,000
10	Concrete Slurry Wall	2	EA	\$ 10,000	\$ 20,000
11	Fill Material under Rip Rap	100	CY	\$ 100	\$ 10,000
12	Filter Fabric, Rip-Rap	60	SY	\$ 200	\$ 12,000
					\$ 272,000

OAK GROVE ISLAND ROAD CULVERTS
OPINION OF PROBABLE COST- OPTION 3
Prepared by: EMC Engineering Services, Inc

4/22/2013

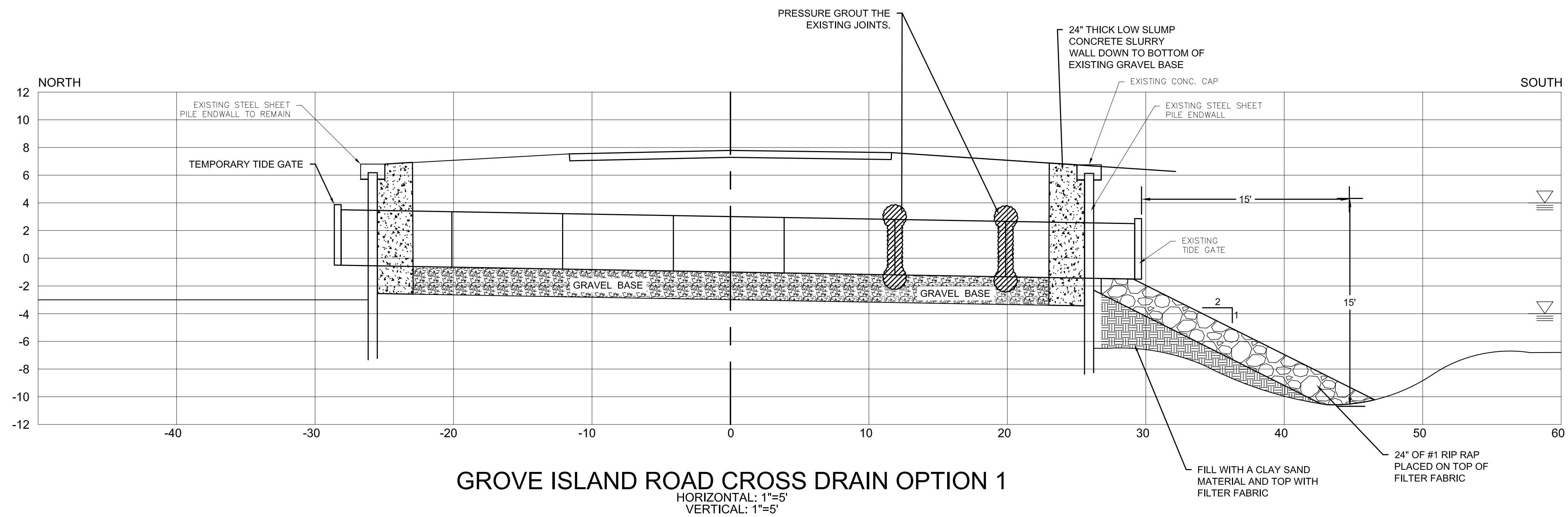
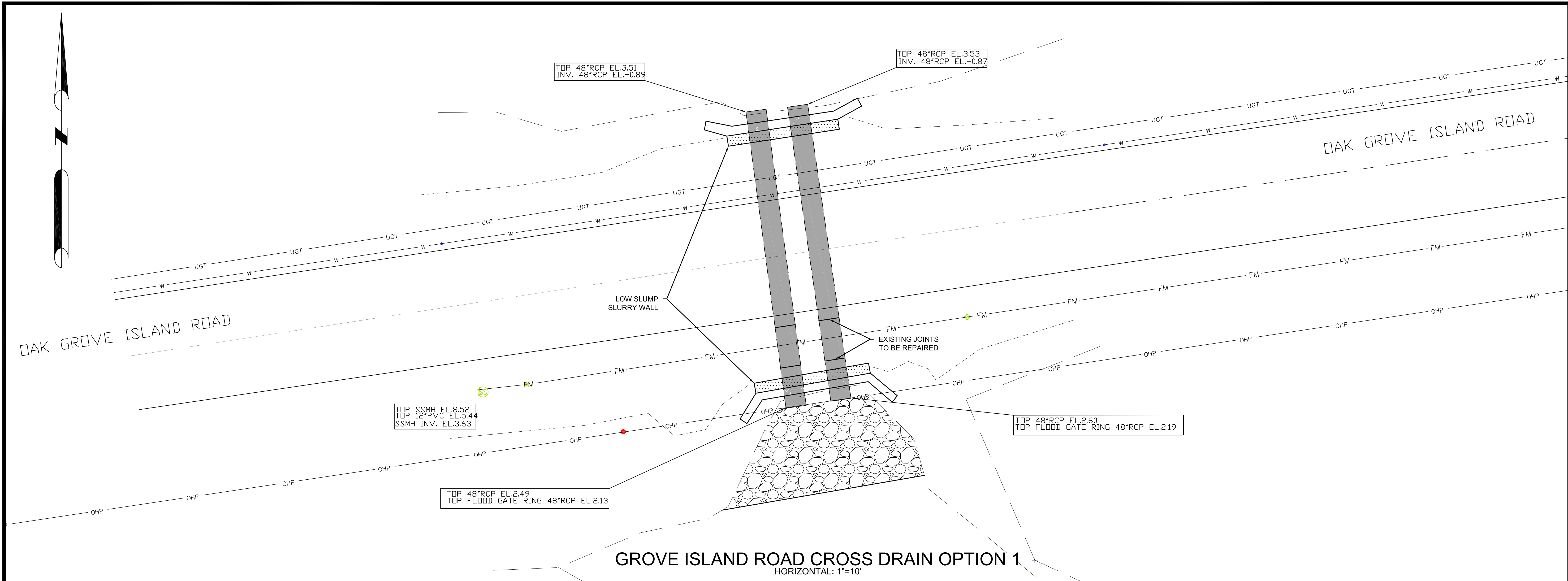
Item	Description	Est. Qty.	Unit	Unit Price	Total Price
1	Mobilization and Demobilization	Job	LS		\$ 30,000
2	Install/Remove Temporary Sheet Piling Cofferdams	175	LF	\$ 2,000	\$ 350,000
3	HDPE Liner Installation	135	LF	\$ 500	\$ 67,500
4	Annular Space Grout Fill	12	CY	\$ 1,000	\$ 12,000
5	Fill Material under Rip Rap	300	CY	\$ 100	\$ 30,000
6	Filter Fabric, Rip-Rap	60	SY	\$ 200	\$ 12,000
7	Conc. Headwall	1	EA	\$ 20,000	\$ 20,000
8	Concrete Slurry Wall	1	EA	\$ 10,000	\$ 10,000
TOTAL					\$ 531,500

OAK GROVE ISLAND ROAD CULVERTS
OPINION OF PROBABLE COST- OPTION 4

Prepared by: EMC Engineering Services, Inc

4/22/2013

Item	Description	Est. Qty.	Unit	Unit Price	Total Price
1	Mobilization and Demobilization	Job	LS		\$ 30,000
2	Power Line Relocation	Job	LS		\$ 15,000
3	Lane Shift Pavement	150	SY	\$ 100	\$ 15,000
4	Install Temporary Concrete Barrier	500	LF	\$ 60	\$ 30,000
5	Sewer Force Main Bypass/Reinstallation	Job	LS		\$ 20,000
6	Install/Remove Temporary Sheet Pile Shoring	100	LF	\$ 1,500	\$ 150,000
7	Install/Remove Temporary Sheet Piling Cofferdams	175	LF	\$ 2,000	\$ 350,000
8	Excavation/Demolition (South side)	500	CY	\$ 80	\$ 40,000
9	Filter wrapped GAB Base	60	CY	\$ 100	\$ 6,000
10	HDPE Pipe (South side)	114	LF	\$ 200	\$ 22,800
11	Backfill	500	CY	\$ 60	\$ 30,000
12	Fill Material under Rip Rap	300	CY	\$ 100	\$ 30,000
13	Filter Fabric, Rip-Rap	60	SY	\$ 200	\$ 12,000
14	Conc. Headwall	1	EA	\$ 20,000	\$ 20,000
15	Pavement Replacement and Lane Shift Pavement	300	SY	\$ 100	\$ 30,000
16	Shift Temporary Concrete Barrier	500	LF	\$ 60	\$ 30,000
17	Temporary Sheet Pile Shoring	100	LF	\$ 1,500	\$ 150,000
18	Excavation/Demolition (North side)	500	CY	\$ 80	\$ 40,000
19	Filter wrapped GAB Base	60	CY	\$ 100	\$ 6,000
20	HDPE Pipe and Connection (North side)	114	LF	\$ 250	\$ 28,500
21	Backfill	500	CY	\$ 60	\$ 30,000
22	Fill Material under Rip Rap	200	CY	\$ 100	\$ 20,000
23	Filter Fabric, Rip-Rap	60	SY	\$ 200	\$ 12,000
24	Pavement Replacement and Striping	150	SY	\$ 100	\$ 15,000
				TOTAL	\$ 1,132,300



REVISION DESCRIPTION		BY	DATE
NO.			

10' 5' 0' 10'
GRAPHIC SCALE: 1"=10'-0"

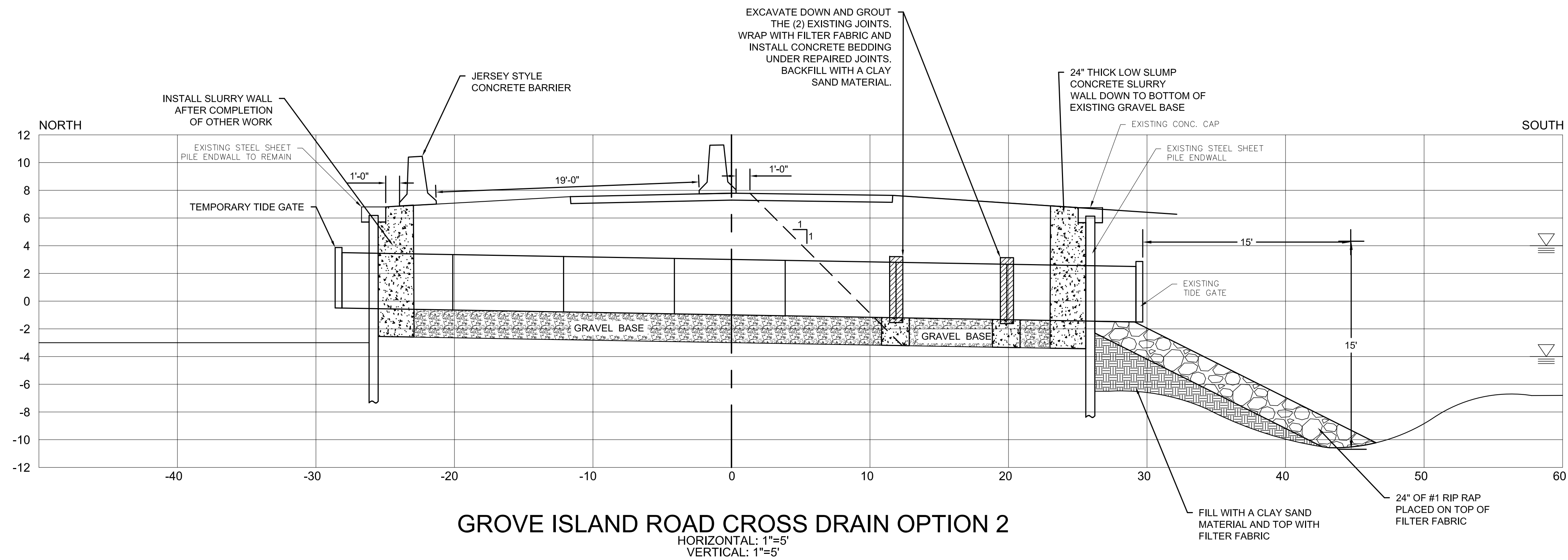
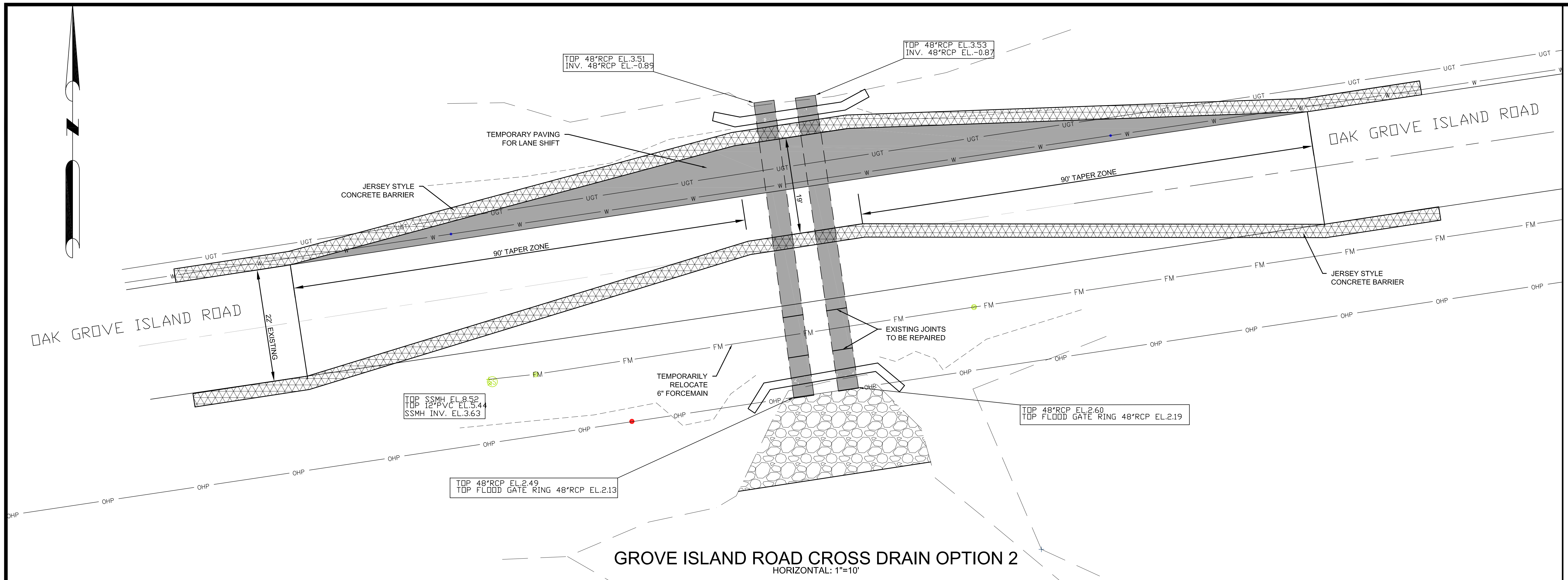
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PHONE: (912) 644-3200
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sean@emc-eng.com

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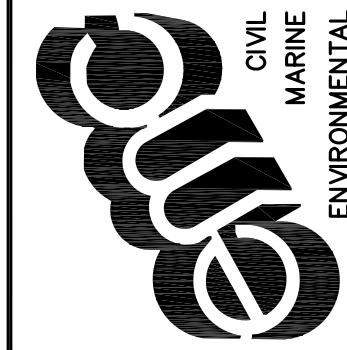
OPTION 1 PLAN AND PROFILE	
OAK GROVE ISLAND ROAD CULVERT	
Prepared for: GLENN COUNTY BOARD OF COMMISSIONERS	

PROJECT NO.:	12-0142
DRAWN BY:	CKM
DESIGNED BY:	JMM
SURVEYED BY:	-
SURVEY DATE:	-
CHECKED BY:	JMM
SCALE:	1"=10'
DATE:	MARCH 2013


SHEET	
1	
OF	5



NO.	REVISION DESCRIPTION	BY	DATE



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REGISTERED
PROFESSIONAL
ENGINEER
JOHN MARK MOBLEY

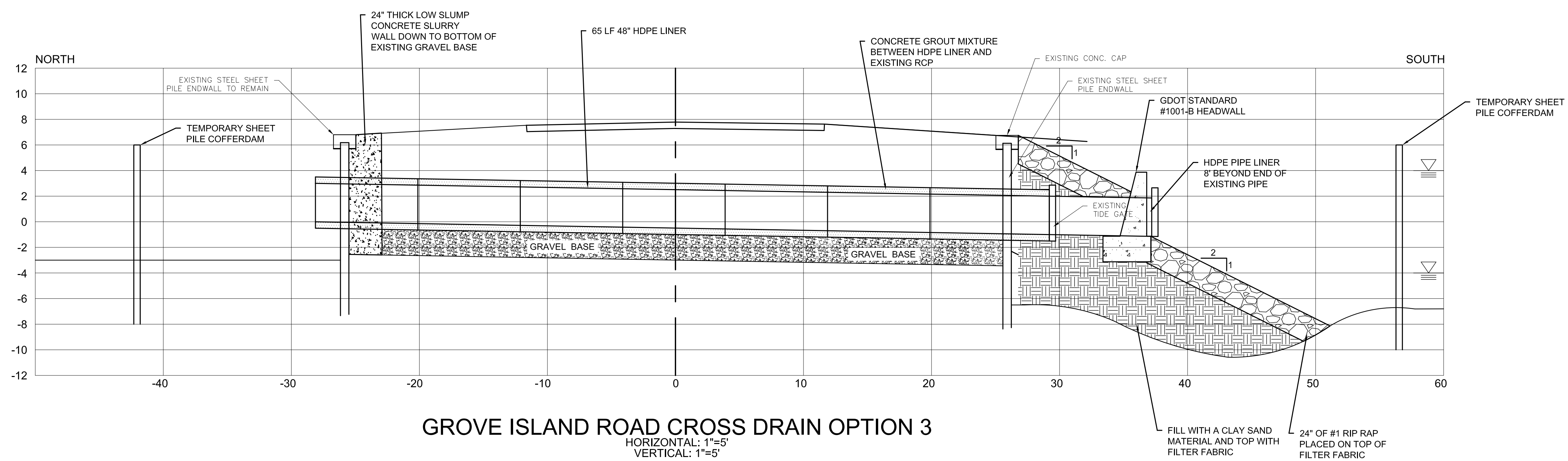
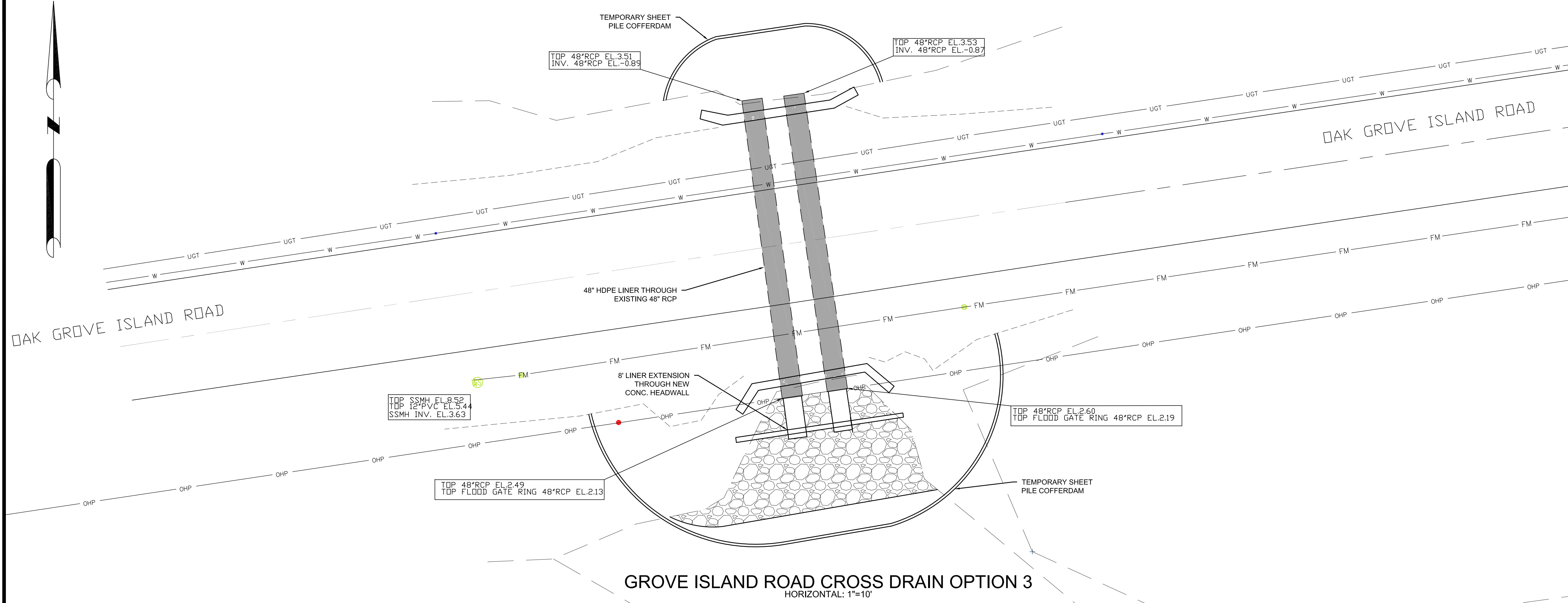
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OPTION 2 PLAN AND PROFILE

OAK GROVE ISLAND ROAD CULVERT

Prepared for:
GLENN COUNTY BOARD OF COMMISSIONERS

PROJECT NO.:	12-0142
DRAWN BY:	CKM
DESIGNED BY:	JMM
SURVEYED BY:	-
SURVEY DATE:	-
CHECKED BY:	JMM
SCALE:	1"=10'
DATE:	MARCH 2013



NO.	REVISION DESCRIPTION	BY	DATE

10' 5' 0' 10'
GRAPHIC SCALE: 1"=10'-0"

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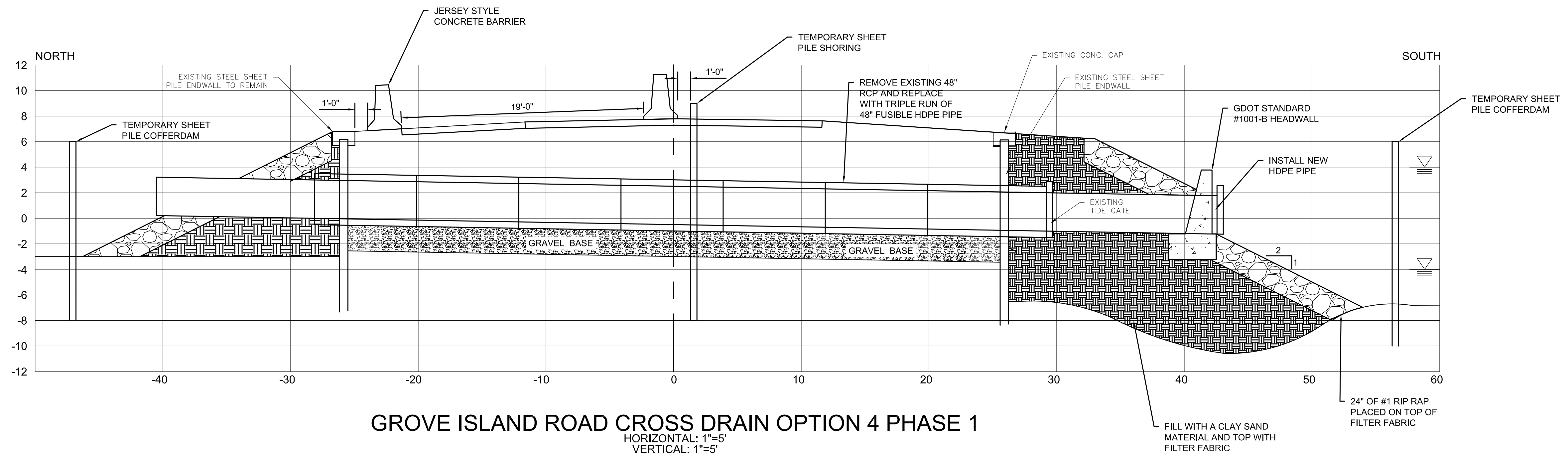
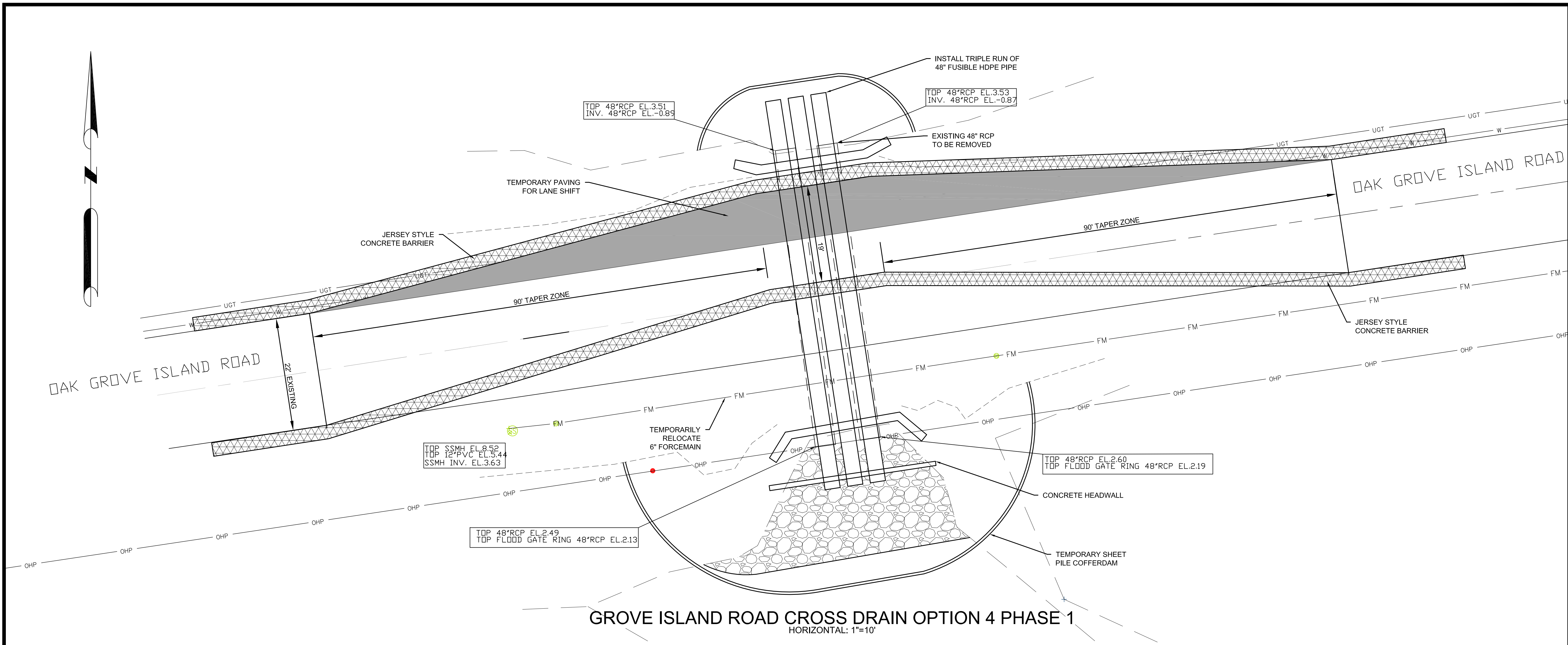
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OPTION 3 PLAN AND PROFILE
OAK GROVE ISLAND ROAD CULVERT

Prepared for:
GLENN COUNTY BOARD OF COMMISSIONERS

PROJECT NO.: 12-0142
DRAWN BY: CKM
DESIGNED BY: JMM
SURVEYED BY: -
SURVEY DATE: -
CHECKED BY: JMM
SCALE: 1"=10'
DATE: MARCH 2013

SHEET 3
OF 5



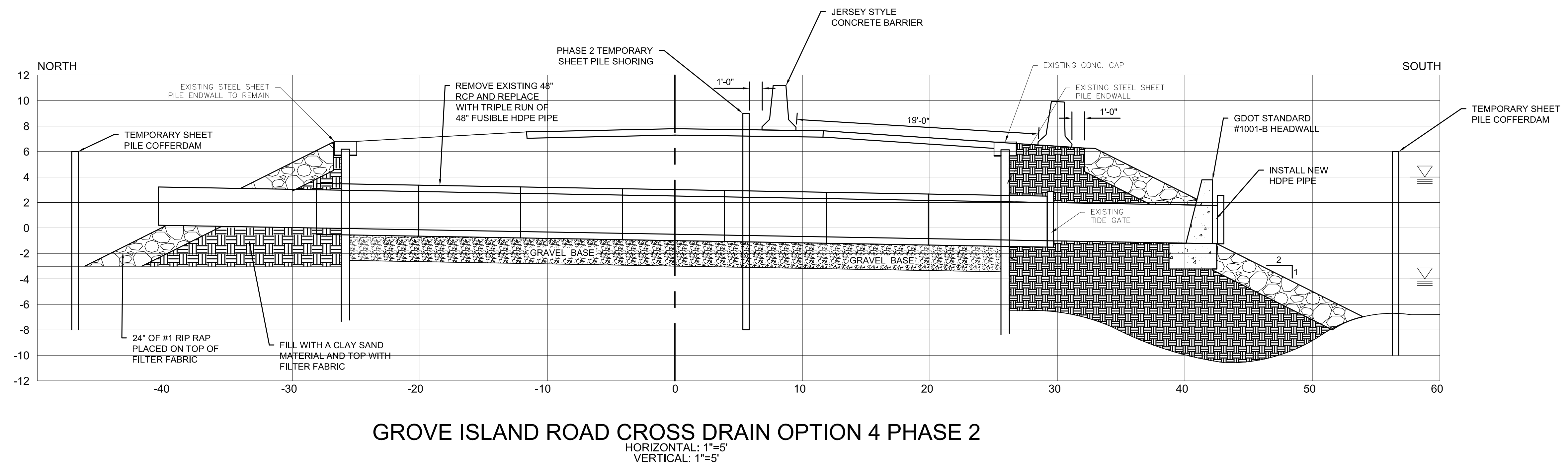
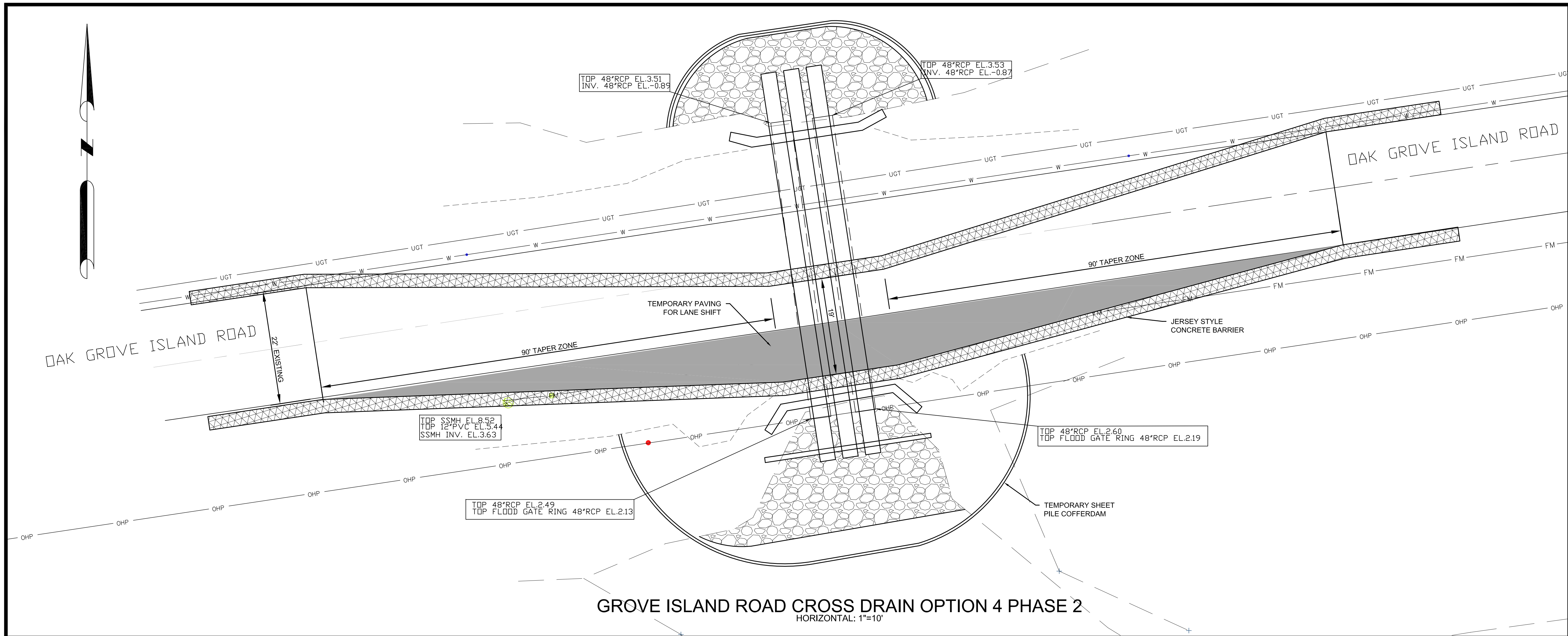
REVISION DESCRIPTION		BY	DATE
NO.			

GRAPHIC SCALE: 1"=10'-0"

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OPTION 4 PHASE 1 PLAN AND PROFILE	
OAK GROVE ISLAND ROAD CULVERT	
Prepared for: GLENN COUNTY BOARD OF COMMISSIONERS	
PROJECT NO.:	12-0142
DRAWN BY:	CKM
DESIGNED BY:	JMM
SURVEYED BY:	-
SURVEY DATE:	-
CHECKED BY:	JMM
SCALE:	1"=10'
DATE:	MARCH 2013
SHEET 4 OF 5	



NO.	REVISION DESCRIPTION	BY	DATE

10' 5' 0' 10'
GRAPHIC SCALE: 1"=10'-0"

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OPTION 4 PHASE 2 PLAN AND PROFILE

OAK GROVE ISLAND ROAD CULVERT

Prepared for:
GLENN COUNTY BOARD OF COMMISSIONERS

PROJECT NO.:	12-0142
DRAWN BY:	CKM
DESIGNED BY:	JMM
SURVEYED BY:	-
SURVEY DATE:	-
CHECKED BY:	JMM
SCALE:	1"=10'
DATE:	MARCH

SHEET

5

OF 5



*A Golden Past.
A Shining Future.*

Grove Island Causeway- Culvert Maintenance and Improvement Project

Appendix 2

- Stormwater Analysis and Design
- Sizing Nomograph for Outlet Protection
- Updated plans with impact area

Oak Grove Island Causeway Pipes
Stormwater Analysis and Design

Prepared for the Glynn Co. Board of Commissioners
by EMC Engineering Services

8/7/2019

Hydrological Calculations Summary

Drainage Area =	521	Acres
Elevation at High Point (U.S. 82) =	20	
Elevation at Oak Grove Island Causeway =	0	
Travel Distance =	7,500	Ft.
Slope =	0.27%	
Time of Concentration =	2.9	Hrs.
SCS Curve No.:	73	
Q ₅₀ for 24-hr. Storm Duration =	560	CFS
Q ₁₀₀ for 24-hr. Storm Duration =	660	CFS

Hydraulic Calculations Summary

Existing Pipes:

4 - 48" Diameter RCP

Existing capacity of pipes is 400 cfs without overtopping road. Therefore, excess of this value is being diverted to the causeway bridge located to the west of the culverts

Max. Area of Opening =	50	Sq. Ft.
Q Max Velocity =	8.55	Ft. per Sec.
Upstream Hydraulic Grade Line Elev. =	5.03	Feet

Proposed Pipes:

4-42" HDPE Liners

Max. Area of Opening (Sq. Ft.)=	38	Sq. Ft.
Q Max Velocity =	10.67	Ft. per Sec.
Upstream Hydraulic Grade Line Elev. =	5.07	Feet

Tidal Flow Check

Tidal Drainage Basin upstream =	124	Acres
Avg. Depth of Tidal Water =	4	Ft
Volume of Water =	21,605,760	Cu. Feet
Tidal Fluctuation Time =	6	Hrs
Flowrate	1,000	CFS


Existing capacity of pipes is 400 cfs without overtopping road. Therefore, excess of this value is being diverted to the causeway bridge located to the west of the culverts

Following are the drainage area maps, detailed hydrological calculations, and detailed hydraulic calculations for the existing culverts and proposed lined culverts.

Oak Grove Island Causeway Pipes

Upstream Marsh Area & Drainage Basin

Legend

 Oak Grove

Google Earth

© 2018 Google



2000 ft



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Wednesday, Aug 7 2019

Oak Grove Island Culverts with Existing 48-inch RCPs

Invert Elev Dn (ft) = 1.00
Pipe Length (ft) = 60.00
Slope (%) = 1.67
Invert Elev Up (ft) = 2.00
Rise (in) = 48.0
Shape = Circular
Span (in) = 48.0
No. Barrels = 4
n-Value = 0.012
Culvert Type = Circular Culvert
Culvert Entrance = Smooth tapered inlet throat
Coeff. K,M,c,Y,k = 0.534, 0.555, 0.0196, 0.9, 0.2

Embankment

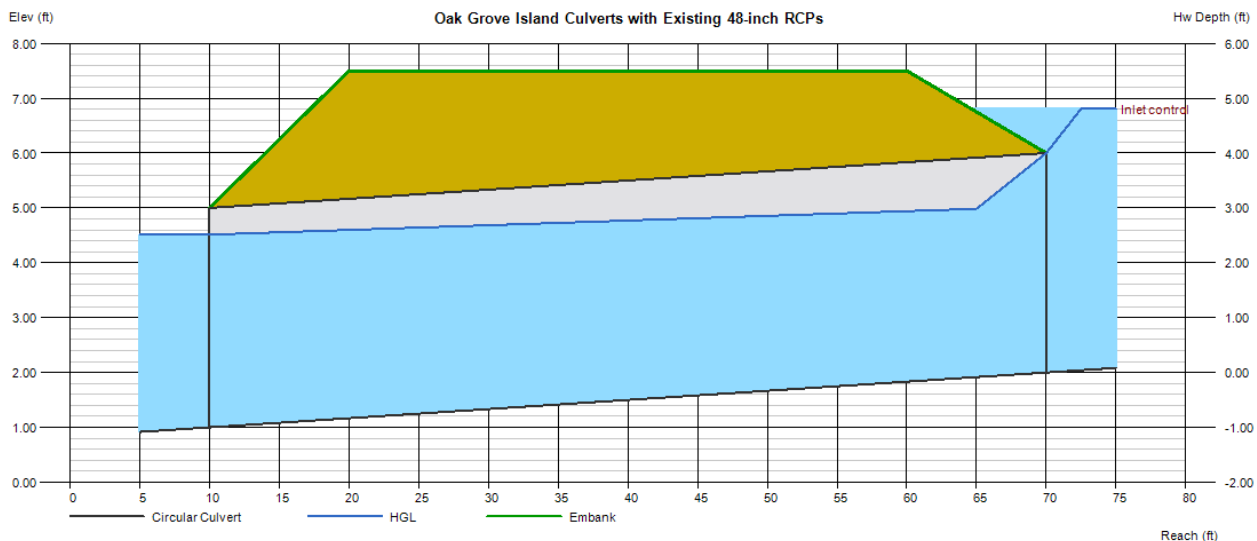
Top Elevation (ft) = 7.50
Top Width (ft) = 40.00
Crest Width (ft) = 10.00

Calculations

Qmin (cfs) = 400.00
Qmax (cfs) = 400.00
Tailwater Elev (ft) = (dc+D)/2

Highlighted

Qtotal (cfs) = 400.00
Qpipe (cfs) = 400.00
Qovertop (cfs) = 0.00
Veloc Dn (ft/s) = 8.55
Veloc Up (ft/s) = 9.80
HGL Dn (ft) = 4.51
HGL Up (ft) = 5.03
Hw Elev (ft) = 6.81
Hw/D (ft) = 1.20
Flow Regime = Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Wednesday, Aug 7 2019

Oak Grove Island Culverts with 42-inch HDPE Liners

Invert Elev Dn (ft) = 1.00
Pipe Length (ft) = 60.00
Slope (%) = 1.67
Invert Elev Up (ft) = 2.00
Rise (in) = 42.0
Shape = Circular
Span (in) = 42.0
No. Barrels = 4
n-Value = 0.010
Culvert Type = Circular Culvert
Culvert Entrance = Smooth tapered inlet throat
Coeff. K,M,c,Y,k = 0.534, 0.555, 0.0196, 0.9, 0.2

Embankment

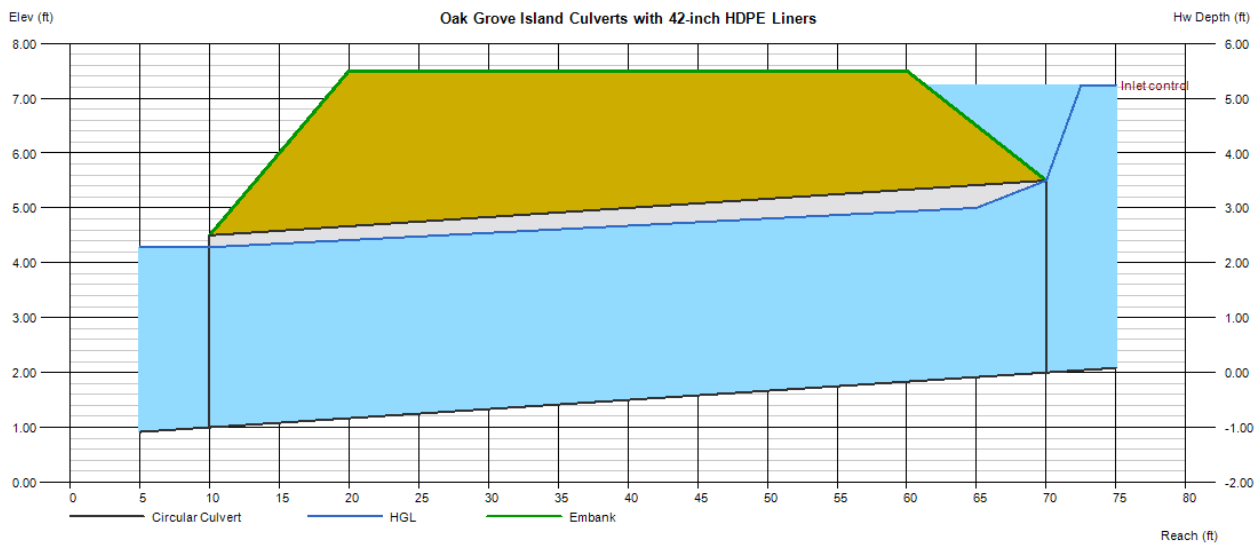
Top Elevation (ft) = 7.50
Top Width (ft) = 40.00
Crest Width (ft) = 10.00

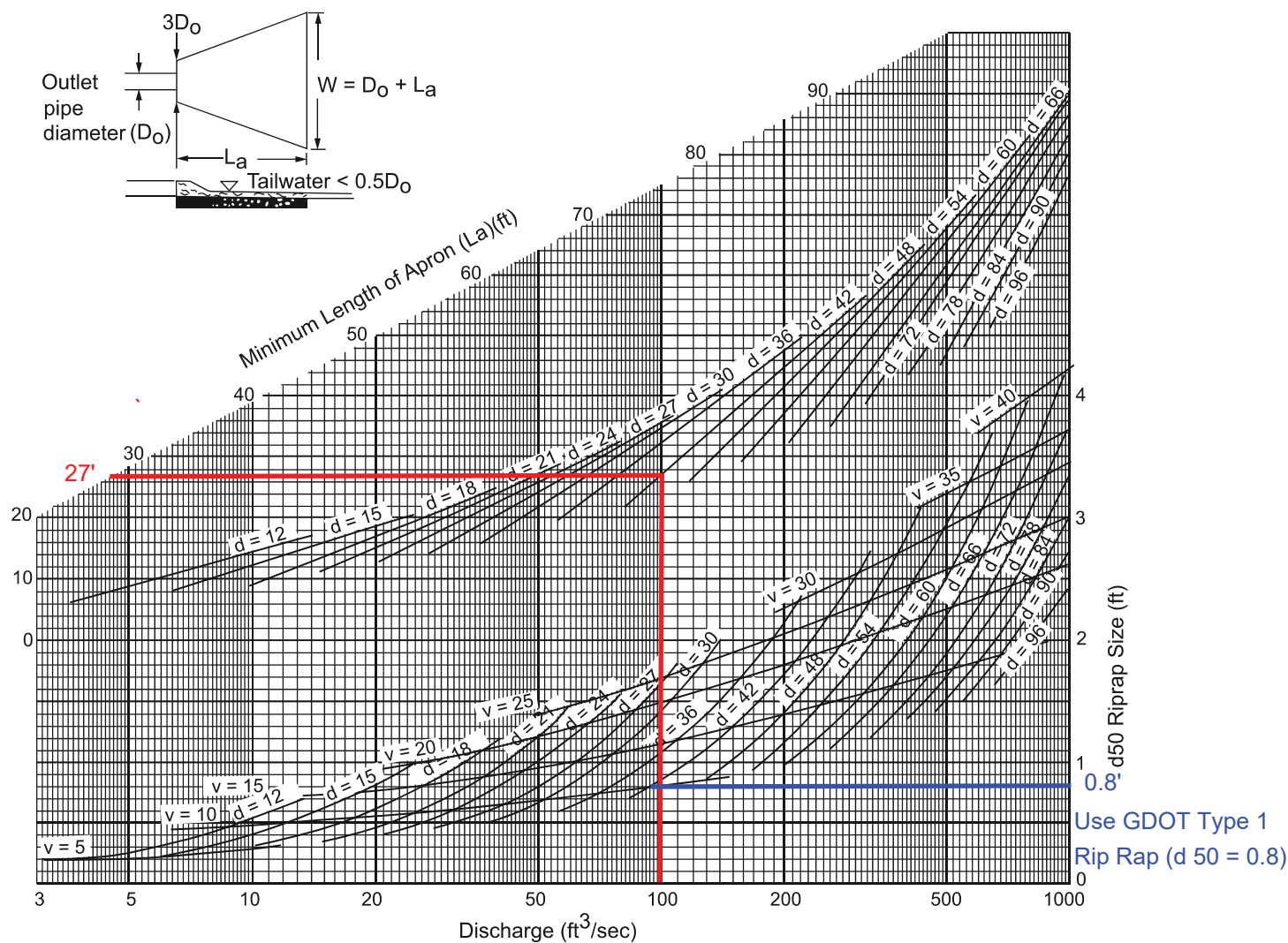
Calculations

Qmin (cfs) = 0.00
Qmax (cfs) = 400.00
Tailwater Elev (ft) = (dc+D)/2

Highlighted

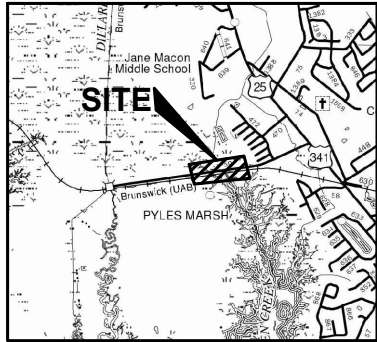
Qtotal (cfs) = 400.00
Qpipe (cfs) = 400.00
Qovertop (cfs) = 0.00
Veloc Dn (ft/s) = 10.67
Veloc Up (ft/s) = 11.19
HGL Dn (ft) = 4.28
HGL Up (ft) = 5.07
Hw Elev (ft) = 7.24
Hw/D (ft) = 1.50
Flow Regime = Inlet Control



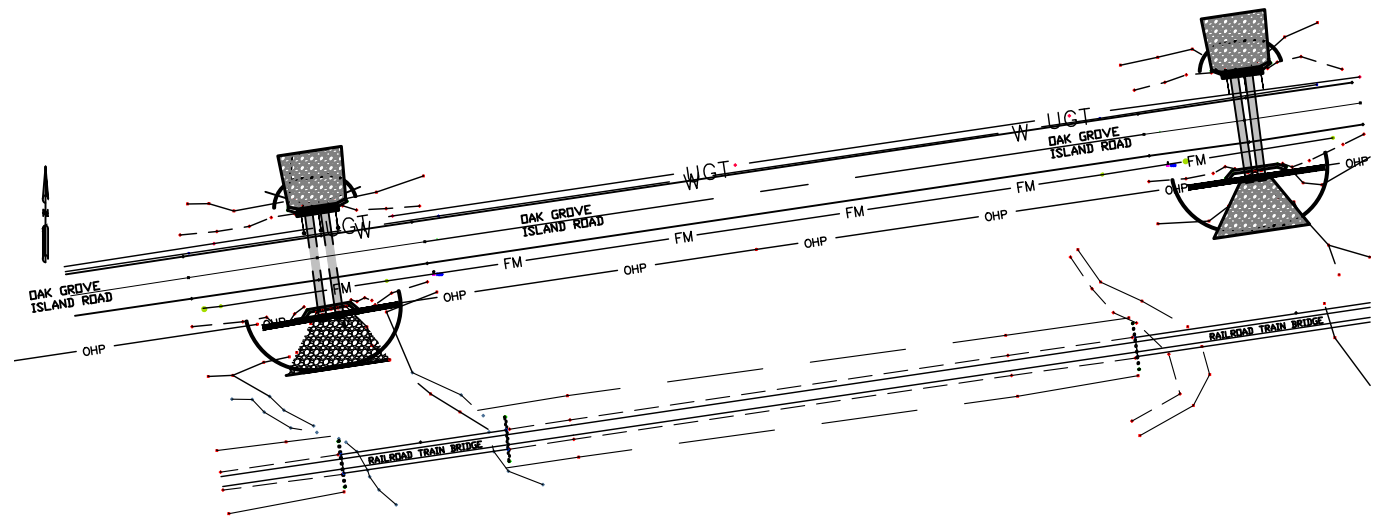


Curves may not be extrapolated.

Figure 6-34.1 - Design of Outlet Protection From a Round Pipe Flowing Full, Minimum Tailwater Condition ($T_w < 0.5$ Diameter)



VICINITY MAP
(NOT TO SCALE)

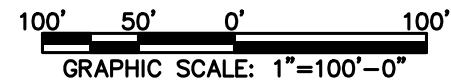


IMPACT SUMMARY :

WEST - 2382 SF / 115.2 CY IMPACT AREA
93 CY OF FILL
214 SY RIP RAP

EAST - 2355 SF / 138.4 CY IMPACT AREA
121 CY OF FILL
200 SY RIP RAP

1. HORIZONTAL CONTROL IS BASED ON GA
EAST ZONE NAD 83.



SHEET 1 OF 4

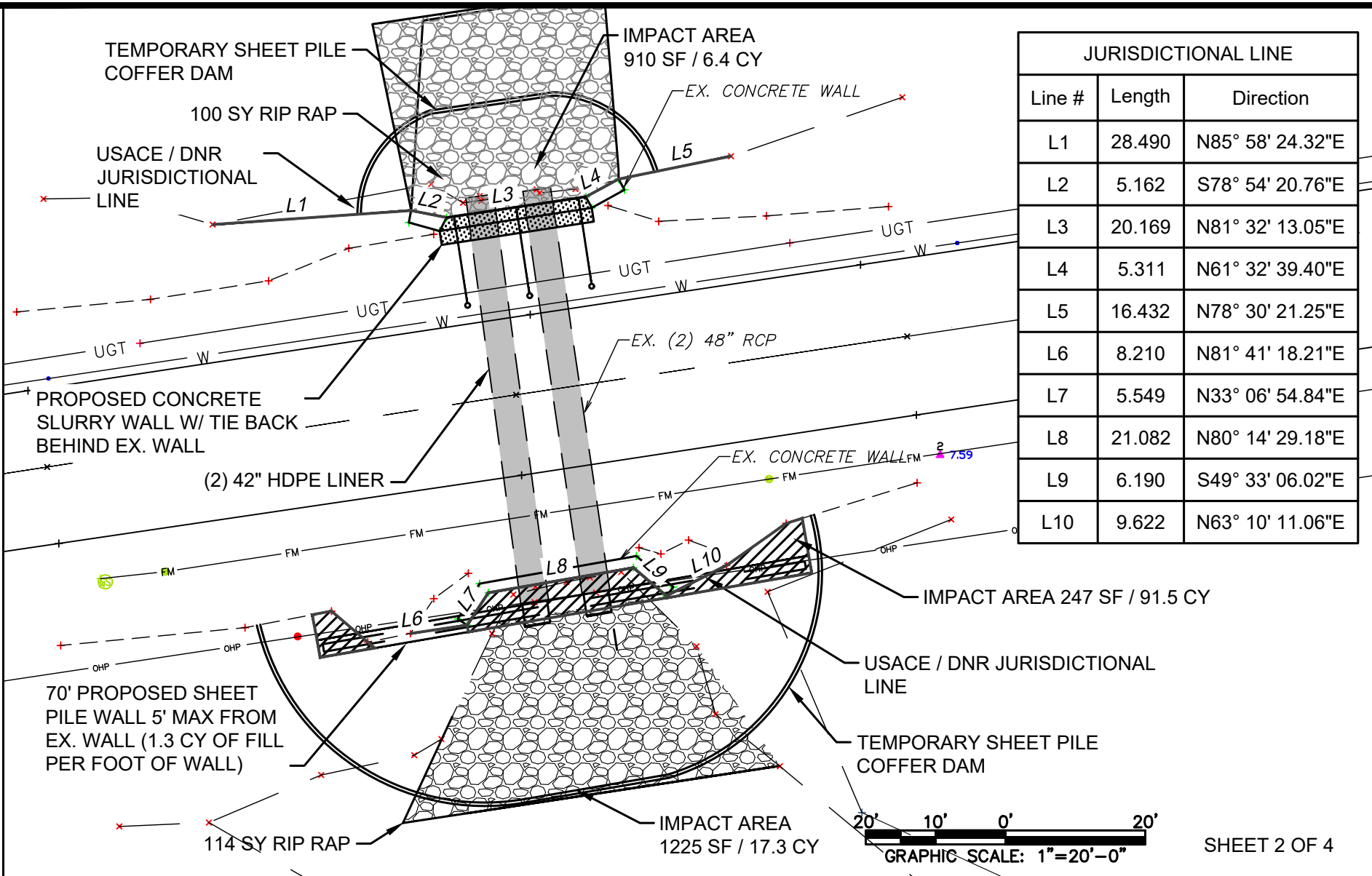
EMC ENGINEERING SERVICES, INC.
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SUITE 100
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ALBANY, ATLANTA, AUGUSTA, BRUNSWICK,
COLUMBUS, SAVANNAH & VALDOSTA

VICINITY AND SITE MAP OAK GROVE ISLAND ROAD CULVERT PIPE REHABILITATION

GLYNN COUNTY, GEORGIA
Prepared for:
GLYNN COUNTY BOARD OF COMMISSIONERS

PROJECT NO.:	17-0057
DRAWN BY:	WCS
DESIGNED BY:	JMM
SURVEYED BY:	
SURVEY DATE:	
CHECKED BY:	
SCALE:	1" = 100'
DATE:	JUNE 2017



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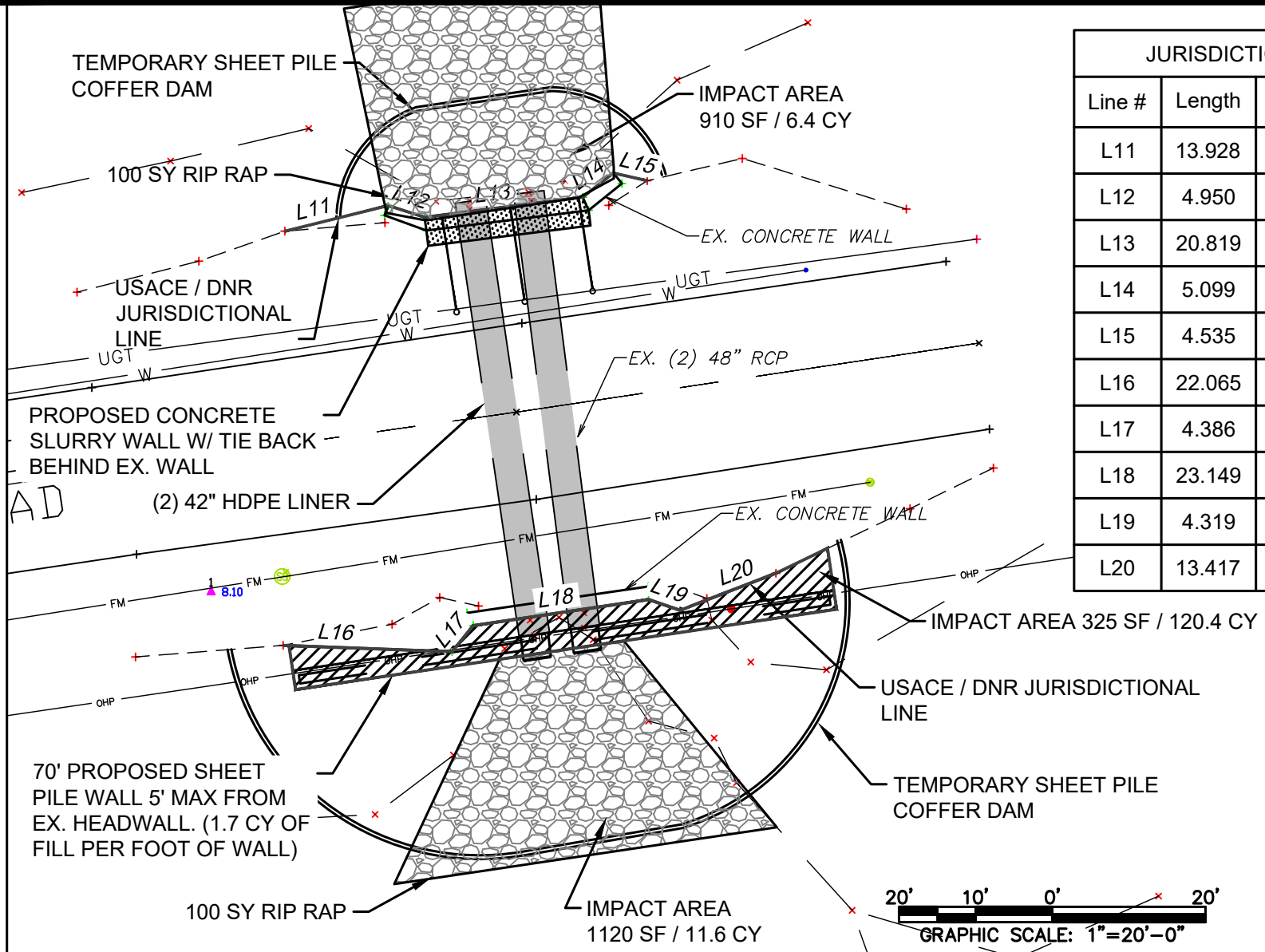
PROPOSED PLAN - WEST OAK GROVE ISLAND ROAD CULVERT PIPE REHABILITATION

GLYNN COUNTY, GEORGIA
 Prepared for:
 GLYNN COUNTY BOARD OF COMMISSIONERS


PROJECT NO.: 17-0007
 DRAWN BY: WCS
 DESIGNED BY: JMM
 SURVEYED BY:
 SURVEY DATE:
 CHECKED BY: TH
 SCALE: 1" = 20'
 DATE: JUNE 2017

ALBANY, ATLANTA, AUGUSTA, BRUNSWICK,
 COLUMBUS, SAVANNAH & VALDOSTA

JURISDICTIONAL LINE		
Line #	Length	Direction
L11	13.928	N76° 06' 48.35"E
L12	4.950	S72° 08' 11.04"E
L13	20.819	N82° 46' 21.65"E
L14	5.099	N51° 46' 54.20"E
L15	4.535	S77° 07' 06.51"E
L16	22.065	S87° 50' 55.93"E
L17	4.386	N38° 57' 34.91"E
L18	23.149	N81° 33' 14.03"E
L19	4.319	S71° 01' 21.85"E
L20	13.417	N68° 53' 45.76"E



SHEET 3 OF 4



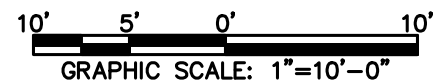
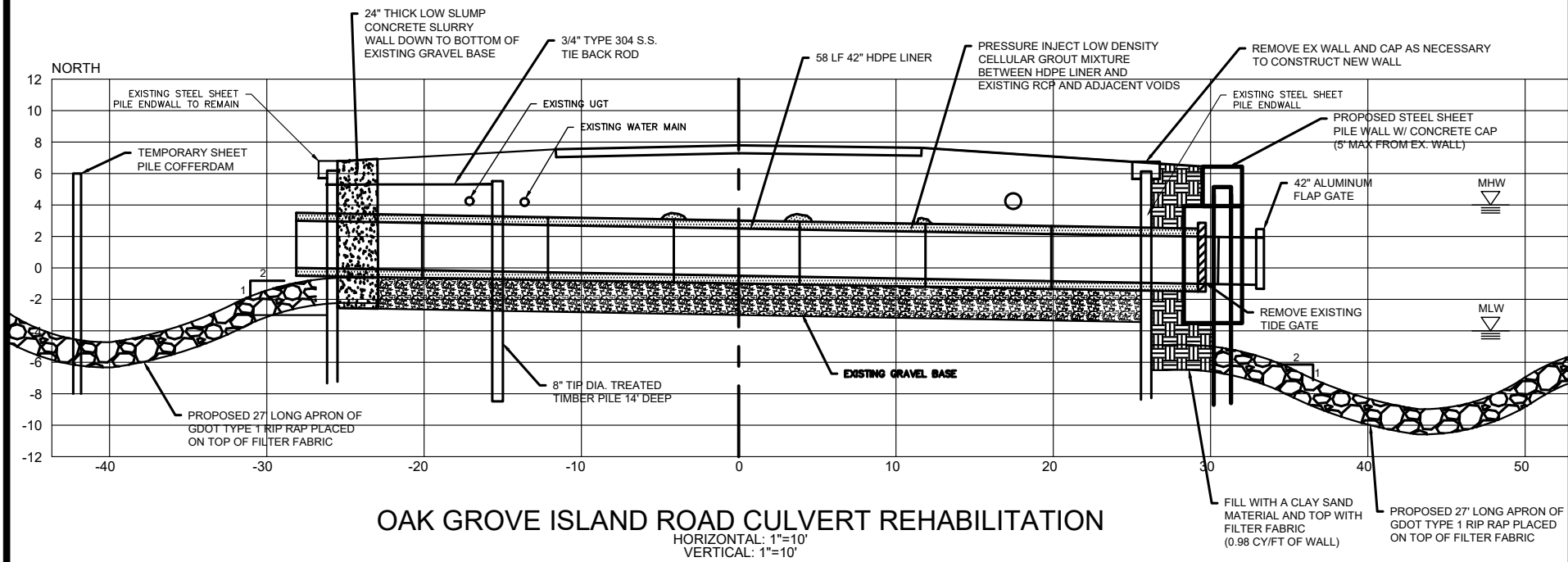
EMC ENGINEERING SERVICES, INC.
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PROPOSED PLAN - EAST
OAK GROVE ISLAND ROAD CULVERT PIPE REHABILITATION
 GLYNN COUNTY, GEORGIA
 Prepared for:
 GLYNN COUNTY BOARD OF COMMISSIONERS

PROJECT NO.:	17-0007
DRAWN BY:	WCS
DESIGNED BY:	JMM
SURVEYED BY:	
SURVEY DATE:	
CHECKED BY:	TH
SCALE:	1" = 20'
DATE:	JUNE 2017

C:\2017\17-0007 OAK GROVE ISLAND CAUSEWAY PIPES\DWG\17-0007C_B02.DWG 8/7/2019 5:19 PM



SHEET 4 OF 4

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ALBANY, ATLANTA, AUGUSTA, BRUNSWICK,
 COLUMBUS, SAVANNAH & VALDOSTA

PROPOSED PROFILE - EAST AND WEST OAK GROVE ISLAND ROAD CULVERT PIPE REHABILITATION

GLYNN COUNTY, GEORGIA

Prepared for:
 GLYNN COUNTY BOARD OF COMMISSIONERS

PROJECT NO.:	17-0007
DRAWN BY:	WCS
DESIGNED BY:	JMM
SURVEYED BY:	
SURVEY DATE:	
CHECKED BY:	TH
SCALE:	1" = 10'
DATE:	JUNE 2017



*A Golden Past.
A Shining Future.*

Grove Island Causeway- Culvert Maintenance and Improvement Project

Appendix 3

- Comparison Photos of Culverts
- Area Elevation Information

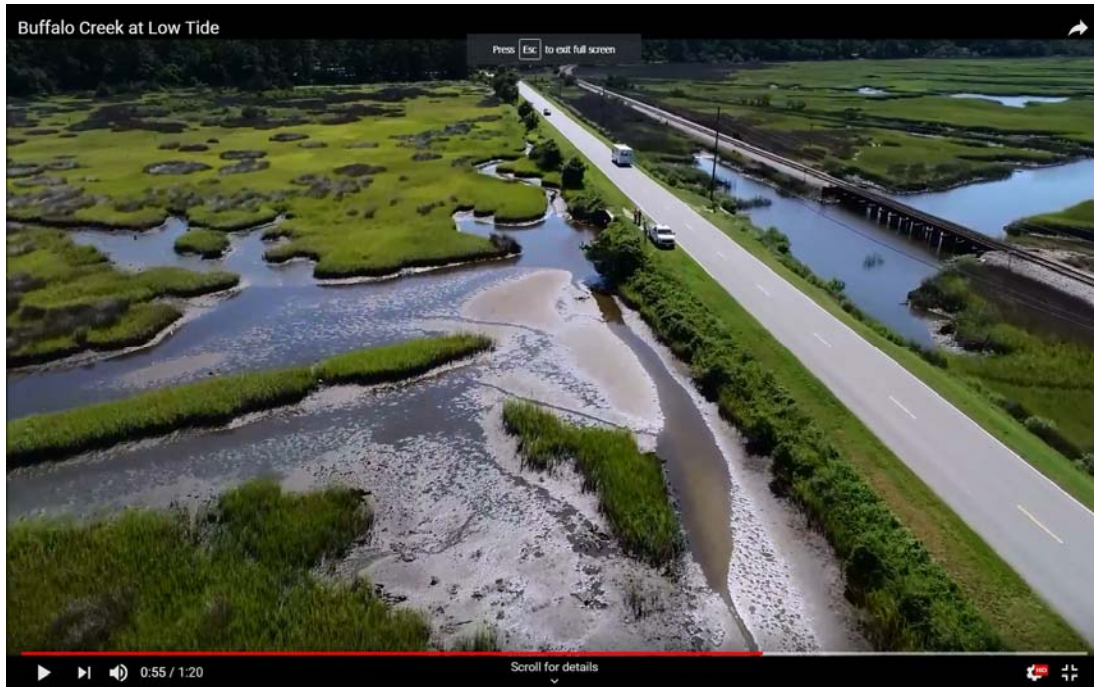
AREA ADJACENT TO THE WESTERN CULVERT SET AT LOW TIDE AND LOW TIDE PLUS 2-INCHES

The different camera angles reflect the sun/sky off of the wetted mud bottoms differently, but the wetted area can be identified in both as the dark flow lines in the mud bottoms



AREA ADJACENT TO THE EASTERN CULVERT SET AT LOW TIDE AND LOW TIDE PLUS 2-INCHES

The different camera angles reflect the sun/sky off of the wetted mud bottoms differently, but the wetted area can be identified in both as the dark flow lines in the mud bottoms



TOPOGRAPHIC INFORMATION ADJACENT TO THE CULVERTS

The elevations are based on 5-year old LIDAR data. Although minor changes may have occurred over this time, the general elevations of the area remain the same

