

London Avenue Canal Load Test – Small Load Test Site Selection

By Noah Vroman (ERDC), Dr. Thomas Brandon (VPI), and Neil Schwanz (MVP)

Objectives:

Select the most critical section along London Avenue Canal for the partial canal load test. The selection of the most critical section will focus on finding areas with the thinnest top stratum thickness at the protected side toe of the levee along with the smallest levee section in terms of height and width. The failures that occurred on the west bank just south of Robert E Lee Avenue and on the east bank just north of Mirabeau Avenue were due to pore pressure induced instability. Thus, a thinner top stratum at the protected side toe of the levee and beyond results in lower effective stresses in the Pine IS Beach Sand and lower factors of safety against heave. In addition, a smaller levee section in terms of height and width will increase the chances of the formation of a gap down to the beach sand (providing a connection of the canal water to the beach sand) at a lower canal water level.

Preliminary Site Selection:

Based on field observations and data from the GDM, the three most critical sites are east bank just south of Robert E. Lee Avenue between GDM stations 107+00 to 114+00, east bank just south of Fillmore Avenue between GDM stations 74+50 to 85+00, and east bank south of Mirabeau Avenue between GDM stations 39+30 to 57+50. Note the levee along the west bank from Mirabeau Avenue to Robert E. Lee Avenue was examined and subsequently excluded from consideration because of the massive rock fill that has been placed over the protected side levee fill for vehicle access, which provides a more robust levee section that is less likely to allow gap propagation to the beach sand, as compared to the east levee section where rock fill does not exist.

These three potential sites are highlighted on the GDM geological profile as shown in Figures 1 and 2.

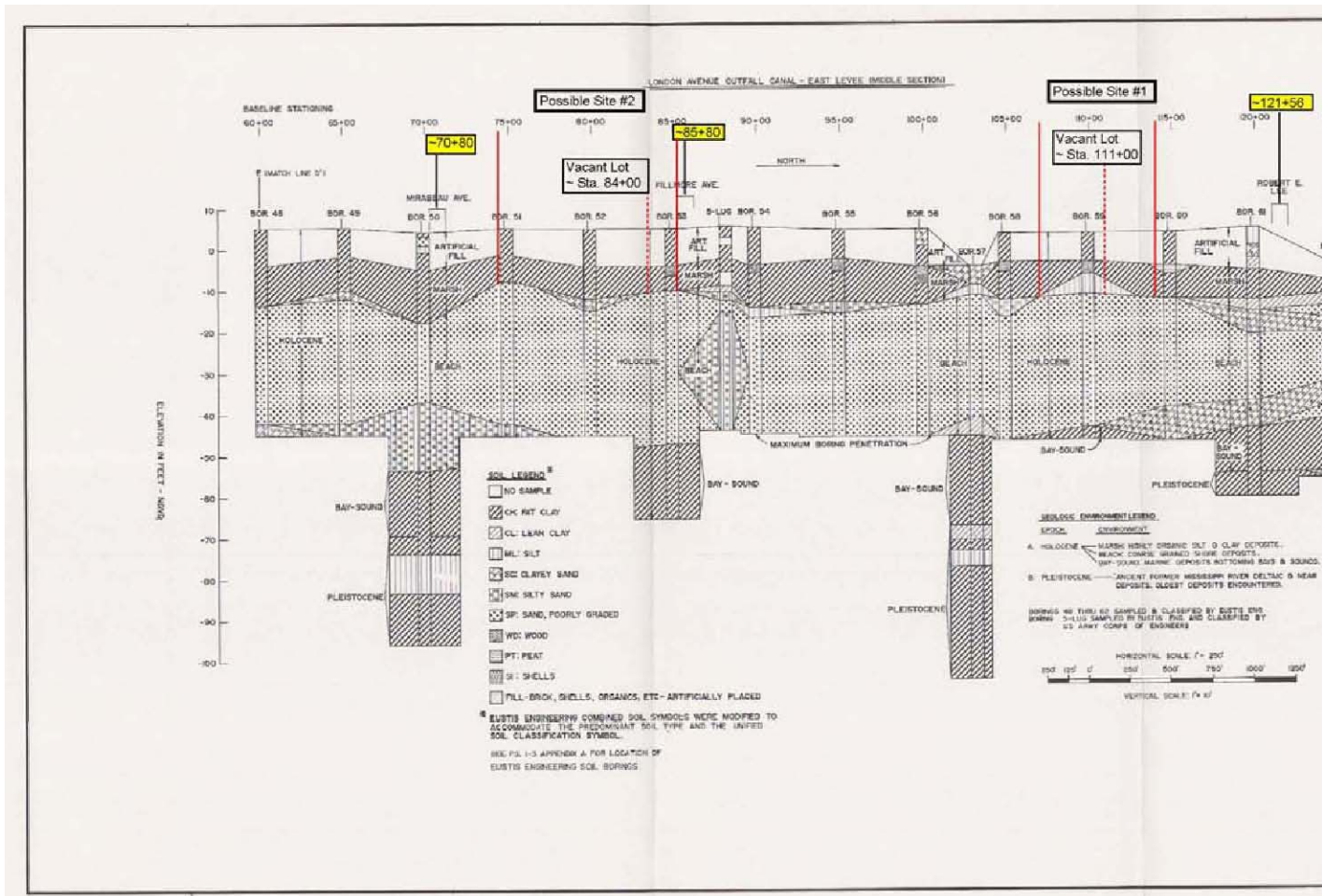
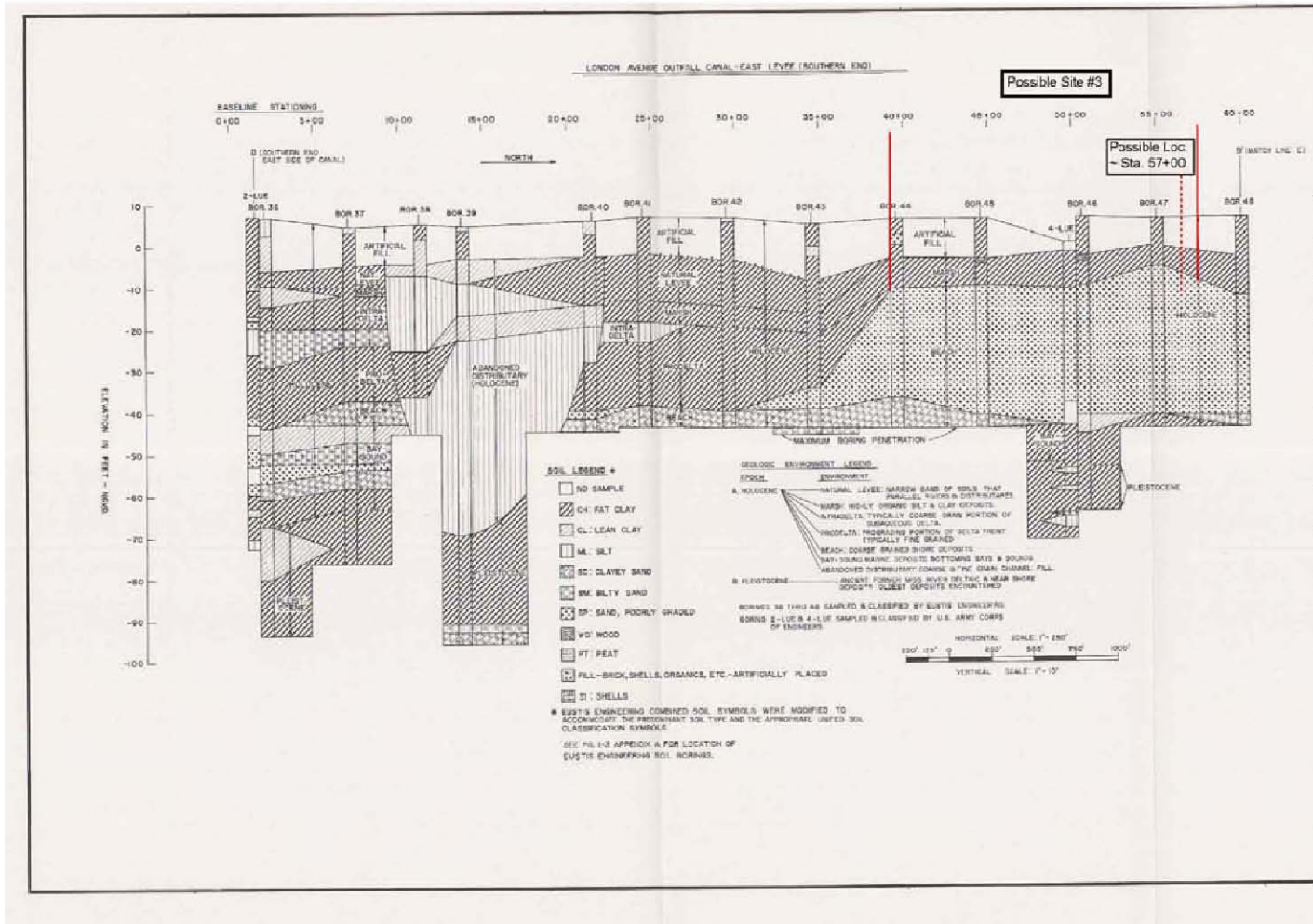


Figure 1. GDM Geological Profile showing potential sites #1 and #2. Figure 2. GDM Geological Profile showing potential site #3.



Discussion of each site is present below:

Potential Site #1 - Station 107+00 to 114+00 (South of Robert E. Lee):

This reach is close in proximity to the north breach on the west bank and the distressed levee on the east bank just south of Robert E. Lee Blvd, which occurred as a result of Hurricane Katrina due to high uplift pressures in the beach sand at the base of the marsh layer. The breach on the west bank occurred between GDM stations 115+00 and 121+00. The distressed levee on the east bank located between GDM stations 116+00 to 120+00 experienced a sand boil at the toe, heaving of the protected side ground, sink holes on the crest of the levee adjacent to the I-wall, and I-wall tilted towards protected side. Note that the distressed levee has been replaced with an "L-wall" that is more robust than the adjacent, older I-wall designs.

Using the information from the GDM and the construction drawings, this reach has a top stratum thickness ranging from 8 to 9 feet with the elevation of the base of the marsh layer ranging from -13 to -15 feet, NAVD88. The sheet pile used in this reach is a cold-rolled sheet pile with a tip elevation of -21.5 ft (NAVD 88) (-20.0 feet NGVD). GDM borings 59 and 60 span this reach with boring 60 just outside the reach area. The blow counts in the beach sand are

relatively low and are listed in the table below for both borings.

Boring 59		Boring 60	
Elev. (ft, NAVD)	Field SPT N	Elev. (ft, NAVD)	Blow Count
-14	5	-18.8	2
-16.5	7	-21.3	6
-19	4	-23.8	11
-21.5	12	-27.3	14
-24	12	-32.3	11
-27.5	15	-37.3	13
-32.5	26	-42.3	2
-37.5	9		
-42.5	5		

These low blow counts are a reason for concern as the failure mechanism that controls this reach may actually be pore pressure induced instability instead of seepage and piping. If this is the case, then failure of the levee during testing may be more catastrophic offering less warning. Analysis of this section of levee prior to testing will be valuable in order to predict the behavior during the field test.

The site of interest in this reach is located at a vacant lot @ GDM station 111+00. This site is shown in the photographs below (Figures 4 through 8). The vacant lot is appealing as it allows easier access with equipment and instrumentation to the levee. The property line (fence line) throughout this reach is at the protected side toe of the levee.

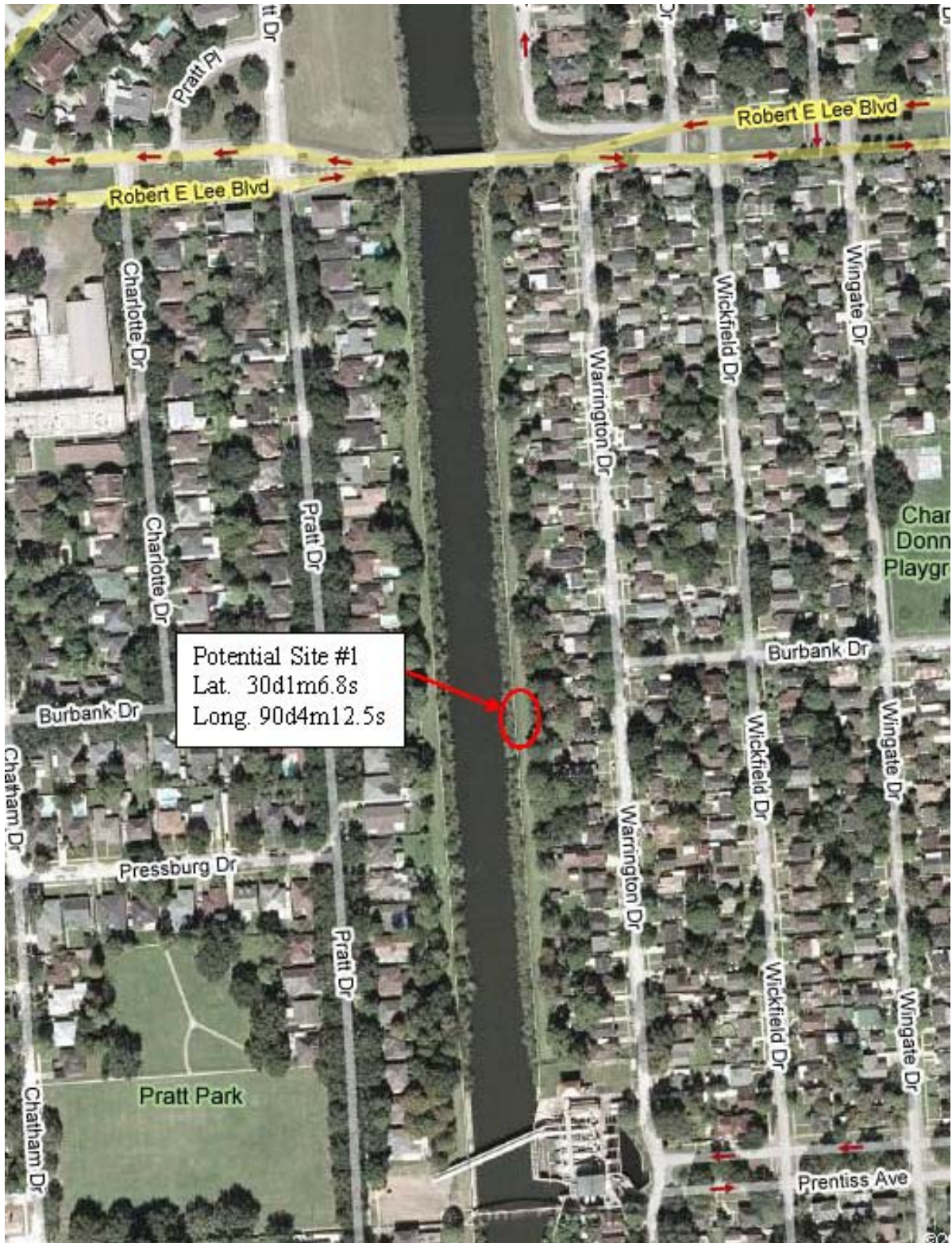


Figure 3. Aerial Photo of Potential Site #1. Figure 4. Photo of potential site #1, view looking south. Figure 5. Photo of potential site #1, view looking south.





Figure 6. Photo of protective side toe, potential site #1. Figure 7. Photo of vacant lot adjacent to potential site#1.





Figure 8. Contact information for the realtors of the vacant lot.

Potential Site #2 - Station 74+50 to 85+00 (South of Fillmore):

This reach has a very thin top stratum providing low resistance to heave. The top stratum thickness ranges from 6 feet to 11 feet. The sheet pile used in this reach appears not to be a cold-rolled sheet pile (based on construction photos) like Potential Site #1. In this reach, the sheet pile has a tip elevation of -17.5 ft (NAVD 88) (-16.0 feet NGVD). GDM borings 51, 52, and 53 span this reach with boring 51 at the southern end of the reach and boring 53 at the northern end. The blow counts in the beach sand are relatively higher in this reach than in the reach for potential site #1. The blow counts for the beach sand are listed in the table below for the borings.

Boring 51		Boring 52		Boring 53	
Elev. (ft, NAVD)	Field SPT N	Elev. (ft, NAVD)	Field SPT N	Elev. (ft, NAVD)	Field SPT N
-13.5	28	-17.5	14	-15	5
-16	36	-20	32	-17.5	13
-18.5	50 after 10"	-22.5	30	-21	19
-21	50 after 10"	-26	42	-26	15
-23.5	50 after 9"	-31	37	-31	35
-26	50 after 8"	-36	35	-36	48
-31	50 after 9"	-41	5	-41	32
-36	50 after 9"	-46	6	-46	8
-41	41				

These higher blow counts suggest that the failure mechanism that controls this reach will likely be seepage and piping.

The site of interest in this reach is also located at a vacant lot @ GDM station 84+00. This site is shown in the photographs below.



Figure 9. Aerial Photo of Potential Site #2.



Figure 10. Photo of potential site #2, view looking north.



Potential Site #3 - Station 39+30 to 57+50 (South of Mirabeau Ave):

This reach has the thinnest top stratum along the canal. The top stratum thickness ranges from 5 feet to 7 feet. The type of sheet pile at this site (hot-rolled vs. cold-rolled) is undetermined. The sheet pile has a tip elevation of -19.0 ft (NAVD 88) (-17.5 feet NGVD). GDM borings 44 through 47 span this reach with boring 44 at the southern end of the reach and boring 47 at the northern end. The blow counts in the beach sand are relatively higher in this reach than in the reach for potential site #1. The blow counts for the beach sand are listed in the table below for the borings.

Boring 44		Boring 45		Boring 46		Boring 47	
Elev. (ft, NAVD)	Field SPT N	Elev. (ft, NAVD)	Field SPT N	Elev. (ft, NAVD)	Field SPT N	Elev. (ft, NAVD)	Field SPT N
-13.3	28	-12.8	6	-12.6	15	-9	38
-15.8	43	-15.3	47	-15.1	42	-11.5	50 after 9 "
-18.3	20	-17.8	18	-17.6	45	-15.5	50 after 10 "
-21.3	39	-20.3	20	-20.1	39	-18	46
-25.3	25	-25.3	29	-25.1	24	-20.5	50 after 11 "
-30.3	32	-30.3	35	-30.1	50 after 10 "	-25.5	50 after 9"

-35.3	43	-35.3	50 after 10 "	-35.1	24	-30.5	50 after 10 "
-40.3	4	-40.3	16	-40.1	30	-35.5	50 after 8"
						-40.5	31

These higher blow counts suggest that the failure mechanism that controls this reach will likely be seepage and piping.

The site of interest in this reach is located at @ GDM station 57+00. This site is shown in the photographs below.



Figure 12. Aerial Photo of Potential Site #3.



Figure 13. Close up aerial photo of potential site #3.



Figure 14. Photo of potential site #3, view looking north.

Summary:

The potential sites for the small load test on London Avenue Canal are listed below in priority:

- 1) GDM Station 111+00 (south of Robert E. Lee Blvd).
- 2) GDM Station 84+00 (south of Fillmore Ave.).
- 3) GDM Station 57+00 (south of Mirabeau).

There is some reason for concern at Site #1 because of low blow counts in the sand. The controlling failure mechanism at site may be pore pressure induced instability, as opposed to seepage and piping. Therefore, there is little to no visual warning signs for this failure mechanism. In addition, the sites adjacent to vacant lots (Sites #1 and #2) are attractive if purchasing or leasing it is considered. This would allow easier access for equipment and instrumentation during the test. The property boundaries along the east bank of the canal are at the protected side toe of the levee and offer basically no access to the toe, which is critical for instrumentation. Field work is needed in order to make the final site selection. This work is necessary to verify elevation, stratification, and soil properties. The field work required at each site includes:

Three survey cross sections with one section at the middle of the proposed test section and one near each end. These cross sections should extend from adjacent street up to and over the wall, canal, and to the canal side of the opposite wall.

Stratification for these cross sections which includes a boring or CPT at the CL, protected side toe, and near the adjacent street for each cross section. All this can be done with a CPT except a boring should be taken at the crest and at the toe (if possible) to collect 5" undisturbed samples of the Levee fill and Marsh material, samples of the sand to verify grain sizes, and to also verify material type. In addition, a sample of the canal bottom is needed to determine whether how thick the siltation is in the canal covering the beach sands.