Appendix E. Wall Pressures

Temporary and permanent wall loading conditions were analyzed for both the inlet system and back structure. The same approach was used to evaluate lateral and uplift pressures for both structures. The two loading conditions described below effectively bound the wall pressures and uplift pressures from high (empty condition) to low (operational conditions).

- Temporary – Empty condition where the structure is dry and subjected to full hydrostatic pressure (both lateral and uplift pressure) from adjacent normal groundwater conditions. This represents the dry construction condition with the conservative assumption that groundwater levels outside the excavation have not been drawn down due to active dewatering.
- Permanent – Operational condition in which the water level in the structure is at elevation +0.0 feet and the groundwater level is equal to or lower than the operational water level. This represents a condition where the channel is operating at normal water levels and groundwater levels outside the structure are such that the walls are not subjected to hydrostatic loading in the direction into the structure.

The inlet and back structure systems will consist of relatively stiff monolithic concrete structures designed to limit deflection and rotation under lateral loading. Therefore, permanent lateral earth pressures were calculated for at-rest and fully drained (long-term) conditions. At-rest earth pressure coefficients (K_0) were evaluated using drained friction angles (ϕ') with the following empirical relationship (Jaky 1944):

$$K_o = 1 - \sin(\phi')$$

No site-specific drained strength testing was available to directly estimate drained friction angles; therefore, parameters for analysis were assumed based primarily on the Unified Soil Classification System soil classifications and available index testing. To select drained friction angles, we followed recommendations in the U.S. Army Corps of Engineers Engineering Manual, which provides conservative drained strength parameters for various soil types when site-specific data are unavailable.

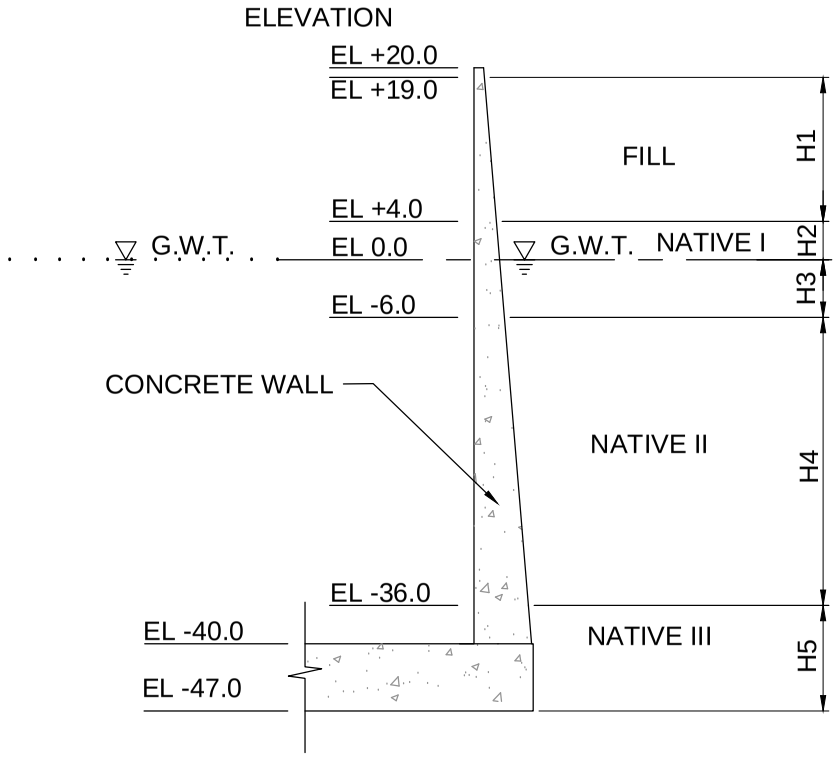
Assumed drained friction angles of 28 degrees for fat clay (CH) (at the outlet system only) and 30 degrees for lean clay, loose sand, and clayey engineered fill (at both the outlet and inlet systems) were selected to evaluate at-rest earth pressure coefficients (K_0). Native soils were assumed to be normally consolidated for the purpose of establishing at-rest earth pressure coefficients. Triangular at-rest earth pressure diagrams were then developed using unit weights estimated from site-specific laboratory testing on samples obtained during the 30% design investigation. Unit weights of native soils ranging from 105 to 120 pounds per cubic foot (pcf) were selected based on laboratory data from Borings NL-3A and NL-9A. Engineered fill was assumed to exhibit a unit weight of 125 pounds per cubic foot with total fill thickness for both systems of 15 feet.

For the inlet system, HDR assumed a finished grade at elevation +19 feet, top of slab at elevation –40 feet, and bottom of slab at elevation –47 feet. For the outlet system, we assumed a finished grade at elevation +15 feet, top of slab at elevation –25 feet, and bottom of slab at elevation –30 feet. For analyses, the groundwater table was taken to be at elevation

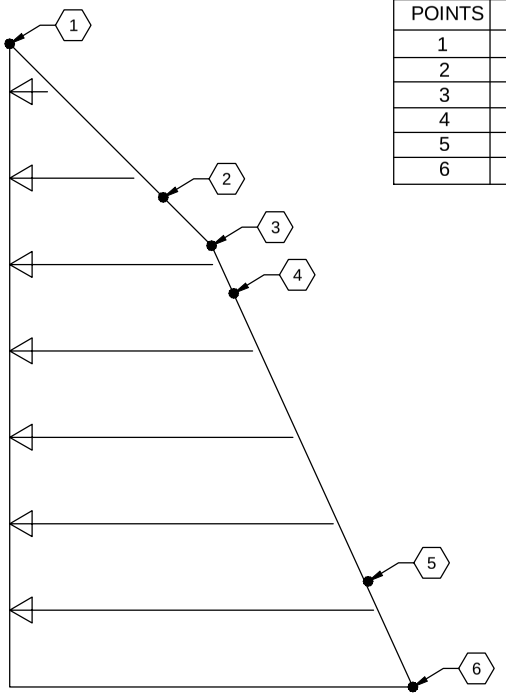
0 feet at the inlet system (assumed normal groundwater level) and elevation –4 feet at the outlet system (approximate existing ground surface).

Preliminary lateral earth pressure, hydrostatic pressure, and uplift pressure diagrams were developed based on the above assumptions for both the inlet system and back structure. Pressure diagrams are presented as figures in this appendix for temporary (empty) and permanent (operational) conditions.

INLET SYSTEM (OPERATING CONDITION)



INLET STRUCTURE



LATERAL EARTH PRESSURE

SOIL PRESSURE POINTS		
POINTS	ELEVATION (ft)	SOIL PRESSURE (psf)
1	19	0
2	4	938
3	0	1168
4	-6	1325
5	-36	2189
6	-47	2506

SOIL PROFILE DESCRIPTION				
LAYER	THICKNESS	SOIL TYPE	EFFECTIVE FRICTION ANGLE	SATURATED UNIT WEIGHT
FILL	H1 = 15ft	FILL(CL)	30°	125psf
NATIVE I (ABOVE G.W.T.)	H2 = 4ft	CL	30°	115psf
NATIVE I (BELOW G.W.T.)	H3 = 6ft	CL	30°	115psf
NATIVE II	H4 = 30ft	CL/ML/SM	30°	120psf
NATIVE III	H5 = 11ft	SM/ML	30°	120psf

DRAWING IS NOT TO SCALE

NOTES:

1. G.W.T. IS GROUNDWATER TABLE.

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MID-BARATARIA SEDIMENT DIVERSION

INLET STRUCTURE

STATE PROJECT NUMBER: BA-153

FEDERAL PROJECT NUMBER: BA-153

DATE: OCTOBER 2013

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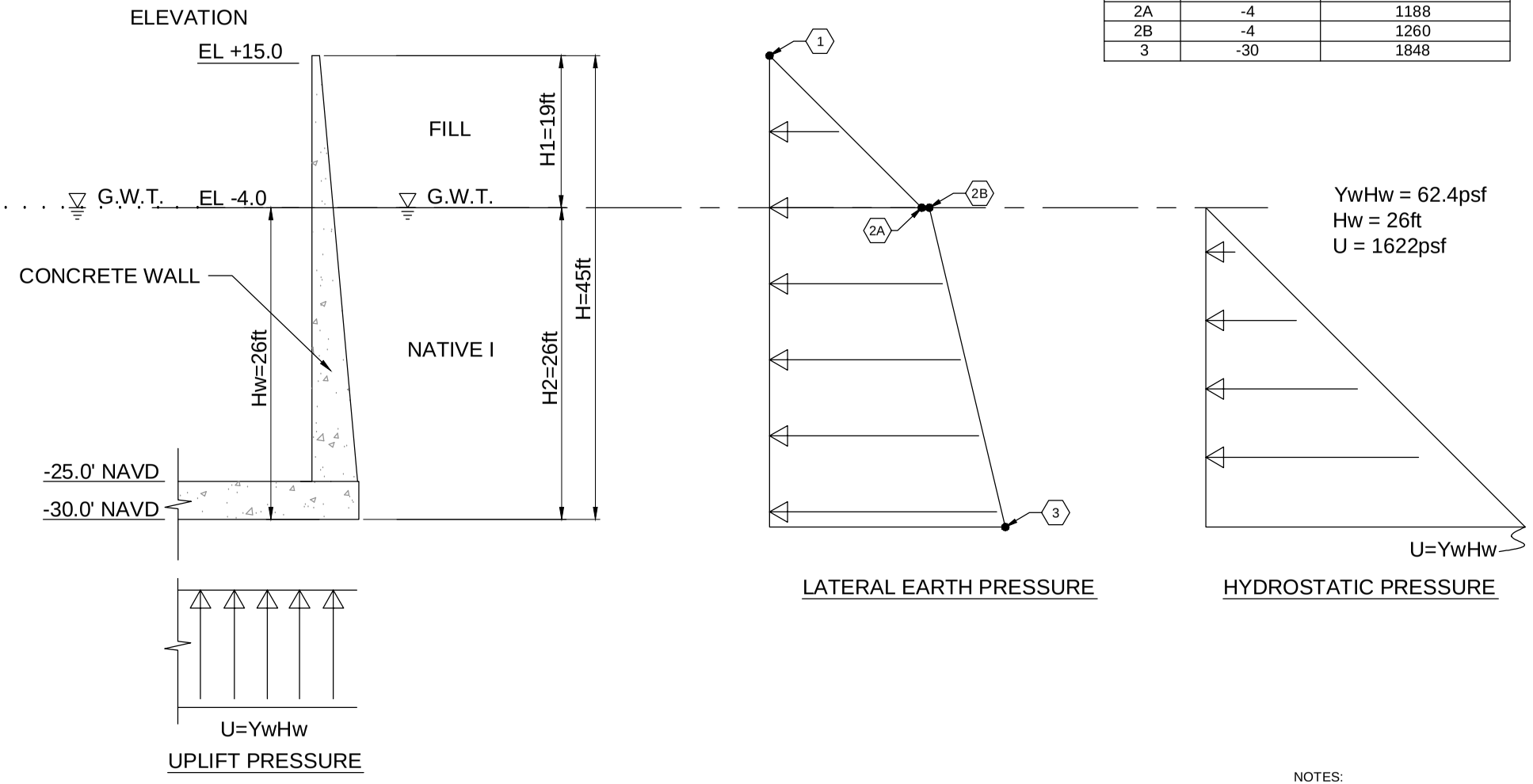
INLET SYSTEM (EMPTY CONDITION)

SOIL PRESSURE POINTS		
POINTS	ELEVATION (ft)	SOIL PRESSURE (psf)
1	15	0
2A	-4	1188
2B	-4	1260
3	-30	1848



INLET STRUCTURE

NOTES:

1.UPLIFT PRESSURE IS EQUAL TO HYDROSTATIC PRESSURE AT THE BOTTOM OF SLAB ELEVATION. THIS PRESSURE IS UNIFORM ACROSS THE BOTTOM OF FOUNDATION.

2. REFER TO SHEET 2 FOR SOIL PROFILE DESCRIPTION.

DRAWING IS NOT TO SCALE

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INLET STRUCTURE (EMPTY CONDITIONS)

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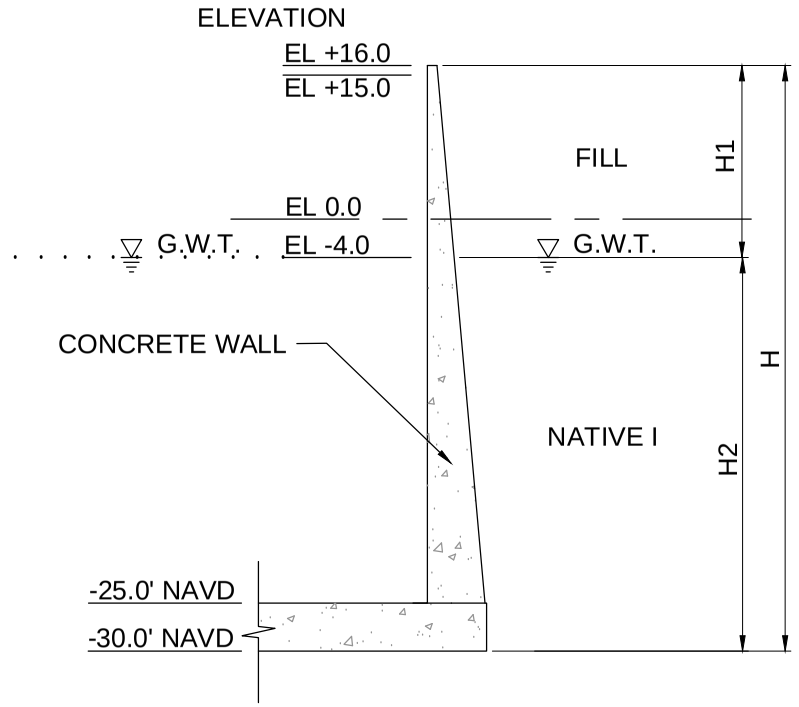
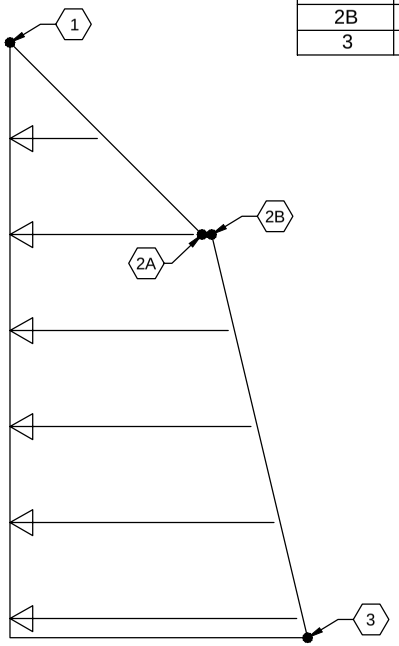
BACK STRUCTURE (OPERATING CONDITION)

SOIL PRESSURE POINTS		
POINTS	ELEVATION (ft)	SOIL PRESSURE (psf)
1	15	0
2A	-4	1188
2B	-4	1260
3	-30	1848





BACK STRUCTURE

LATERAL EARTH PRESSURE

SOIL PROFILE DESCRIPTION				
LAYER	THICKNESS	SOIL TYPE	EFFECTIVE FRICTION ANGLE	SATURATED UNIT WEIGHT
FILL	H1 = 19ft	FILL(CL)	30°	125psf
NATIVE I	H2 = 26ft	CL/CH/CHO	28°	115psf

DRAWING IS NOT TO SCALE

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BACK (OUTLET) STRUCTURE

DATE: OCTOBER 2013

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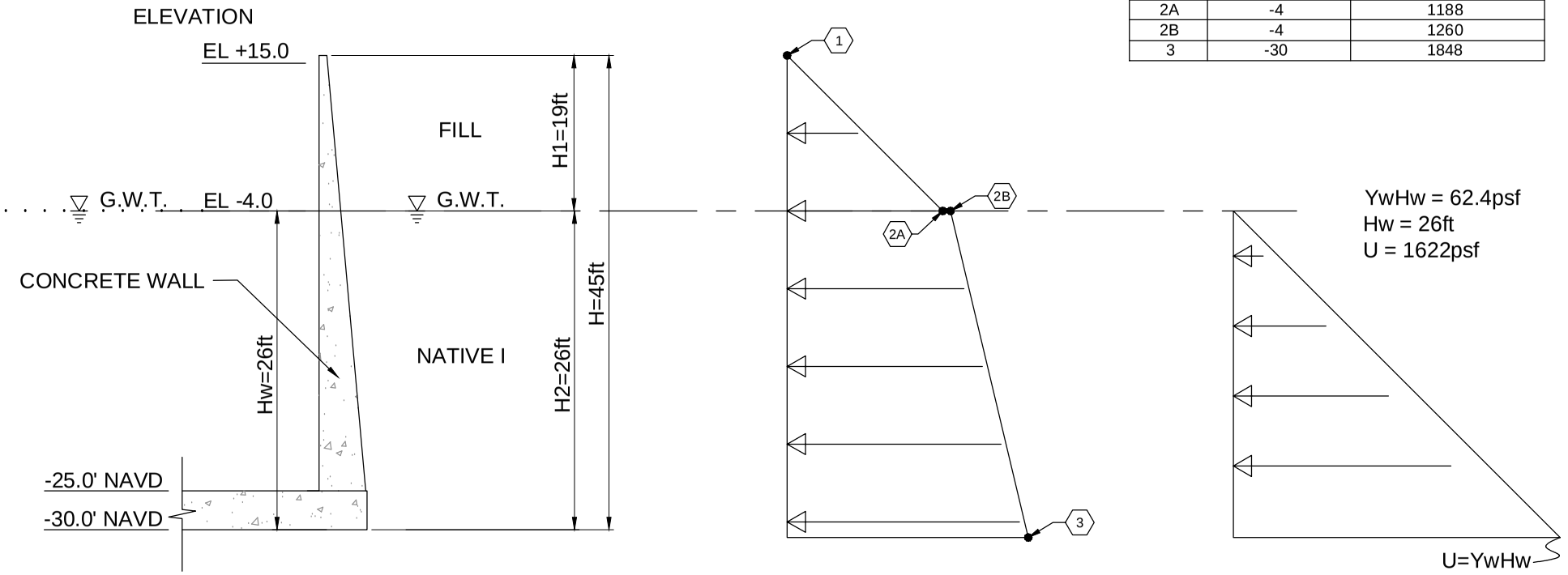
BACK STRUCTURE (EMPTY CONDITION)

SOIL PRESSURE POINTS		
POINTS	ELEVATION (ft)	SOIL PRESSURE (psf)
1	15	0
2A	-4	1188
2B	-4	1260
3	-30	1848



UPLIFT PRESSURE

LATERAL EARTH PRESSURE

HYDROSTATIC PRESSURE

BACK STRUCTURE

DRAWING IS NOT TO SCALE

NOTES:

1.UPLIFT PRESSURE IS EQUAL TO HYDROSTATIC PRESSURE AT THE BOTTOM OF SLAB ELEVATION. THIS PRESSURE IS UNIFORM ACROSS THE BOTTOM OF FOUNDATION.

2. REFER TO SHEET 3 FOR SOIL PROFILE DESCRIPTION.

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INLET STRUCTURE (EMPTY CONDITIONS)

DATE: OCTOBER 2013

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