Memo

Date:	Tuesday, April 12, 2016
Project:	Passaic Tidal Closure Structure
To:	John Dromsky-Reed
From:	Wes Jacobs Bogdan Bogdanovic
Subject:	**Preliminary Design and Cost Study of the Passaic River Closure Gate Structures in Support of the Passaic River Ecosystem Restoration Feasibility Studies Conducted under Indefinite Delivery Contract IDC-PL-3005: W912DS-11-D-0008**

This memorandum presents the results of our preliminary (planning level) designs and cost study of the Passaic River closure gate structures in the tidal areas of Kearney, Newark, and Harrison, NJ.

1. INTRODUCTION

This study addresses the design of closure gates in typical reaches along the Passaic River extending from Kearny to Harrison, NJ. The design and cost element defined herein represents a 30-percent level conceptual design using the latest revision inventory document of the closure gates titled "**Passaic River-Final Closure Gate Inventory**" dated March 10, 2016 (see Appendix A). The closure gates were grouped into several different categories based on gate openings, heights and types. The gate types used were predominantly swing gates with the exception of roller gates for openings of 50 feet or larger. The gates are assumed a mix of closures to span railroads, highways and pedestrian crossings.

Through coordination with technical staff from AECOM, as well as standard engineering practice, the 30% design includes four basic load cases which are loadings that typically control floodwall/closure gate structures designs. A full array of load cases will need to be investigated in the final design phase. The load cases included in the 30% design are:

- Construction + Wind: Dead load of the concrete monolith and steel gate, a conservative wind load of 50 psf, no earthen backfill, no uplift, no construction surcharge. A 33% overstress is permitted for this load case.
- Flood stage at still water (SWL) at 2 feet below top of gate structure with debris impact loading of 500lbs/ft applied at the SWL. A 33% overstress is permitted for this load case.
- Flood stage at water to top of gate (TOG).Wave force is not included. A 33% overstress is permitted for this load case.
- Flood stage at SWL at 2 feet below top of gate structure. A 0% overstress is permitted for this load case.

The gate members (girders, intercostals, and skin plates), concrete monolith (abutments/footings), and foundations were sized to carry these anticipated loads as mentioned above for all different gate categories which have been selected. Secondary gate features such as any hinge assemblies, connections, casters, trolleys, or hanger systems were conceptually shown based on previous similar projects and engineering judgment. Calculations were not performed to size these types of features. Wave loadings are expected to be minimal due to topographic conditions and lack of proximity/exposure

to full coastal storm surge associated with hurricanes. It is also assumed, per technical discussions, that there will be no unbalanced loading or downdrag forces seen by the gates at this level of design. This will require more in-depth analysis and can be fully vetted during later design stages. Complex pile group analysis, therefore, was not be required. Seismic forces were not considered to govern and were not applied at this level of design.

For the 30 % design effort the following codes and standards will be used, as well as the applicable portions of the HSDRRSDG (Hurricane Storm Damage Risk Reduction System Design Guidelines) and the existing project GDM:

- EM 1110-2-2705 – Structural Design of Closure Structures for Local Flood Protection Projects
- EM 1110-2-2104 – Strength Design for Concrete Hydraulic Structures
- EM 1110-2-2105 – Strength Design for Hydraulic Steel Structures

Once the preliminary gate designs were compiled for all different gate selections, costs were developed based on the major contributing "bid" items that would typically be present in final documents such as: concrete monolith structure (abutments and footings), structural steel gate (gate overall weight plus detail factor), concrete reinforcing for monolith structure, and pile foundation (total pile length for the gates). Items such as steel embeds, seals, turnbuckles, casters, hinge assemblies, access ladders, etc. were included in the structural steel gate item. Unit prices were based on recent, similar construction projects and adjusted for any regional effects and applied to the various bid item quantities.

2. DISCUSSION AND RESULTS

The final closure gate inventory has 64 closure gate structures that fluctuate in gate opening width and gate height. The gate heights for all 64 closure gates were determined based on the design water elevation of 14 feet and their respective existing grade elevations. In addition, evaluations were completed for gate heights 2 feet and 4 feet above the 14 foot elevation.

All gates were grouped into several scenarios based on gate openings and heights as shown in table 1. The Kearny, Newark and Flanking areas consist of H-pile foundation whereas the Harrison area consists of concrete micro pile foundation. Any opening width equal to 10-feet or smaller was grouped with the 10-foot gate opening. The 20-foot gate opening was grouped with a series of opening widths ranging from 15 to 20 feet. The majority of opening widths in the inventory was for the 30-foot width. The 30-foot gate opening was grouped from 25 to 30 feet. The 35-foot, 40-foot, 45-foot and 50-foot gate openings were grouped individually, since their gate opening width is considered to be on the larger end of the swinging gate spectrum.

Once the gates were group as described above, the smallest gate height and the tallest gate height for each respective group was determined and a 2-feet incremental height increase was implemented starting from the minimum to the maximum gate heights. Typically gates for openings larger than 38 feet would be considered at the threshold for the swing gates. Roller gates predominantly are seen for openings larger than 38 feet. The gate opening width identified in the flanking area of the final closure structure inventory ranged from 40 to 150 feet. After further assessment of the gate openings in the flanking area, the roller gate option will not be feasible due to the limited space in this area which does not facilitate the construction of the larger concrete monolith structure. Therefore the 150 feet opening was divided into three swing gates with an opening of 50 feet. The inventory list also includes four gate widths opening of 50 feet which have been grouped together as roller gates since the vicinity permitted a

larger concrete monolith structure. The same grouping procedure described above was followed with respect to gate heights.

Table 1. Gate Grouping Scenarios

GATE OPENING (Feet)	SWING GATE(H-Pile Foundation)								
	GATE HEIGHTS(Feet)								
10	6	8	10	12	14	16	-	-	-
20	5	7	9	11	13	-	-	-	-
30	2	4	6	8	10	12	14	16	18
35	9	11	13	15	17	-	-	-	-
40	10	12	14	-	-	-	-	-	-
45	5	7	9	-	-	-	-	-	-
50	6	8	10	-	-	-	-	-	-
GATE OPENING (Feet)	SWING GATE(Micro Pile Foundation, Harrison Area)								
	GATE HEIGHTS(Feet)								
30	11	13	15	17	-	-	-	-	-
40	2	4	6	8	10	12	-	-	-
GATE OPENING (Feet)	ROLLER GATE								
	GATE HEIGHTS(Feet)								
50	10	12	14	16	-	-	-	-	-

The structural design of the swing/roller gate includes the layout and design of the major structural elements of the concrete monolith structure and floodgate. This includes the gate steel members, the concrete gate bay walls and support columns, base slab and the pile foundations. The structural steel gate members include top and bottom girders spanning horizontally between concrete bay columns, vertical intercostal framing spaced at approximately 2 feet on center and spanning between top and bottom girders, steel skin plate spanning between the vertical intercostal, and steel cross bracing and horizontal bracing. The concrete monoliths are comprised of two concrete gate bay walls/columns on either side which are formed into the base slab and pile foundation. The concrete monoliths are supported by the pile foundations. Steel H-piles and concrete micro piles were applied during design for consistency with the floodwall team. It is assumed that each gate monolith structure will be flanked by the floodwall structures in the adjacent reaches. The floodgate drawings in Appendix B are preliminary in nature and not to be used for construction. The sections and views on the drawings are grouped as described above in table 1. Based on the gate width and heights, the design elements will vary in size, location and spacing accordingly.

The analysis of the steel gate and concrete monolith was performed based on the load cases noted in the introduction. The governing load case was typically the flood stage with water at the top of the gate. Loads were applied as hydrostatic pressures corresponding to the water surface elevations on the flood-side. A debris impact uniform loading (500lbs/ft.) was applied at the appropriate water surface elevations. The skin plate was designed as a fixed end beam spanning between the vertical intercostals and the deflection was limited to 0.4 of the thickness to ensure that the flat plate theory is applicable. The horizontal girders were designed as larger wide flange simply supported beams spanning between the bearing points on the concrete columns making them true beam elements allowing for flexural stresses.

The vertical intercostals were designed as simple beams spanning between horizontal girders. The vertical intercostals consist of a WT section welded to the skin plate and were designed as a combined section utilizing the steel skin plate as the tension flange of the total combined section. The analysis of the reinforced concrete monolith walls and columns was performed considering fixed support at the interface of the bottom of the wall and top of slab. The wall analysis considered a 1 foot unit width of the wall acting as a cantilever and connected only to the base slab. The column analysis considered half of the gate width and width of the column loading on the column acting as a cantilever and connected only to the base slab. The entire analysis for the floodgate and concrete monolith was carried out by hand calculations for one gate width and height which than an excel spreadsheet program was developed to generated the analysis design for all chosen gate scenarios listed in table 1. The calculations are provided in Appendix C.

Opinions of probable cost (using unit prices from similar, recent projects) were developed based on the results of the analysis above. The cost estimate was broken down into four items corresponding to each individual gate width and height. The four cost items are the structural steel gate, concrete monolith structure, concrete reinforcing and pile foundation with a final total project cost. The cost breakdown for all listed scenarios is provided in table format in Appendix D. In addition, compiled cost curve graphs for each gate opening width based on total project cost versus gate height to gate opening width were developed and are shown below for each gate type.

Figure 1. Cost curve graph for swing gates

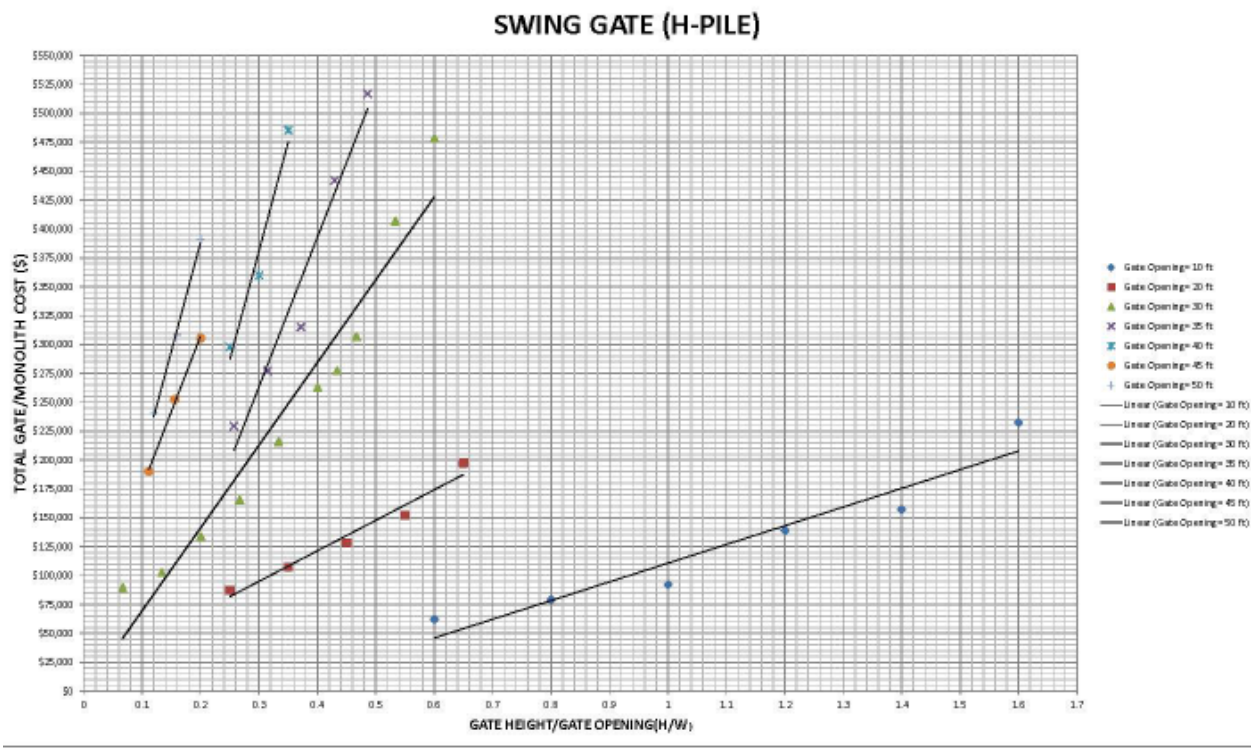


Figure 2. Cost curve graph for swing gates (micro pile, Harrison Area)

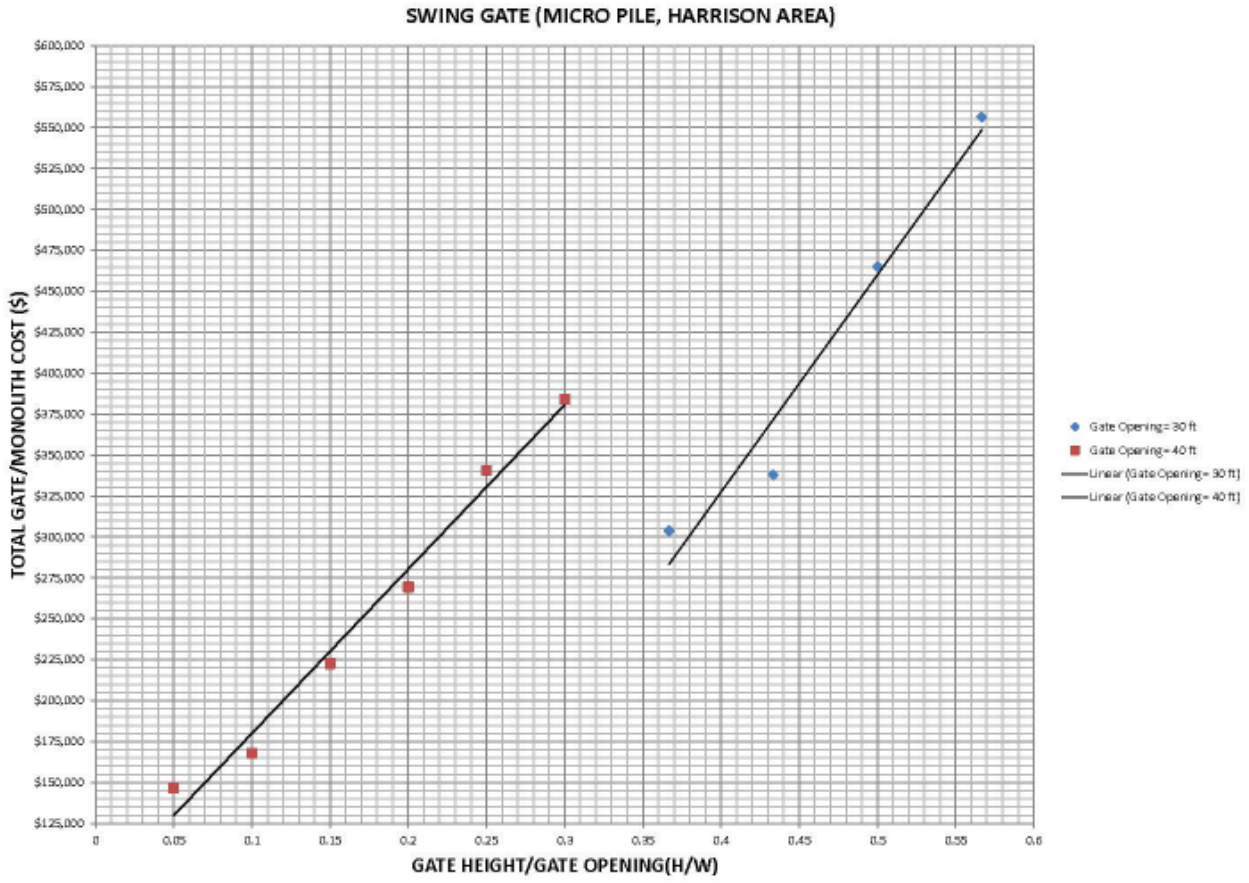
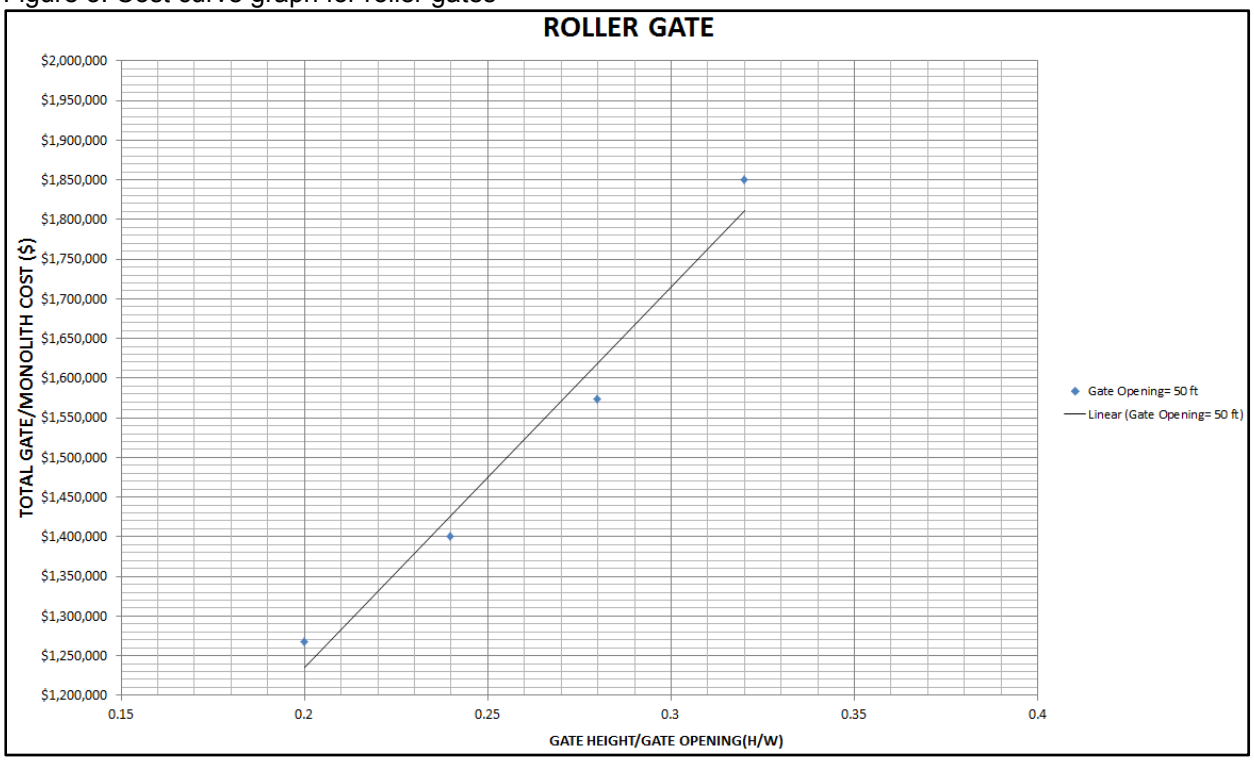


Figure 3. Cost curve graph for roller gates



The intent to these curves is to be able to achieve an approximate construction cost estimate based on the gate width opening for varying gate height to width ratio. Opinions of probable construction cost for each of the 64 gates in the inventory were developed from these cost curves and are reported in Appendix A. The closure gate costs, by reach, are reported in table 2.

Table 2. Summary of Closure Gate Costs By Project Reach

	Project Reach				
Design Water Surface Elevation[1]	Kearney	Newark	Harrison 1	Newark Flanking	TOTAL
14 ft (GDM)	$8,247,020	$4,023,917	$2,403,056	$1,558,707	$16,232,701
16 ft (GDM + 2 ft)	$9,896,957	$5,402,250	$3,242,335	$2,108,385	$20,649,928
18 ft (GDM + 4 ft)	$11,556,451	$6,780,583	$3,956,389	$2,658,063	$24,951,486

[1] All elevations reference the NAVD 88 vertical datum.

Appendix A:
Passaic River-Final Closure Gate Inventory and Cost

PASSAIC RIVER - FINAL CLOSURE GATE INVENTORY

Passaic River Ecosystem Restoration Feasibility Studies Conducted under Indefinite Delivery Contract IDC-PL-3005: W912DS-11-D-0008

USACE New York District

FINAL Closure Structure Inventory, 10 March 2016

Total Number of Closure Structures: 64

Source Documents: GDM September 1995 - Vol II of II; AECOM e-mail transmittal, 11/11/15

Originator: Bogdan Bogdanovich

QC: Michael Vecchio, 12/8/15; Revision 1 - 1/19/16, Revision 2 - 3/10/16 for Closure Gate Inventory, Post-QC Revisions: 4/14/2016

Incorporation of Cost Equations: K Hayden - 3/29/2016; K Hayden Addition of micro-pile 40-ft wide gate cost equations -0 4/21/16

QC of Cost Equations: Jaak Van den Sype, 3/31/16; Kim Hayden - 4/14/2016; Michae Vecchio - 4/21/16

QC of Transmitted Table: Michael Murphy, 4/7/2016

Gate No.	Revised Reach	GIS file description from AECOM	Gate Type	Original GDM Height (ft)[4]	Opening Width (O) (ft)[4]	Existing Grade (ft)[1]	GDM DWSE (ft)[2]	GDM + 2 ft[3]	GDM + 4 ft[3]	Computed GDM Height (H) (ft)	H/O for GDM	GDM Construction Cost[5]	Computed GDM +2 Height (ft)	H/O for GDM +2 ft	GDM + 2 ft Construction Cost[5]	Computed GDM +4 Height (ft)	H/O for GDM+4 ft	GDM + 4 ft Construction Cost[5]
5	Kearny	RAILROAD CLOSURE	swing	8.0	35	8.0	14.0	16.0	18.0	6.0	0.2	$ 97,258	8.0	0.2	$ 171,216	10.0	0.286	$ 245,173
6	Kearny	±15 L.F. CLOSURE ±7.0' HT. T.O.L. 14.9'	swing	7.0	15	7.2	14.0	16.0	18.0	6.8	0.5	$ 59,431	8.8	0.6	$ 75,456	10.8	0.723	$ 91,481
7	Kearny	±15 L.F. CLOSURE ±3.5' HT. T.O.L. 14.9'	swing	3.5	15	7.5	14.0	16.0	18.0	6.5	0.4	$ 56,337	8.5	0.6	$ 72,362	10.5	0.698	$ 88,387
8	Kearny	±15 L.F. CLOSURE ±3.5' HT. T.O.L. 14.9'	swing	8.5	15	8.6	14.0	16.0	18.0	5.4	0.4	$ 47,608	7.4	0.5	$ 63,633	9.4	0.625	$ 79,658
9	Kearny	±35 L.F. CLOSURE ±3.5' HT. T.O.L. 14.9'	swing	8.5	35	5.1	14.0	16.0	18.0	8.9	0.3	$ 204,849	10.9	0.3	$ 278,806	12.9	0.369	$ 352,764
10	Kearny	±25 L.F. CLOSURE ±7.0' HT. T.O.L. 14.9'	swing	7.0	25	6.8	14.0	16.0	18.0	7.2	0.3	$ 61,879	9.2	0.4	$ 74,816	11.2	0.447	$ 87,752
11	Kearny	±50 L.F. CLOSURES ±8.5' HT.	roller	8.5	50	1.6	14.0	16.0	18.0	12.4	0.2	$ 1,465,076	14.4	0.3	$ 1,656,990	16.4	0.328	$ 1,848,905
12	Kearny	±50 L.F. CLOSURES ±8.5' HT.	roller	8.5	50	3.8	14.0	16.0	18.0	10.2	0.2	$ 1,255,561	12.2	0.2	$ 1,447,476	14.2	0.284	$ 1,639,390
13	Kearny	±50 L.F. CLOSURES ±8.5' HT.	roller	8.5	50	2.6	14.0	16.0	18.0	11.4	0.2	$ 1,365,937	13.4	0.3	$ 1,557,852	15.4	0.307	$ 1,749,766
14	Kearny	30' CLOSURE ±6.9' HT.	swing	6.9	30	7.4	14.0	16.0	18.0	6.6	0.2	$ 124,496	8.6	0.3	$ 181,378	10.6	0.354	$ 238,259
15	Kearny	30' CLOSURE ±7.2' HT.	swing	7.2	30	6.0	14.0	16.0	18.0	8.0	0.3	$ 163,383	10.0	0.3	$ 220,265	12.0	0.400	$ 277,147
16	Kearny	±30 L.F. CLOSURE ±8.4' HT. T.O.L. 14.9'	swing	8.4	30	3.9	14.0	16.0	18.0	10.1	0.3	$ 222,050	12.1	0.4	$ 278,932	14.1	0.469	$ 335,814
17	Kearny	±30 L.F. CLOSURE ±8.4' HT. T.O.L. 14.9'	swing	8.4	30	4.0	14.0	16.0	18.0	10.0	0.3	$ 220,416	12.0	0.4	$ 277,298	14.0	0.467	$ 334,180
18	Kearny	±30 L.F. CLOSURE ±8.9' LOCATION MAY	swing	8.9	30	6.0	14.0	16.0	18.0	8.0	0.3	$ 163,630	10.0	0.3	$ 220,512	12.0	0.400	$ 277,394
19	Kearny	±35 L.F. CLOSURE ±8.9' HT. T.O.L. 14.9'	swing	8.9	35	0.7	14.0	16.0	18.0	13.3	0.4	$ 366,789	15.3	0.4	$ 440,747	17.3	0.494	$ 514,704
20	Kearny	±50 L.F. CLOSURE ACROSS EXISTING DISC	roller	6.0	50	7.3	14.0	16.0	18.0	6.7	0.1	$ 914,901	8.7	0.2	$ 1,106,815	10.7	0.213	$ 1,298,729
21	Kearny	±20 L.F. CLOSURE 5.0' HT. T.O.L. 14.9'	swing	6.0	20	5.8	14.0	16.0	18.0	8.2	0.4	$ 124,304	10.2	0.5	$ 150,731	12.2	0.611	$ 177,158
21A	Kearny	±20 L.F. CLOSURE 5.0' HT. T.O.L. 14.9'	swing	6.0	20	5.2	14.0	16.0	18.0	8.8	0.4	$ 131,638	10.8	0.5	$ 158,066	12.8	0.639	$ 184,493
22	Kearny		roller	?	50	6.3	14.0	16.0	18.0	7.7	0.2	$ 1,012,969	9.7	0.2	$ 1,204,883	11.7	0.234	$ 1,396,798
23	Kearny		swing	5.0	30	12.9	14.0	16.0	18.0	1.1	0.0	$ 83,158	3.1	0.1	$ 96,494	5.1	0.169	$ 119,386
24	Kearny		swing	5.0	30	8.0	14.0	16.0	18.0	6.0	0.2	$ 105,349	8.0	0.3	$ 162,230	10.0	0.332	$ 219,112
	KEARNY SUBTOTALS											**$ 8,247,020**			**$ 9,896,957**			**$ 11,556,451**
26	Newark	±30 L.F. CLOSURE ±7.5' HT. T.O.L. 14.9'	swing	7.5	30	4.3	14.0	16.0	18.0	9.7	0.3	$ 210,647	11.7	0.4	$ 267,529	13.7	0.455	$ 324,410
27	Newark	±30 L.F. CLOSURE ±6.0' HT. T.O.L. 14.9'	swing	6.0	30	6.6	14.0	16.0	18.0	7.4	0.2	$ 146,688	9.4	0.3	$ 203,570	11.4	0.380	$ 260,452
28	Newark	±30 L.F. CLOSURE ±6.0' HT. T.O.L. 14.9'	swing	6.0	30	6.9	14.0	16.0	18.0	7.1	0.2	$ 137,273	9.1	0.3	$ 194,155	11.1	0.369	$ 251,037
29	Newark	±30 L.F. CLOSURE ±6.0' HT. T.O.L. 14.9'	swing	6.0	30	5.8	14.0	16.0	18.0	8.2	0.3	$ 168,956	10.2	0.3	$ 225,838	12.2	0.406	$ 282,720
30	Newark	±30 L.F. CLOSURE ±6.0' HT. T.O.L. 14.9'	swing	6.0	30	6.9	14.0	16.0	18.0	7.1	0.2	$ 137,158	9.1	0.3	$ 194,040	11.1	0.369	$ 250,922
31	Newark	±30 L.F. CLOSURE ±9.0' HT. T.O.L. 14.9'	swing	9.0	30	4.9	14.0	16.0	18.0	9.1	0.3	$ 194,953	11.1	0.4	$ 251,835	13.1	0.437	$ 308,716
32	Newark	±30 L.F. CLOSURE ±7.5' HT. T.O.L. 14.9'	swing	7.5	30	6.4	14.0	16.0	18.0	7.6	0.3	$ 152,538	9.6	0.3	$ 209,419	11.6	0.387	$ 266,301
33	Newark	±30 L.F. CLOSURE ±8.0' HT. T.O.L. 14.9'	swing	6.0	30	3.6	14.0	16.0	18.0	10.4	0.3	$ 231,966	12.4	0.4	$ 288,847	14.4	0.480	$ 345,729
34	Newark	±30 L.F. CLOSURE ±5.5' HT. T.O.L. 14.9'	swing	5.5	30	5.8	14.0	16.0	18.0	8.2	0.3	$ 170,512	10.2	0.3	$ 227,394	12.2	0.408	$ 284,276
35	Newark	±30 L.F. CLOSURE ±5.5' HT. T.O.L. 14.9'	swing	5.5	30	8.8	14.0	16.0	18.0	5.2	0.2	$ 83,994	7.2	0.2	$ 140,876	9.2	0.307	$ 197,757
36	Newark	±10 L.F. CLOSURE ±10.0' HT. T.O.L. 14.9'	swing	10.0	10	3.6	14.0	16.0	18.0	10.4	1.0	$ 116,652	12.4	1.2	$ 148,977	14.4	1.436	$ 181,301
38	Newark	±30 L.F. CLOSURE ±9.0' HT. T.O.L. 14.9'	swing	9.0	30	5.8	14.0	16.0	18.0	8.2	0.3	$ 168,277	10.2	0.3	$ 225,159	12.2	0.405	$ 282,040
39	Newark	±30 L.F. CLOSURE ±9.0' HT. T.O.L. 14.9'	swing	9.0	30	4.7	14.0	16.0	18.0	9.3	0.3	$ 201,141	11.3	0.4	$ 258,023	13.3	0.444	$ 314,905
40	Newark	±30 L.F. CLOSURE ±9.0' HT. T.O.L. 14.9'	swing	9.0	30	6.2	14.0	16.0	18.0	7.8	0.3	$ 159,251	9.8	0.3	$ 216,133	11.8	0.395	$ 273,015
41	Newark	±30 L.F. CLOSURE ±9.0' HT. T.O.L. 14.9'	swing	9.0	30	5.4	14.0	16.0	18.0	8.6	0.3	$ 181,027	10.6	0.4	$ 237,909	12.6	0.420	$ 294,791
42	Newark	PROVIDE 1-10' CLOSURE 2-4' CLOSURE	swing		10	5.4	14.0	16.0	18.0	8.6	0.9	$ 88,451	10.6	1.1	$ 120,775	12.6	1.262	$ 153,100
43	Newark	PROVIDE 1-10' CLOSURE 2-4' CLOSURE	swing		4	8.5	14.0	16.0	18.0	5.5	1.4	$ 61,365	7.5	1.9	$ 86,333	9.5	2.381	$ 111,301
44	Newark	PROVIDE 1-10' CLOSURE 2-4' CLOSURE	swing		4	9.6	14.0	16.0	18.0	4.4	1.1	$ 47,397	6.4	1.6	$ 72,365	8.4	2.101	$ 97,333
47	Newark	±10 L.F. CLOSURE ±6.0' HT. T.O.L. 14.9'	swing	6.0	10	7.7	14.0	16.0	18.0	6.3	0.6	$ 50,601	8.3	0.8	$ 82,926	10.3	1.028	$ 115,250
48	Newark	±10 L.F. CLOSURE ±6.0' HT. T.O.L. 14.9'	swing	6.0	10	6.6	14.0	16.0	18.0	7.4	0.7	$ 68,304	9.4	0.9	$ 100,628	11.4	1.137	$ 132,953
49	Newark	20 L.F. CLOSURE ±6.0' HT.	swing	6.0	20	7.2	14.0	16.0	18.0	6.8	0.3	$ 105,350	8.8	0.4	$ 131,778	10.8	0.539	$ 158,205
49A	Newark	±10 L.F. CLOSURE ±6.0' HT. T.O.L. 14.9'	swing	6.0	10	8.0	14.0	16.0	18.0	6.0	0.6	$ 46,120	8.0	0.8	$ 78,444	10.0	1.000	$ 110,769
50	Newark	±10 L.F. CLOSURE ±6.0' HT. T.O.L. 14.9'	swing	6.0	10	6.8	14.0	16.0	18.0	7.2	0.7	$ 64,901	9.2	0.9	$ 97,225	11.2	1.116	$ 129,550
51	Newark	30' L.F. CLOSURE ±4.5' HT.	swing	4.5	30	6.7	14.0	16.0	18.0	7.3	0.2	$ 144,461	9.3	0.3	$ 201,343	11.3	0.378	$ 258,225
52	Newark	30' L.F. CLOSURE ±4.5' HT.	swing	4.5	30	6.5	14.0	16.0	18.0	7.5	0.3	$ 150,648	9.5	0.3	$ 207,530	11.5	0.385	$ 264,412
53	Newark	20' CLOSURE ±4' HT.	swing	4.0	20	9.6	14.0	16.0	18.0	4.4	0.2	$ 74,104	6.4	0.3	$ 100,531	8.4	0.421	$ 126,958
	NEWARK SUBTOTALS											**$ 4,023,917**			**$ 5,402,250**			**$ 6,780,583**
53A	Harrison 1	30' L.F. CLOSURES ±6.4' HT. & ±7.4' HT.	swing		40	7.5	14.0	16.0	18.0	6.5	0.2	$ 243,026	8.5	0.2	$ 293,132	10.5	0.263	$ 343,237
54	Harrison 1	30' L.F. CLOSURES ±6.4' HT. & ±7.4' HT.	swing	6.4	40	7.9	14.0	16.0	18.0	6.1	0.2	$ 233,598	8.1	0.2	$ 283,704	10.1	0.253	$ 333,810
55	Harrison 1	30' CLOSURES ±8.4' HT. NEED TO CHECK	swing	7.4	30	5.1	14.0	16.0	18.0	8.9	0.3	$ 189,288	10.9	0.4	$ 277,729	12.9	0.429	$ 366,170
56	Harrison 1	30' L.F. CLOSURES ±6' HT.	swing	7.4	30	4.3	14.0	16.0	18.0	9.7	0.3	$ 227,249	11.7	0.4	$ 315,690	13.7	0.458	$ 404,131
57	Harrison 1	30' L.F. CLOSURES ±6' HT.	swing	8.4	30	3.9	14.0	16.0	18.0	10.1	0.3	$ 244,463	12.1	0.4	$ 332,904	14.1	0.471	$ 421,345
58	Harrison 1	30' L.F. CLOSURES ±6' HT.	swing	6.0	30	1.4	14.0	16.0	18.0	12.6	0.4	$ 354,728	14.6	0.5	$ 443,169	16.6	0.554	$ 531,610
59	Harrison 1	30' L.F. CLOSURES ±6' HT.	swing	6.0	30	4.1	14.0	16.0	18.0	9.9	0.3	$ 234,237	11.9	0.4	$ 322,678	13.9	0.463	$ 411,119
59A	Harrison 1		swing		40	9.3	14.0	16.0	18.0	4.7	0.1	$ 196,894	6.7	0.2	$ 247,000	8.7	0.217	$ 297,105
59B	Harrison 1		swing		40	8.8	14.0	16.0	18.0	5.2	0.1	$ 211,145	7.2	0.2	$ 261,251	9.2	0.231	$ 311,357
59C	Harrison 1		swing		40	6.5	14.0	16.0	18.0	7.5	0.2	$ 268,428	9.5	0.2	$ 318,534	11.5	0.288	$ 368,639
59D	Harrison 1		swing		40	14.0	14.0	16.0	18.0	0.0	0.0		2.0	0.1	$ 146,546	4.0	0.100	$ 167,867
	HARRISON 1 SUBTOTALS											**$ 2,403,056**			**$ 3,242,335**			**$ 3,956,389**
60	Newark Flanking	- Western most section (1)	swing	4	45	12.0	14.0	16.0	18.0	2.0	0.0	$ 105,033	4.0	0.1	$ 162,756	6.0	0.133	$ 220,478
61	Newark Flanking	1 of 2	swing	4	45	9.4	14.0	16.0	18.0	4.6	0.1	$ 179,386	6.6	0.1	$ 237,109	8.6	0.191	$ 294,832
62	Newark Flanking	2 of 2	swing	4	45	9.6	14.0	16.0	18.0	4.4	0.1	$ 173,077	6.4	0.1	$ 230,799	8.4	0.186	$ 288,522
63	Newark Flanking	RR 1	swing	8	30	6.0	14.0	16.0	18.0	8.0	0.3	$ 163,365	10.0	0.3	$ 220,246	12.0	0.400	$ 277,128
64	Newark Flanking	(3) 50-foot swing gates in lieu of 150-foo	swing	8	50	8.3	14.0	16.0	18.0	5.7	0.1	$ 682,255	7.7	0.2	$ 908,021	9.7	0.194	$ 1,133,787
65	Newark Flanking	RR 3	swing	10	40	4.7	14.0	16.0	18.0	9.3	0.2	$ 255,592	11.3	0.3	$ 349,454	13.3	0.333	$ 443,316
	NEWARK FLANKING SUBTOTALS											**$1,558,707**			**$2,108,385**			**$2,658,063**
	TOTALS											**$16,232,701**			**$20,649,928**			**$24,951,486**

1 Data provided by AECOM

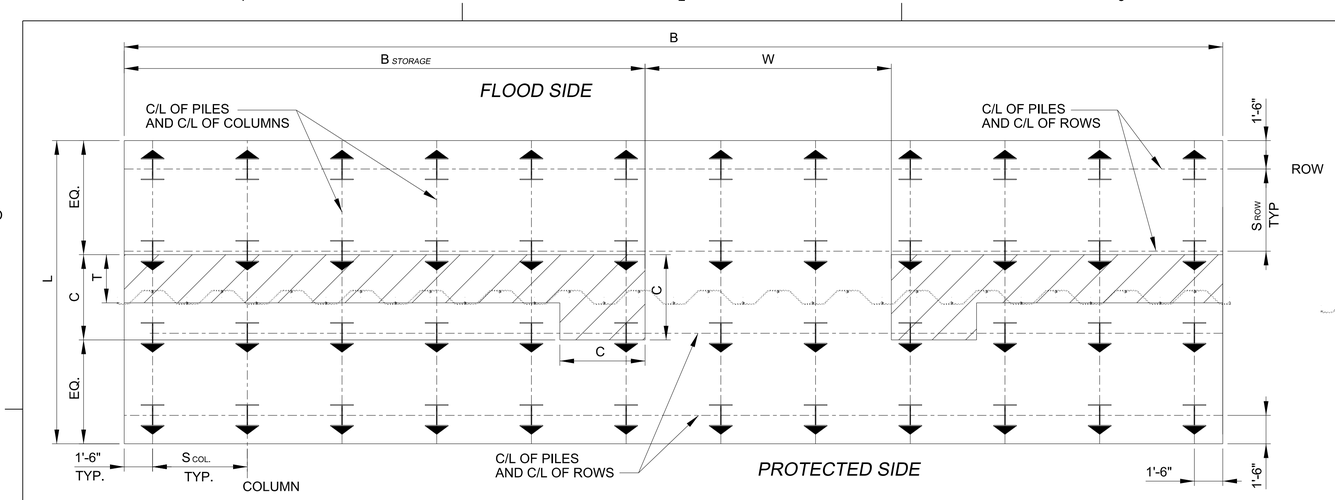
2 Provided by AECOM

3 Per scope of work.

4 Taken from 1/27/90 GDM drawings.

5 Construction includes the following materials, exclusively: structural steel gate; concrete monolith structure; concrete reinforcing; piles foundatio

Appendix B:
Typical Flood-Gate and Monolith Concrete Structure Drawings

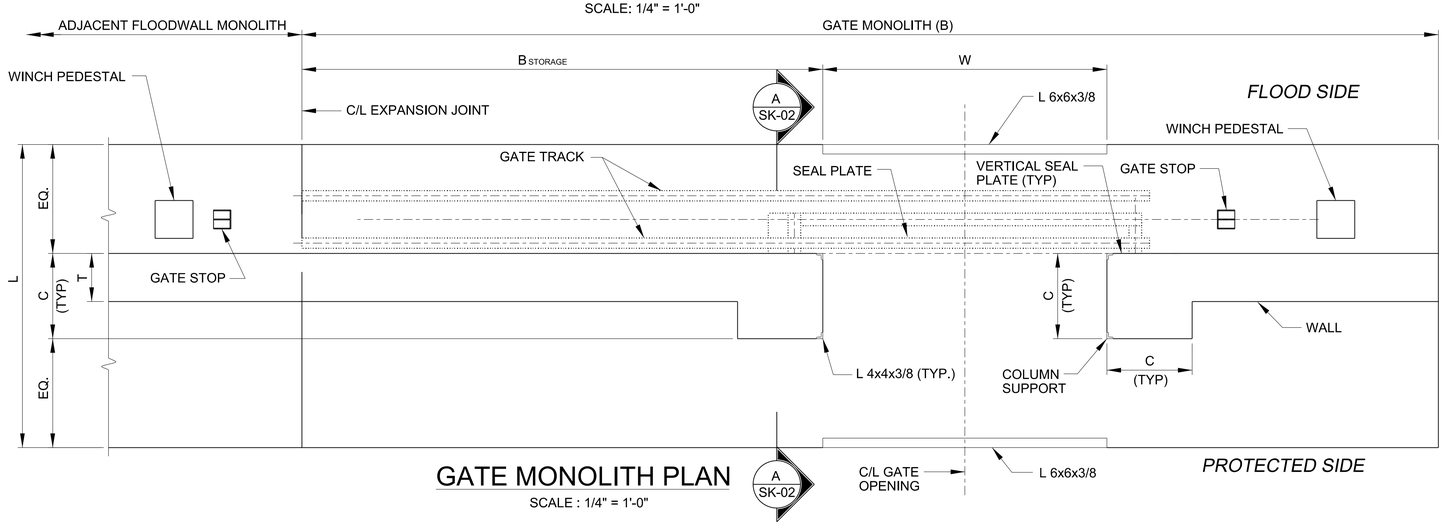


LEGEND

- BATTERED STEEL PILE (3V ON 1H)
- SHEET PILE

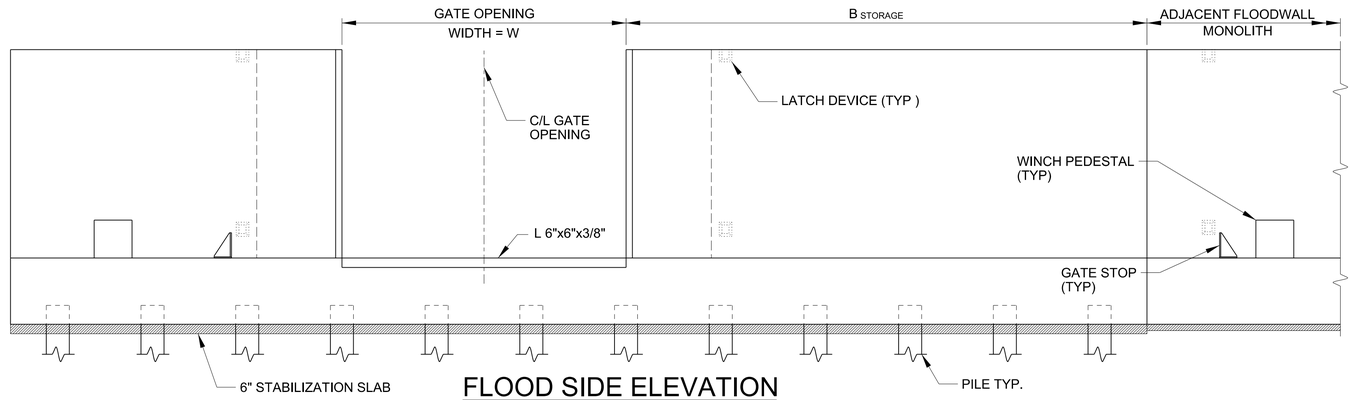
PILE AND FOUNDATION PLAN - GATE MONOLITH

SCALE: 1/4" = 1'-0"



GATE MONOLITH PLAN

SCALE : 1/4" = 1'-0"



FLOOD SIDE ELEVATION

SCALE : 1/4" = 1'-0"

1) WEST KEARNY AREA (H-PILE)

ROLLER GATE STEEL MEMBER SIZES

GATE DESIGNATIONS	GATE HEIGHTS "H" (ft)			
	10	12	14	16
Top Girder	W24x62	W30x90	W33x118	W33x118
Bottom Girder	W24x146	W30x148	W33x201	W33x241
Intercostal	WT7x11	WT7x11	WT7x11	WT7x11
X-Bracing	C10x20	C10x20	C10x20	C10x20
Skin Plate	3/8	3/8	3/8	3/8
Horiz. Brace	L4x4x0.25	L4x4x0.5	L4x4x0.5	L4x4x0.5
GATE OPENING WIDTH "W"=	**50 ft**			

CONCRETE MONOLITH DIMENSION

DIMENSION DESIGNATIONS (ft)	GATE HEIGHTS "H" (ft)			
	10	12	14	16
L	15	15	15	17
B	120	120	120	120
$B_{storage.}$	60	60	60	60
A	4	4	4	4
C	3.5	3.5	4.5	4.5
T	2	2	2.5	2.5
GATE OPENING WIDTH "W"=	**50 ft**			

PILE DIMENSIONS AND INFORMATION

PILE TYPE 14 H-PILE	GATE HEIGHTS "H" (ft)			
	10	12	14	16
# Piles	96	96	96	120
Tip Elevation (ft)	-50	-55	-60	-60
Pile Length(ft)	53	58	64	64
# Rows	4	4	4	5
# Columns	24	24	24	24
$S_{ROW.}$ (ft)	4	4	4	3.5
$S_{COL.}$ (ft)	5'-1"	5'-1"	5'-1"	5'-1"
GATE OPENING WIDTH "W"=	**50 ft**			

US Army Corps
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New York District

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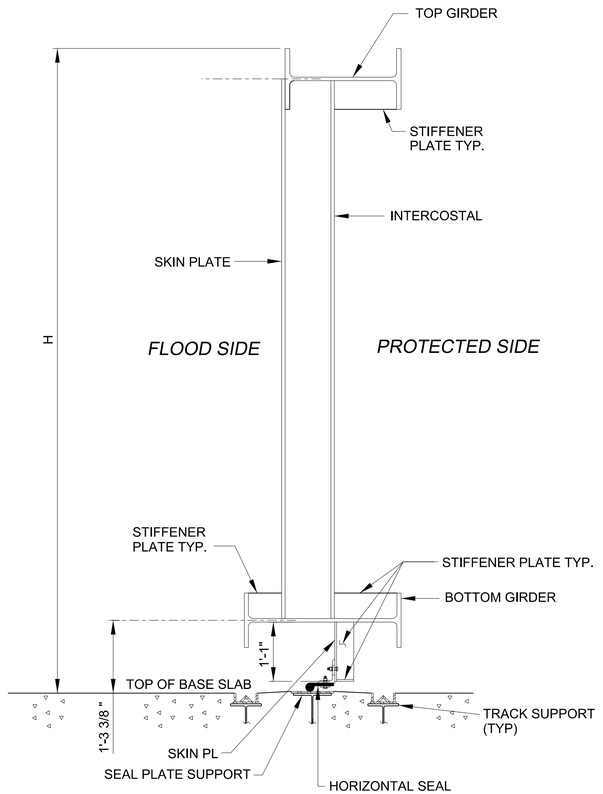
PLOT DATE: $SYTIME$

PASSAIC RIVER TIDAL
GENERAL REEVALUATION REPORT
LOWER PASSAIC RIVER, NJ

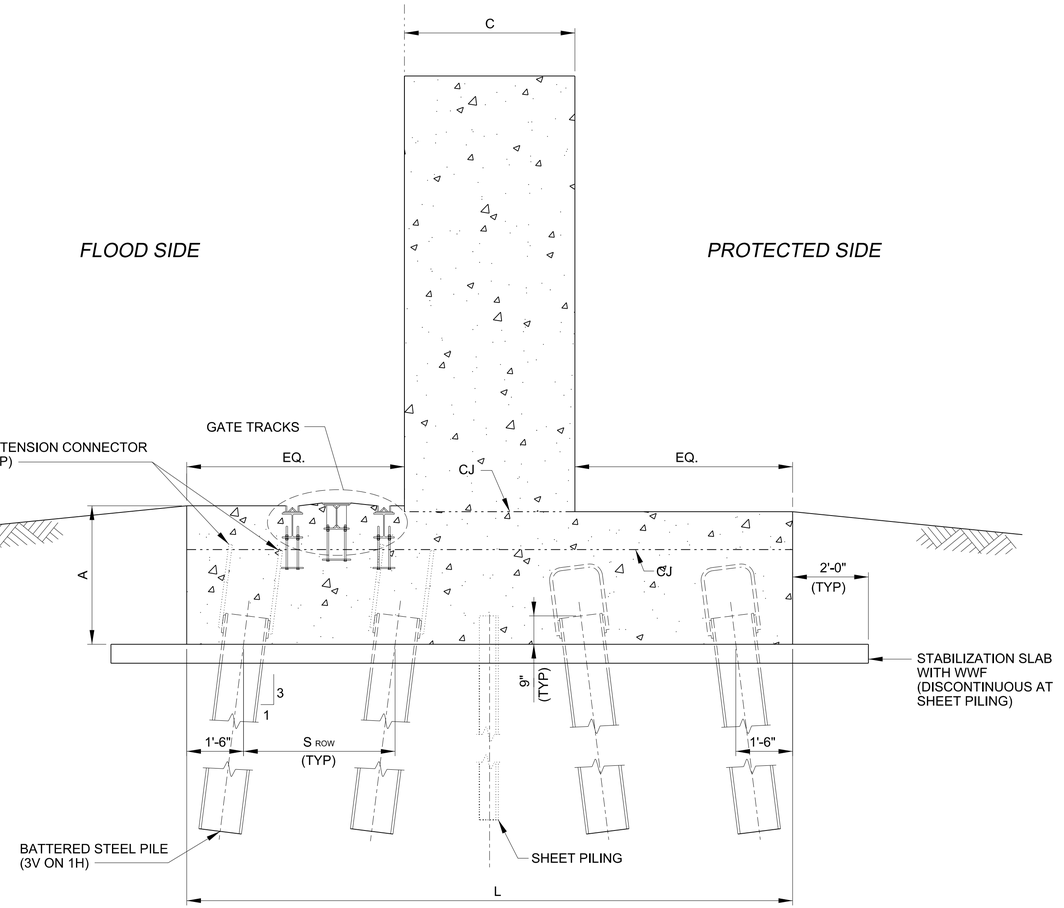
MONOLITH PLAN AND ELEVATIONS
ROLLER GATES

SHEET REFERENCE NUMBER
SK-01
SHEET 1 OF 6



ROLLER GATE SECTION (B / SK-03)

SCALE: 3/4" = 1'-0"



MONOLITH SECTION (A / SK-01)

SCALE: 1/2" = 1'-0"

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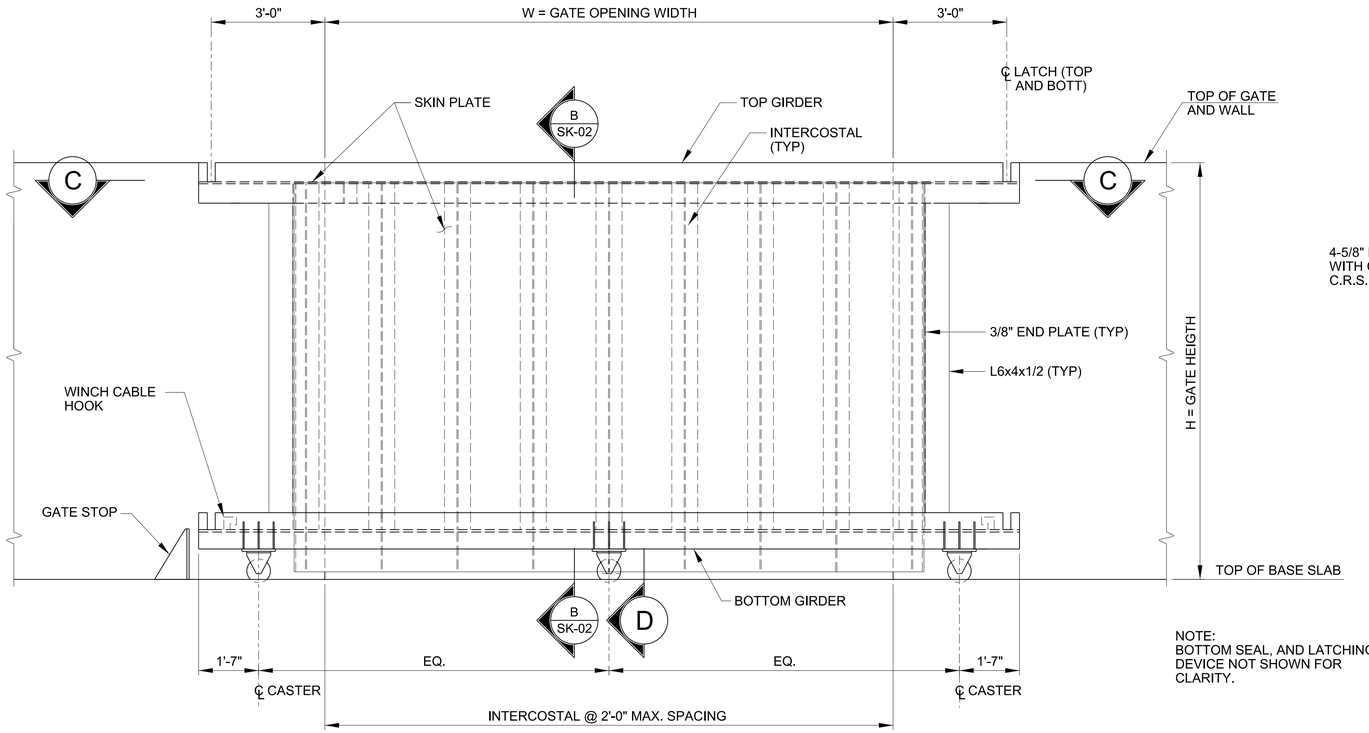
LOWER PASSAIC RIVER, NJ

TYPICAL MONOLITH AND ROLLER GATE SECTIONS

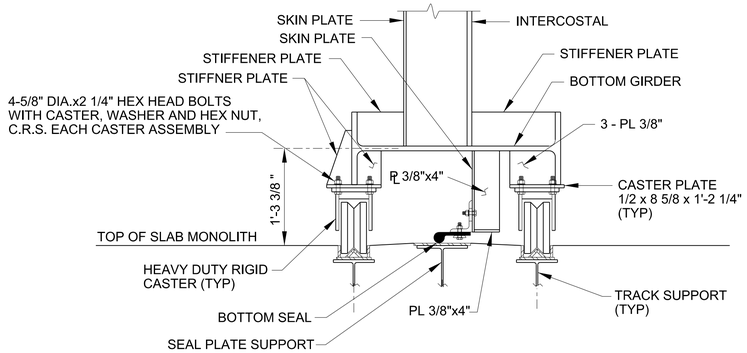
SHEET REFERENCE NUMBER
SK-02
SHEET 2 OF 6



NOTE:
BOTTOM SEAL, AND LATCHING DEVICE NOT SHOWN FOR CLARITY.

ROLLER GATE FLOOD SIDE ELEVATION

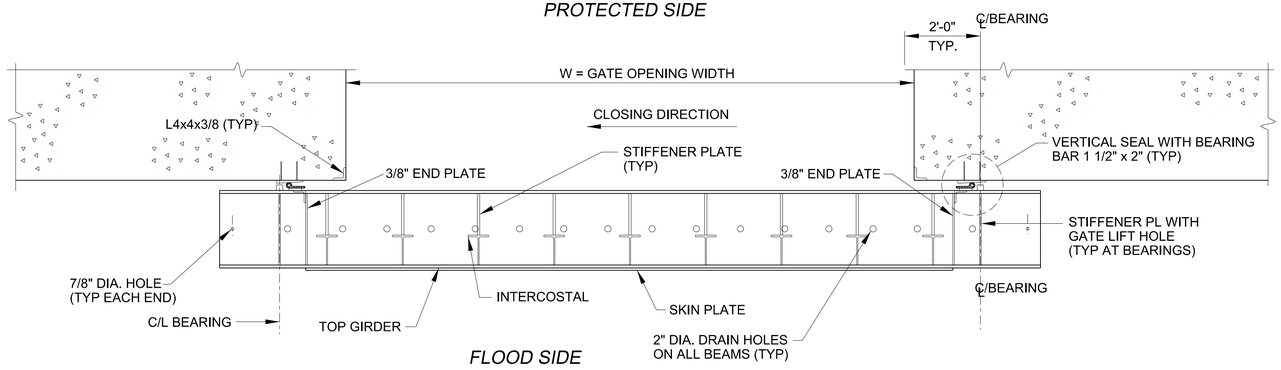
CLOSED POSITION



GATE DETAIL

VIEW D

SCALE: 1" = 1'-0"



NOTE: LATCHING DEVICES NOT SHOWN FOR CLARITY.

SECTION C

SCALE: 1/2" = 1'-0"

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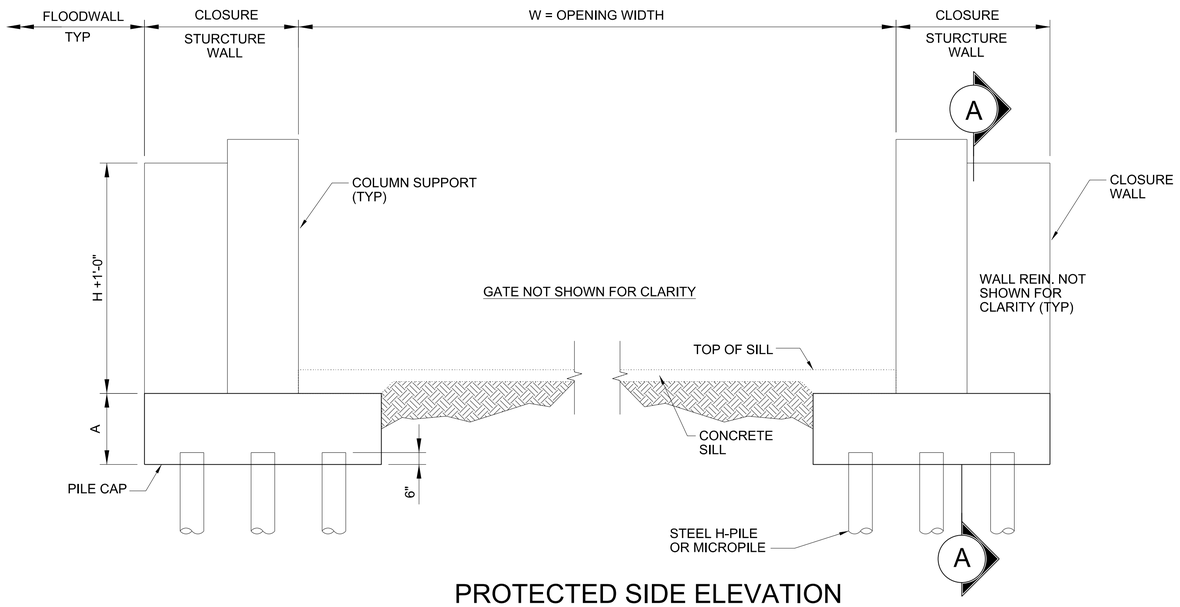
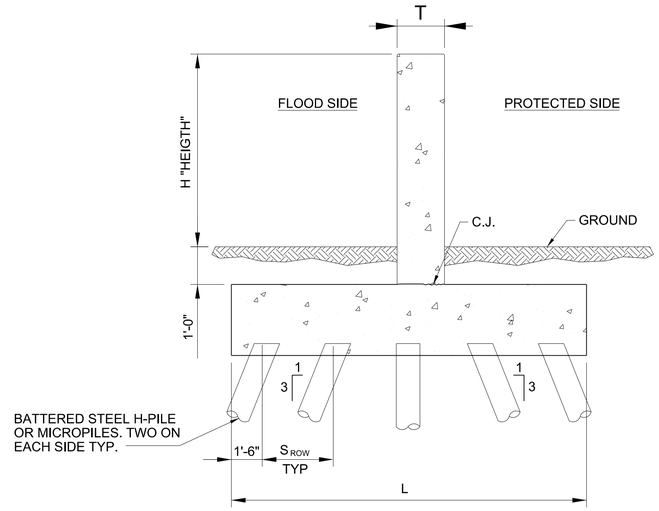
PASSAIC RIVER TIDAL
GENERAL REEVALUATION REPORT
LOWER PASSAIC RIVER, NJ

TYPICAL
SECTIONS & ELEVATIONS
ROLLER GATES

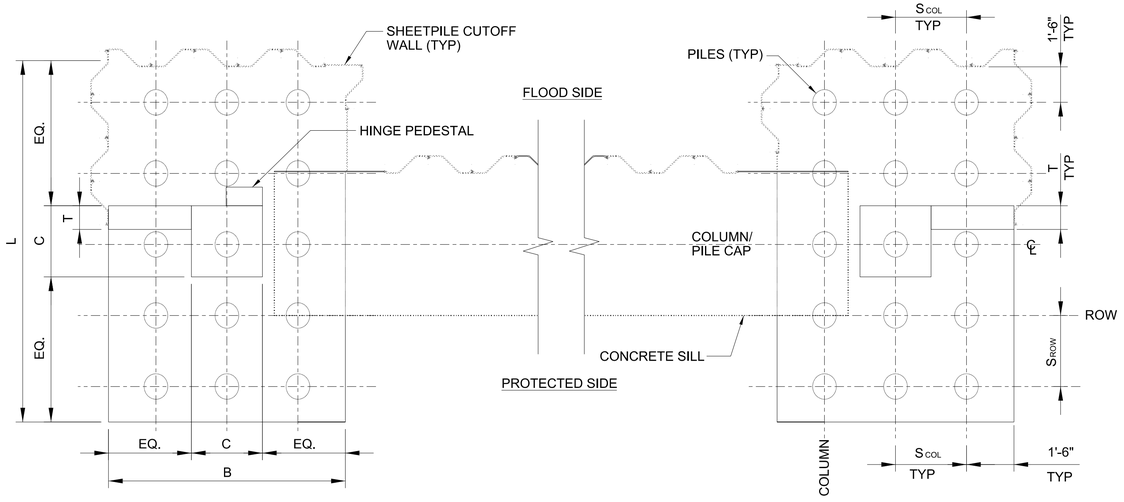
SHEET REFERENCE NUMBER
SK-03
SHEET 3 OF 6



PROTECTED SIDE ELEVATION



SECTION A-A



GATE MONOLITH AND PILE PLAN

SCALE: 3/4" = 1'-0"

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New York District

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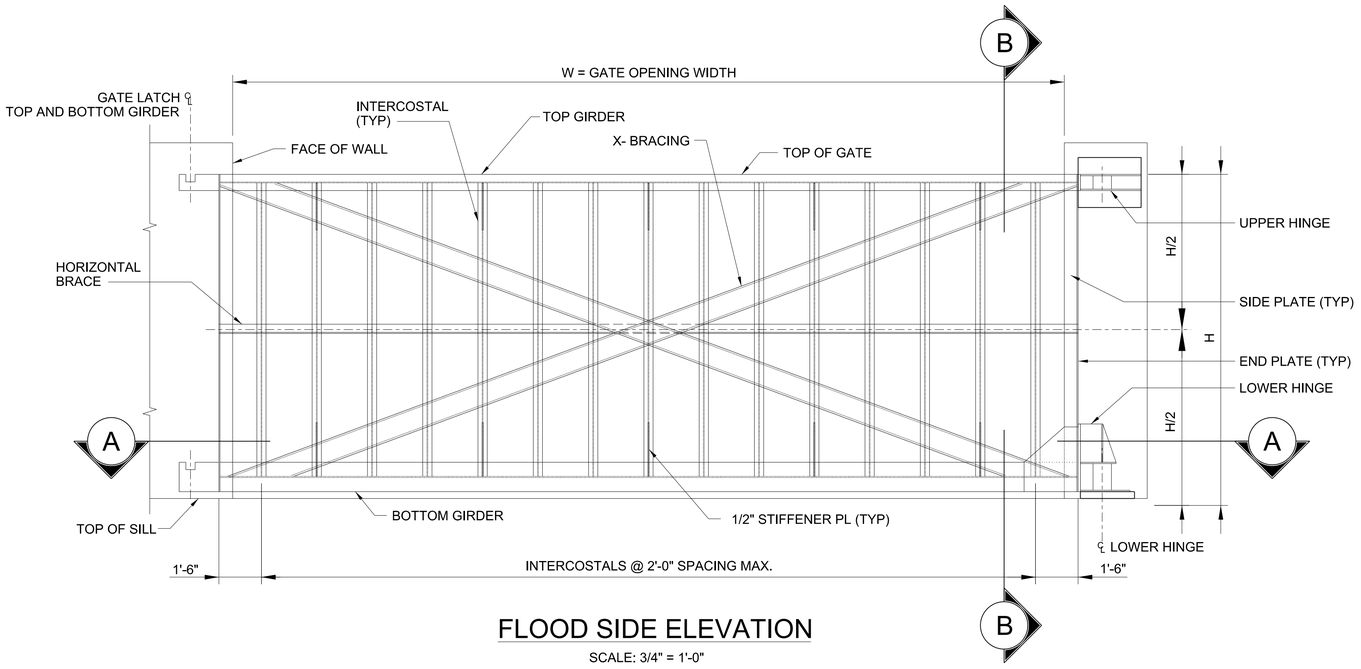
PASSAIC RIVER TIDAL
GENERAL REEVALUATION REPORT
LOWER PASSAIC RIVER, NJ

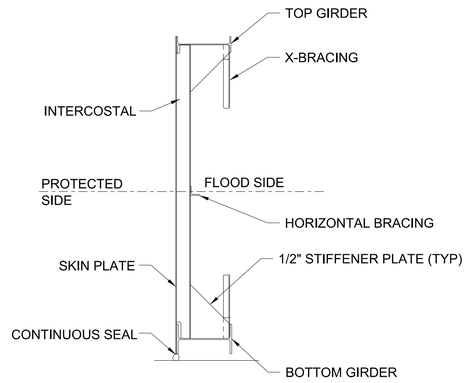
TYPICAL PROPOSED MONOLITH
SUPPORT STRUCTURE
SWING GATE

SHEET REFERENCE NUMBER
SK-04
SHEET 4 OF 6



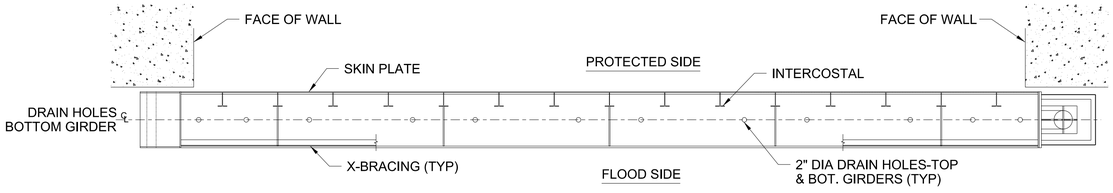
FLOOD SIDE ELEVATION

SCALE: 3/4" = 1'-0"



SECTION B-B

SCALE: 1/4" = 1'-0"



SECTION A-A

SCALE: 3/4" = 1'-0"

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PASSAIC RIVER TIDAL
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LOWER PASSAIC RIVER, NJ

TYPICAL PROPOSED GATE
PLAN AND ELEVATION
SWING GATE

SHEET
REFERENCE
NUMBER
SK-05
SHEET 5 OF 6

EAST/WEST OF KEARNY, NEWARK AND HARRISON AREA (H-PILE)

1)

SWING GATE STEEL MEMBER SIZES						
GATE DESIGNATIONS	GATE HEIGHTS "H" (ft)					
	6	8	10	12	14	16
Top Girder	Wx8x13	W8x13	W10x12	W12x16	W14x22	W14x22
Bottom Girder	W8x18	W8x18	W10x22	W12x26	W14x30	W14x34
Intercostal	WT3x6	WT3x6	WT4x6.5	WT5x7.5	WT6x8	WT7x11
X-Bracing	C10x20	C10x20	C10x20	C10x20	C10x20	C10x20
Skin Plate	5/16	5/16	5/16	5/16	6/16	6/16
Horiz. Brace	L4x4x0.25	L4x4x0.5	L4x4x0.5	L4x4x0.5	L4x4x0.5	L4x4x0.5
GATE OPENING WIDTH "W"=	**10 ft**					

CONCRETE MONOLITH DIMENSION						
DIMENSION DESIGNATIONS	GATE HEIGHTS "H" (ft)					
	6	8	10	12	14	16
L	7	9	9	12	12	15
B	6	6	6	9	9	10
A	2.5	2.5	2.5	3	3	4
C	2	2	2.5	3	3	3.5
T	1	1	1	1.5	1.5	1.75
GATE OPENING WIDTH "W"=	**10 ft**					

PILE DIMENSIONS AND INFORMATION						
PILE TYPE 14 H-PILE	GATE HEIGHTS "H" (ft)					
	6	8	10	12	14	16
# Piles	4	6	6	9	9	15
Tip Elevation (ft)	-35	-40	-45	-50	-55	-55
Pile Length(ft)	37	43	48	53	58	58
# Rows	2	3	3	3	3	5
# Columns	2	2	2	3	3	3
$S_{ROW.}$ (ft)	4	3	3	4.5	4.5	3
$S_{COL.}$ (ft)	3	3	3	3	3	3.5
GATE OPENING WIDTH "W"=	**10 ft**					

2)

CONCRETE MONOLITH DIMENSION					
DIMENSION DESIGNATIONS (ft)	GATE HEIGHTS "H" (ft)				
	5	7	9	11	13
L	7	9	9	9	10
B	6	6	6	6	9
A	2.5	2.5	2.5	2.5	3
C	2	2	2	2.5	2.5
T	1	1	1	1.5	1.5
GATE OPENING WIDTH "W"=	**20 ft**				

PILE DIMENSIONS AND INFORMATION					
PILE TYPE 14 H-PILE	GATE HEIGHTS "H" (ft)				
	5	7	9	11	13
# Piles	4	6	6	6	9
Tip Elevation (ft)	-35	-40	-50	-55	-55
Pile Length(ft)	37	43	53	58	58
# Rows	2	3	3	3	3
# Columns	2	2	2	2	3
$S_{ROW.}$ (ft)	4	3	3	3	3.5
$S_{COL.}$ (ft)	3	3	3	3	3
GATE OPENING WIDTH "W"=	**20 ft**				

3)

SWING GATE STEEL MEMBER SIZES										
GATE DESIGNATIONS	GATE HEIGHTS "H" (ft)									
	2*	4	6	8	10	12	13	14	16	18
Top Girder	W12x16	W12x16	W12x22	W16x26	W18x35	W24x55	W24x55	W24x55	W24x62	W24x68
Bottom Girder	W12x26	W12x26	W12x35	W16x50	W18x65	W24x84	W24x84	W24x94	W24x117	W24x146
Intercostal	WT3x6	WT3x6	WT3x6	WT3x6	WT4x6.5	WT5x7.5	WT5x7.5	WT6x8	WT7x11	WT7x11
X-Bracing	C10x20	C10x20	C10x20	C10x20	C10x20	C10x20	C10x20	C10x20	C10x20	C10x20
Skin Plate	5/16	5/16	5/16	5/16	5/16	5/16	5/16	3/8	3/8	3/8
Horiz. Brace	L4x4x0.25	L4x4x0.25	L4x4x0.25	L4x4x0.5	L4x4x0.5	L4x4x0.5	L4x4x0.5	L4x4x0.5	L4x4x0.5	L4x4x0.5
GATE OPENING WIDTH "W"=	**30 ft**									
*** Gate Height was rounded up to 2ft**										

CONCRETE MONOLITH DIMENSION										
DIMENSION DESIGNATIONS (ft)	GATE HEIGHTS "H" (ft)									
	2*	4	6	8	10	12	13	14	16	18
L	6	6	9	9	10	12	12	12	15	17
B	6	6	6	6	9	9	9	9	10	10
A	2.5	2.5	2.5	2.5	3	3	3	3	4	4
C	1.5	1.5	2	2	2.5	3	3	3	3.5	4
T	1	1	1	1	1	1.5	1.5	1.5	1.75	2
GATE OPENING WIDTH "W"=	**30 ft**									
*** Gate Height was rounded up to 2ft**										

PILE DIMENSIONS AND INFORMATION										
PILE TYPE 14 H-PILE	GATE HEIGHTS "H" (ft)									
	2*	4	6	8	10	12	13	14	16	18
# Piles	4	4	6	6	9	9	9	9	15	15
Tip Elevation (ft)	-40	-40	-40	-50	-50	-55	-60	-60	-60	-60
Pile Length(ft)	43	43	43	53	53	58	64	64	64	64
# Rows	2	2	3	3	3	3	3	3	5	5
# Columns	2	2	2	2	3	3	3	3	3	3
$S_{ROW.}$ (ft)	3	3	3	3	3.5	4.5	4.5	4.5	3	3.5
$S_{COL.}$ (ft)	3	3	3	3	3	3	3	3	3.5	3.5
GATE OPENING WIDTH "W"=	**30 ft**									
*** Gate Height was rounded up to 2ft**										

4)

SWING GATE STEEL MEMBER SIZES					
GATE DESIGNATIONS	GATE HEIGHTS "H" (ft)				
	9	11	13	15	17
Top Girder	W18x35	W24x55	W24x55	W24x68	W27x84
Bottom Girder	W18x65	W24x76	W24x103	W24x131	W27x146
Intercostal	WT4x6.5	WT5x7.5	WT6x8.0	WT7x11	WT7x17
X-Bracing	C10x20	C10x20	C10x20	C10x20	C10x20
Skin Plate	5/16	5/16	5/16	3/8	3/8
Horiz. Brace	L4x4x0.25	L4x4x0.5	L4x4x0.5	L4x4x0.5	L4x4x0.5
GATE OPENING WIDTH "W"=	**35 ft**				

CONCRETE MONOLITH DIMENSION					
DIMENSION DESIGNATIONS (ft)	GATE HEIGHTS "H" (ft)				
	9	11	13	15	17
L	10	12	12	15	17
B	9	9	9	10	10
A	3	3	3	4	4
C	2.5	3	3	3.5	4
T	1	1.5	1.5	1.75	2
GATE OPENING WIDTH "W"=	**35 ft**				

PILE DIMENSIONS AND INFORMATION					
PILE TYPE 14 H-PILE	GATE HEIGHTS "H" (ft)				
	9	11	13	15	17
# Piles	9	9	9	15	15
Tip Elevation (ft)	-50	-55	-60	-60	-60
Pile Length(ft)	53	58	64	64	64
# Rows	3	3	3	5	5
# Columns	3	3	3	3	3
$S_{ROW.}$ (ft)	3.5	4.5	4.5	3	3.5
$S_{COL.}$ (ft)	3	3	3	3.5	3.5
GATE OPENING WIDTH "W"=	**35 ft**				

HARRISON AREA (MICROPILES)

5)

SWING GATE STEEL MEMBER SIZES			
GATE DESIGNATIONS	GATE HEIGHTS "H" (ft)		
	10	12	14
Top Girder	W24x55	W24x62	W24x76
Bottom Girder	W24x84	W24x117	W24x162
X-Bracing	C10x20	C10x20	C10x20
Skin Plate	5/16	5/16	3/8
Horiz. Brace	L4x4x0.25	L4x4x0.5	L4x4x0.5
GATE OPENING WIDTH "W"=	**40 ft**		

CONCRETE MONOLITH DIMENSION			
DIMENSION DESIGNATIONS (ft)	GATE HEIGHTS "H" (ft)		
	10	12	14
L	12	12	15
B	9	9	10
A	3	3	4
C	3	3	3.5
T	1.5	1.5	1.75
GATE OPENING WIDTH "W"=	**40 ft**		

PILE DIMENSIONS AND INFORMATION			
PILE TYPE 14 H-PILE	GATE HEIGHTS "H" (ft)		
	10	12	14
# Piles	9	12	15
Tip Elevation (ft)	-55	-60	-60
Pile Length(ft)	58	64	64
# Rows	3	4	5
# Columns	3	3	3
$S_{ROW.}$ (ft)	4.5	3	3
$S_{COL.}$ (ft)	3	3	3.5
GATE OPENING WIDTH "W"=	**40 ft**		

6)

SWING GATE STEEL MEMBER SIZES			
GATE DESIGNATIONS	GATE HEIGHTS "H" (ft)		
	5	7	9
Top Girder	W16x26	W21x44	W21x48
Bottom Girder	W16x45	W21x62	W21x93
Intercostal	WT3x6	WT3x6	WT3x6
X-Bracing	C10x20	C10x20	C10x20
Skin Plate	5/16	5/16	5/16
Horiz. Brace	L4x4x0.25	L4x4x0.5	L4x4x0.5
GATE OPENING WIDTH "W"=	**45 ft**		

CONCRETE MONOLITH DIMENSION			
DIMENSION DESIGNATIONS (ft)	GATE HEIGHTS "H" (ft)		
	5	7	9
L	9	10	12
B	6	9	9
A	3	3	3
C	2.5	3	3
T	1.5	1.5	1.5
GATE OPENING WIDTH "W"=	**45 ft**		

PILE DIMENSIONS AND INFORMATION			
PILE TYPE 14 H-PILE	GATE HEIGHTS "H" (ft)		
	5	7	9
# Piles	6	9	9
Tip Elevation (ft)	-45	-45	-50
Pile Length(ft)	48	48	53
# Rows	3	3	3
# Columns	2	3	3
$S_{ROW.}$ (ft)	3	3.5	4.5
$S_{COL.}$ (ft)	3	3	3
GATE OPENING WIDTH "W"=	**45 ft**		

7)

SWING GATE STEEL MEMBER SIZES			
GATE DESIGNATIONS	GATE HEIGHTS "H" (ft)		
	6	8	10
Top Girder	W18x40	W24x55	W24x62
Bottom Girder	W18x65	W24x84	W24x131
Intercostal	WT3x6	WT3x6	WT3x6
X-Bracing	C10x20	C10x20	C10x20
Skin Plate	5/16	5/16	5/16
Horiz. Brace	L4x4x0.25	L4x4x0.5	L4x4x0.5
GATE OPENING WIDTH "W"=	**50 ft**		

CONCRETE MONOLITH DIMENSION			
DIMENSION DESIGNATIONS (ft)	GATE HEIGHTS "H" (ft)		
	6	8	10
L	9	10	12
B	6	9	9
A	3	3	3
C	2.5	3	3
T	1.5	1.5	1.5
GATE OPENING WIDTH "W"=	**50 ft**		

PILE DIMENSIONS AND INFORMATION			
PILE TYPE 14 H-PILE	GATE HEIGHTS "H" (ft)		
	6	8	10
# Piles	6	9	12
Tip Elevation (ft)	-50	-50	-55
Pile Length(ft)	53	53	58
# Rows	3	3	4
# Columns	2	3	3
$S_{ROW.}$ (ft)	3	3.5	3
$S_{COL.}$ (ft)	3	3	3
GATE OPENING WIDTH "W"=	**50 ft**		

1)

SWING GATE STEEL MEMBER SIZES				
GATE DESIGNATIONS	GATE HEIGHTS "H" (ft)			
	11	13	15	17
Top Girder	W21x44	W21x44	W24x55	W24x68
Bottom Girder	W21x68	W21x93	W24x104	W24x146
Intercostal	WT5x7.5	WT6x8.0	WT7x17	WT7x17
X-Bracing	C10x20	C10x20	C10x20	C10x20
Skin Plate	5/16	5/16	3/8	3/8
Horiz. Brace	L4x4x0.25	L4x4x0.5	L4x4x0.5	L4x4x0.5
GATE OPENING WIDTH "W"=	**30 ft**			

CONCRETE MONOLITH DIMENSION				
DIMENSION DESIGNATIONS (ft)	GATE HEIGHTS "H" (ft)			
	11	13	15	17
L	12	12	15	17
B	9	9	10	10
A	3	3	4	4
C	3	3	3.5	4
T	1.5	1.5	1.75	2
GATE OPENING WIDTH "W"=	**30 ft**			

PILE DIMENSIONS AND INFORMATION				
PILE TYPE 9" MICROPILES	GATE HEIGHTS "H" (ft)			
	11	13	15	17
# Piles	9	9	12	15
Tip Elevation (ft)®	-60	-60	-60	-60
Pile Length(ft)	64	64	64	64
# Rows	3	3	4	5
# Columns	3	3	3	3
$S_{ROW.}$ (ft)	4.5	4.5	4	3.5
$S_{COL.}$ (ft)	3	3	3.5	3.5
GATE OPENING WIDTH "W"=	**30 ft**			

®MICRO PILE TIP INCLUDES 10' SOCKET, ASSUMED BED ROCK @ EL. -50.0 SOCKET TIP @ EL. -60.0

2)

SWING GATE STEEL MEMBER SIZES						
GATE DESIGNATIONS	GATE HEIGHTS "H" (ft)					
	2	4	6	8	10	12
Top Girder	W12x19	W12x26	W12x30	W18x40	W24x62	W24x76
Bottom Girder	W12x35	W12x35	W12x53	W18x76	W24x94	W24x117
Intercostal	WT3x6	WT3x6	WT3x6	WT5x7.5	WT5x7.5	WT6x8.0
X-Bracing	C10x20	C10x20	C10x20	C10x20	C10x20	C10x20
Skin Plate	5/16	5/16	5/16	5/16	5/16	5/16
Horiz. Brace	L4x4x0.25	L4x4x0.25	L4x4x0.25	L4x4x0.25	L4x4x0.25	L4x4x0.25
GATE OPENING WIDTH "W"=	**40 ft**					

CONCRETE MONOLITH DIMENSION						
DIMENSION DESIGNATIONS (ft)	GATE HEIGHTS "H" (ft)					
	2	4	6	8	10	12
L	6	6	9	9	12	12
B	6	6	6	6	6	6
A	2.5	2.5	2.5	3	3	3
C	1.5	2	2	2.5	3	3
T	1	1.5	1.5	1.5	1.5	1.5
GATE OPENING WIDTH "W"=	**40 ft**					

PILE DIMENSIONS AND INFORMATION						
PILE TYPE 9" MICROPILES	GATE HEIGHTS "H" (ft)					
	2	4	6	8	10	12
# Piles	4	4	6	6	8	8
Tip Elevation (ft)®	-60	-60	-60	-60	-60	-60
Pile Length(ft)	64	64	64	64	64	64
# Rows	2	2	3	3	4	4
# Columns	2	2	2	2	2	2
$S_{ROW.}$ (ft)	3	3	3	3	3	3
$S_{COL.}$ (ft)	3	3	3	3	3	3
GATE OPENING WIDTH "W"=	**40 ft**					

®MICRO PILE TIP INCLUDES 10' SOCKET, ASSUMED BED ROCK @ EL. -50.0 SOCKET TIP @ EL. -60.0

US Army Corps of Engineers
New York District

MARK	DESCRIPTION	DATE	APPR.
MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY:
DWN BY:
CKD BY:
SUBMITTED BY:
DATE: MAY 2016
SOLICITATION NO.:
CONTRACT NO.:
FILE NAME: $FILE$$
SIZE: ANSI D
PLOTTED BY: $USERNAME$
PLOT DATE: $SYTIME$

U. S. ARMY ENGINEER DISTRICT
NEW YORK
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PASSAIC RIVER TIDAL
GENERAL REEVALUATION REPORT
LOWER PASSAIC RIVER, NJ
GATE / MONOLITH
SIZE, DIMENSIONS AND INFORMATION
TABLES
SWING GATE

SHEET REFERENCE NUMBER
SK-06
SHEET 6 OF 6

MAY 2009, NYD BORDER
Submitted by: $USERNAME$
FILE NAME : $FILE$
Plot Date: $DATE$ $SYTIME$