Improvements to Hoboken Terminal Corridor

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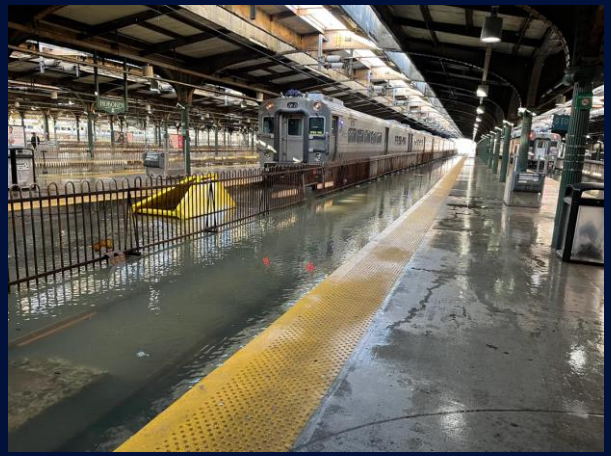
Advisors:
Dr. Michael Horst, Dr. Thomas Brennan

Site Overview

Problem Statement

- Inadequate service from aging infrastructure
- Frequent rainfall flooding and Hudson River overtopping
- High traffic congestion



Realistic Constraints

-Environmental: Disturbance, Pollutants

-Sustainability: Maintenance, Durability

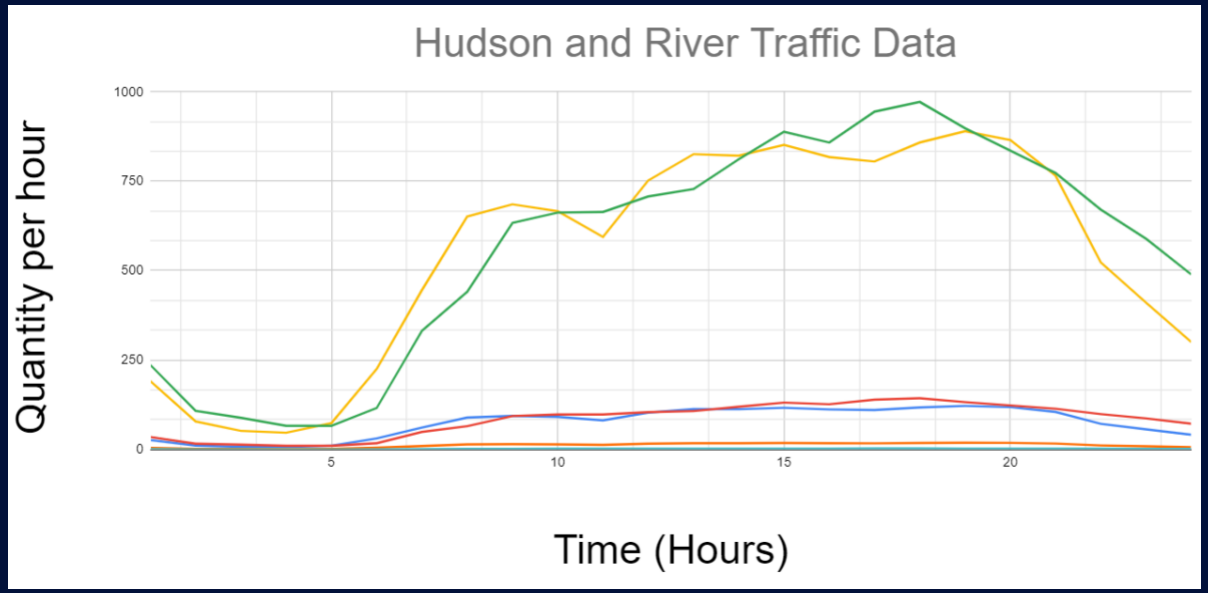
-Constructability: Dense Urban Area

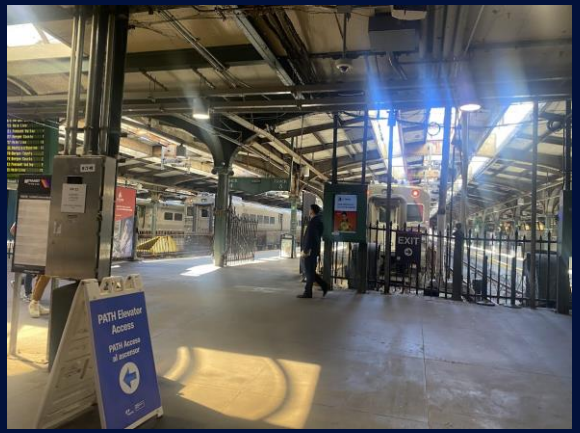
-Health and Safety: Public Impact

-Political: Hoboken Zoning, Historic Landmarks

-Economic: Project Cost, Economic Impact

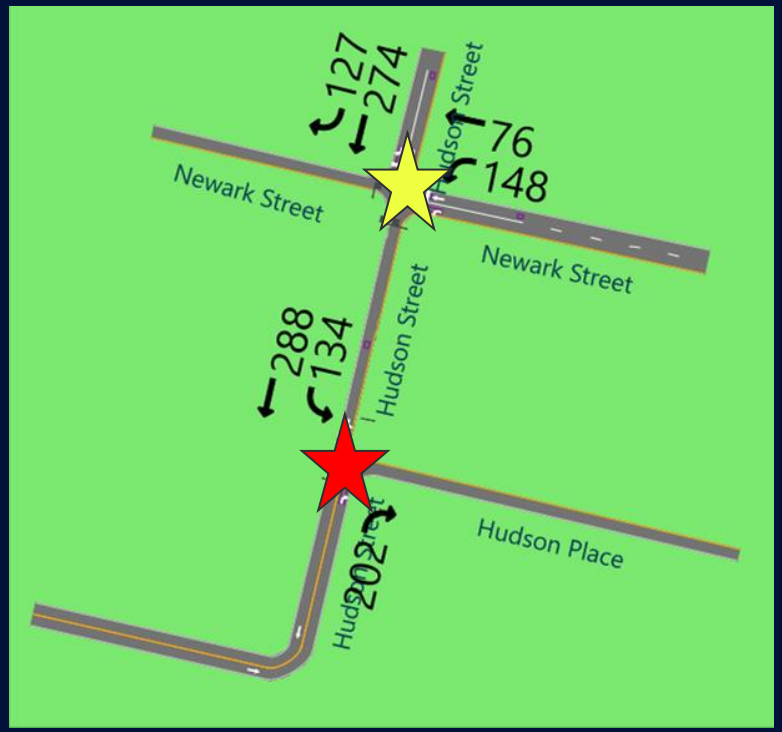
Transportation Design Constraints





- Crowding and congestion
- Existing NJ Transit infrastructure

Transportation Analysis



Hydrologic Design Constraints: Rainfall

Drainage Area: 0.1 sq mi

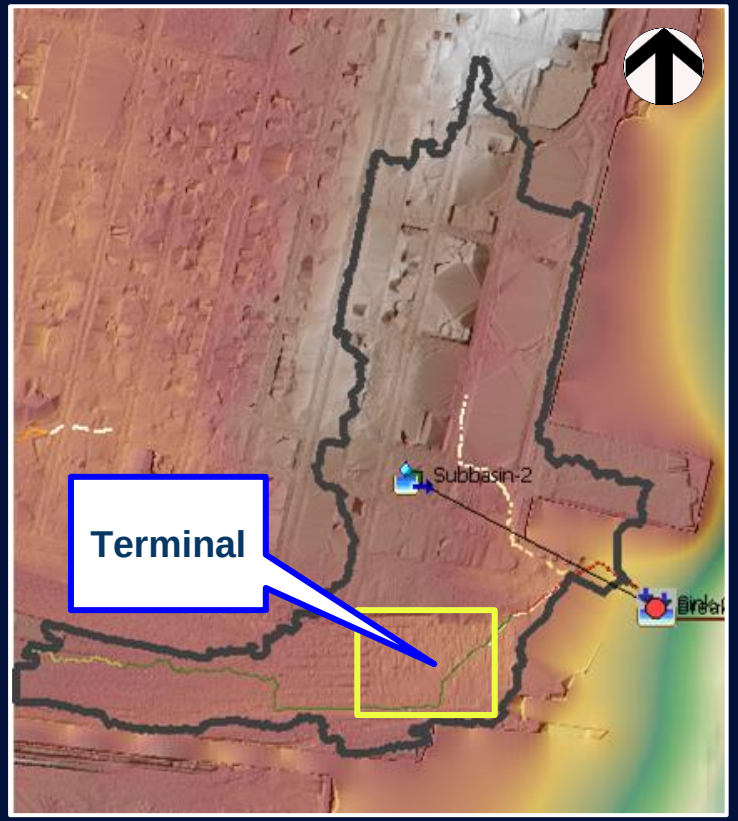
Curve Number: 98

Longest Flowpath Length: 3,562 ft

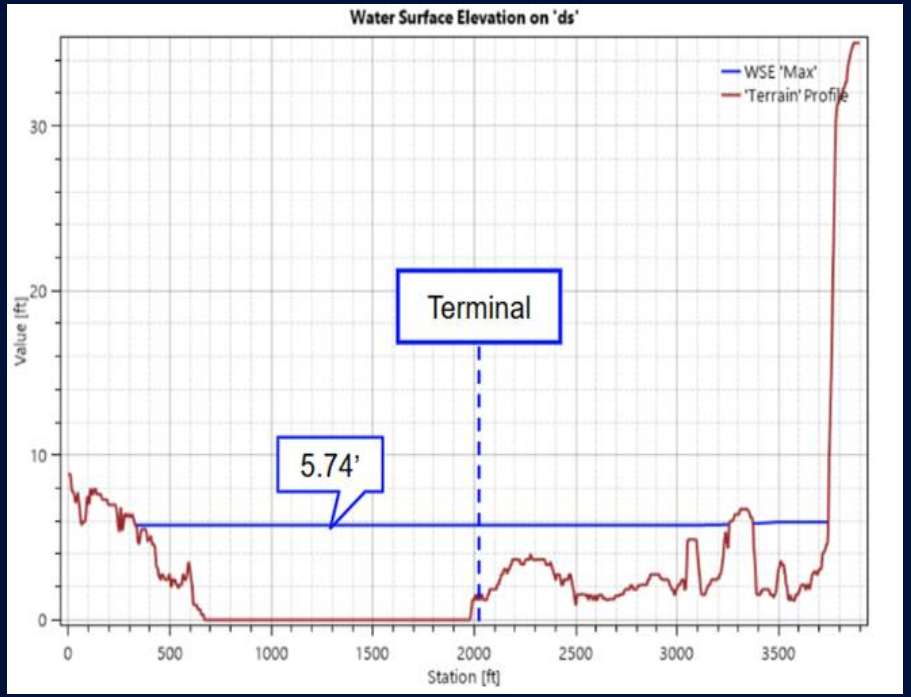
Basin Slope: 0.1672 ft/ft

Peak Discharge: 180.5 cfs

Direct Runoff Volume: 44.2 acre-ft



Hydrologic Design Constraints: Riverine



Applicable Standards

- NJDOT Roadway Design Manual
- NJ Complete Streets Design Guide
- NJ Transit Design Standards
- NJDEP (BMP Manual)
- FEMA Design Standards
- Hoboken Zoning Ordinances
- ADA Compliance

Modern Engineering Tools

Autodesk Civil 3D

- Design Plan Drafting

SYNCHRO 12

- Traffic Volume Analysis

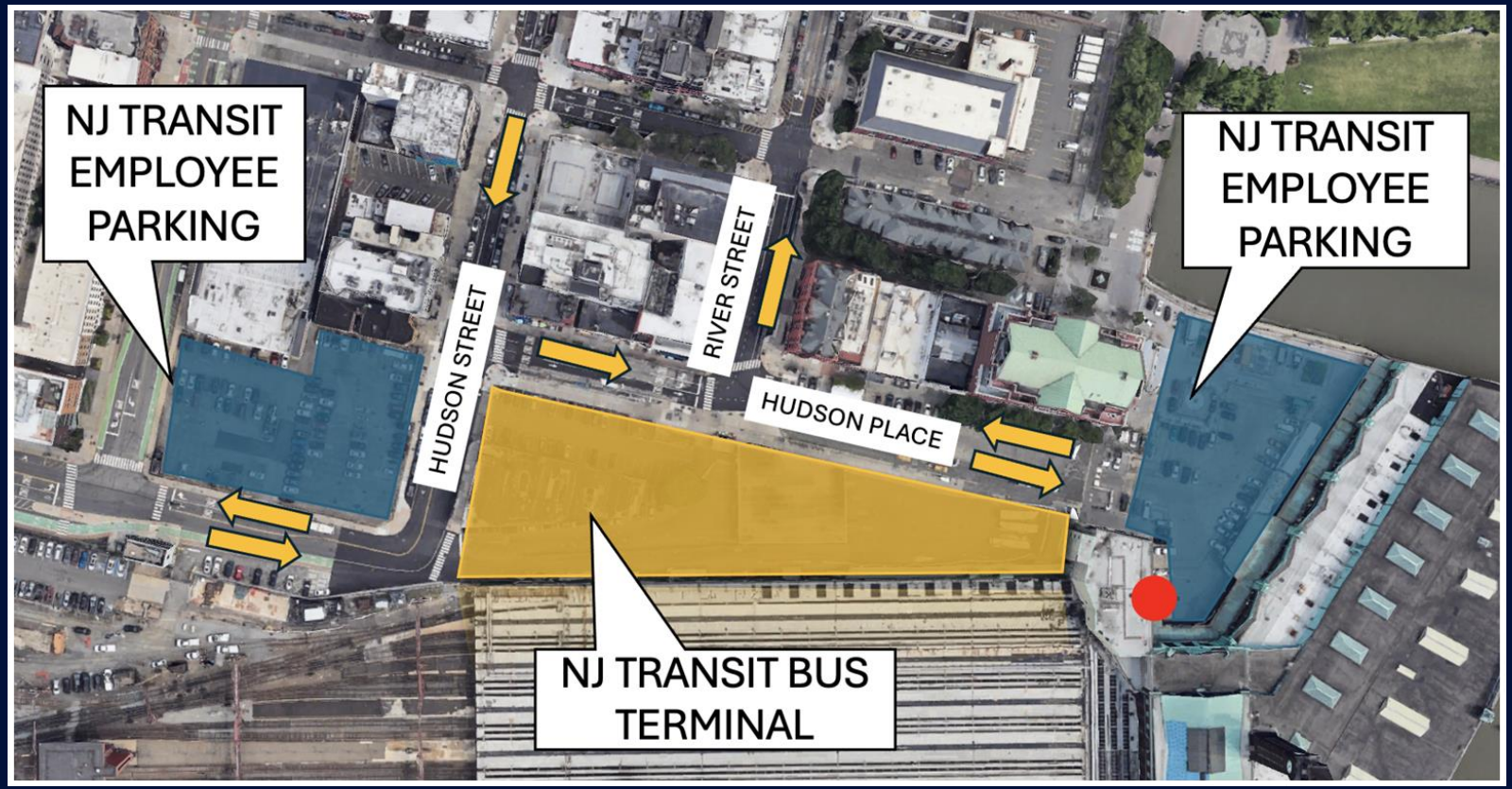
HEC-HMS

- Stormwater Runoff Analysis

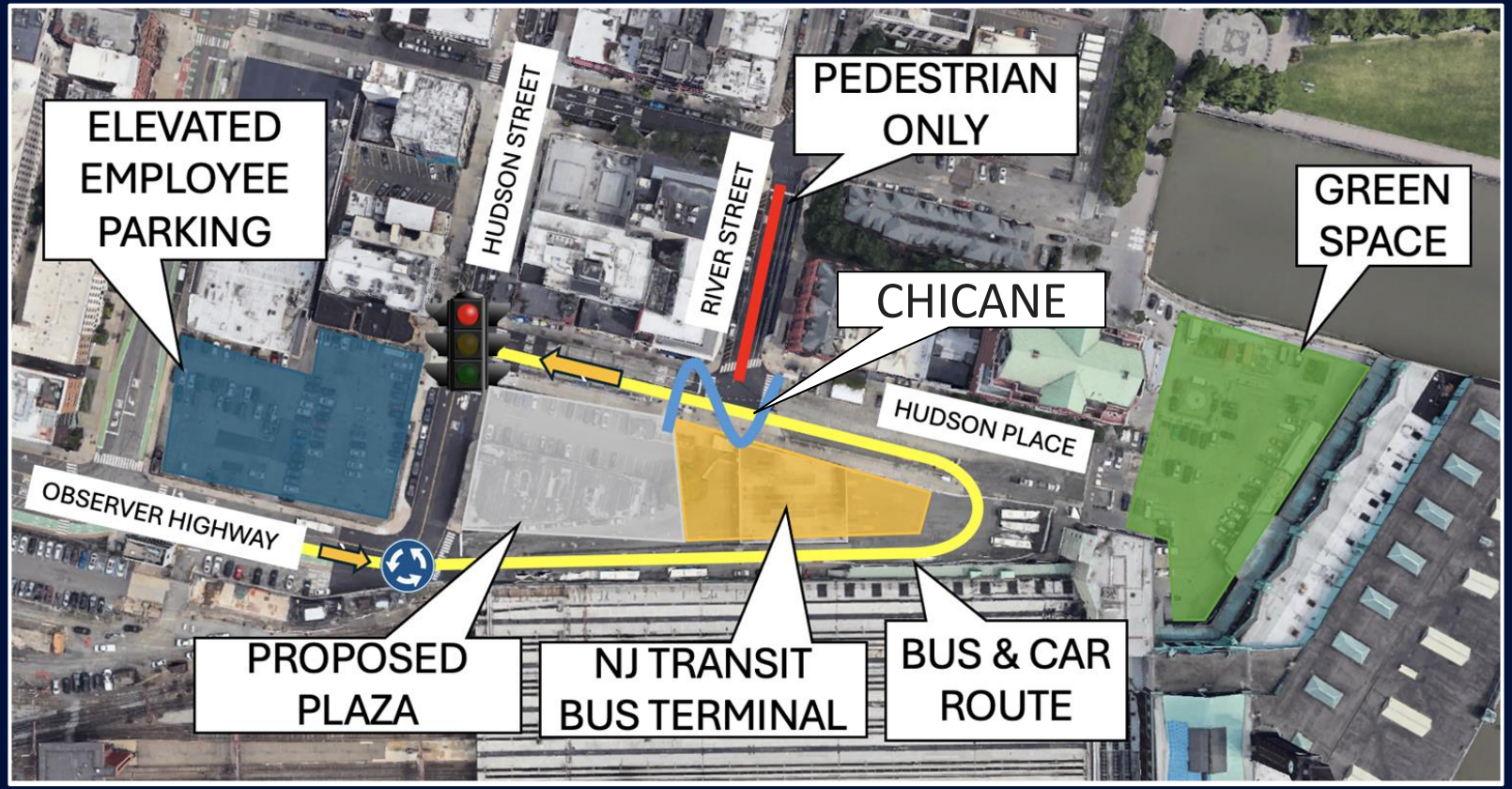
HEC-RAS 6.7 Beta

- Hydraulic Modeling & Design

Existing Site Layout



Alternative 1



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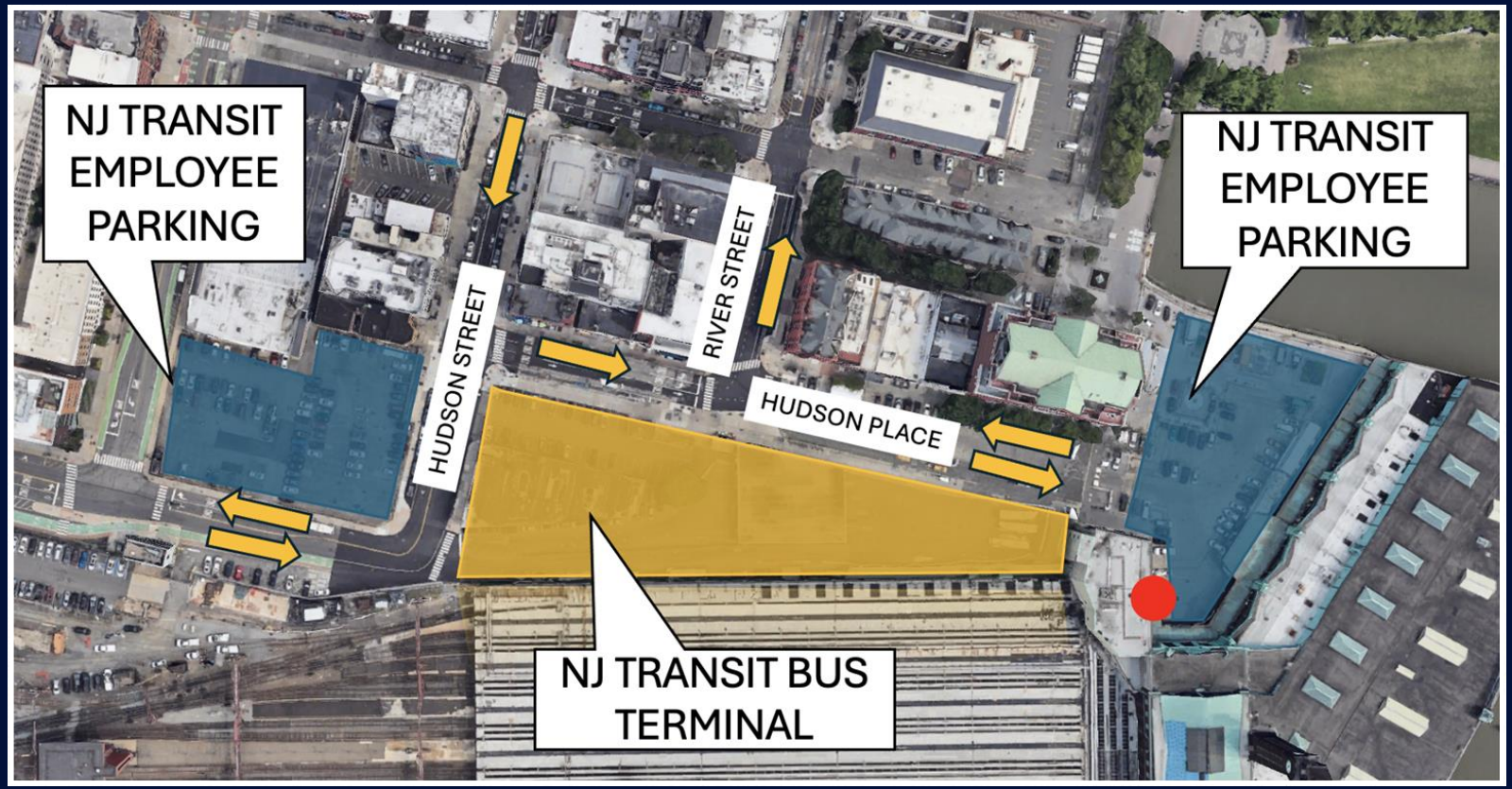
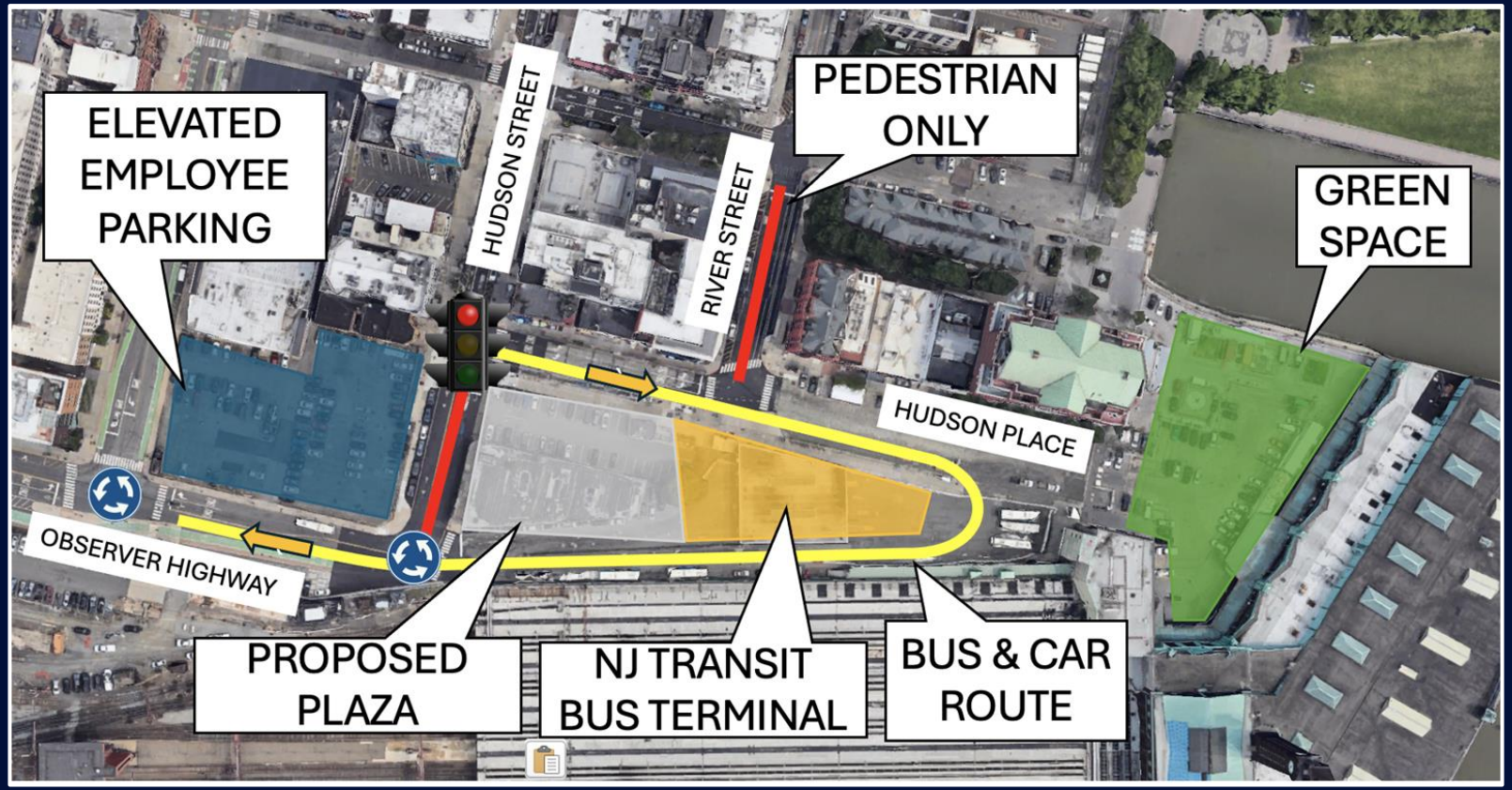


Alternative 2



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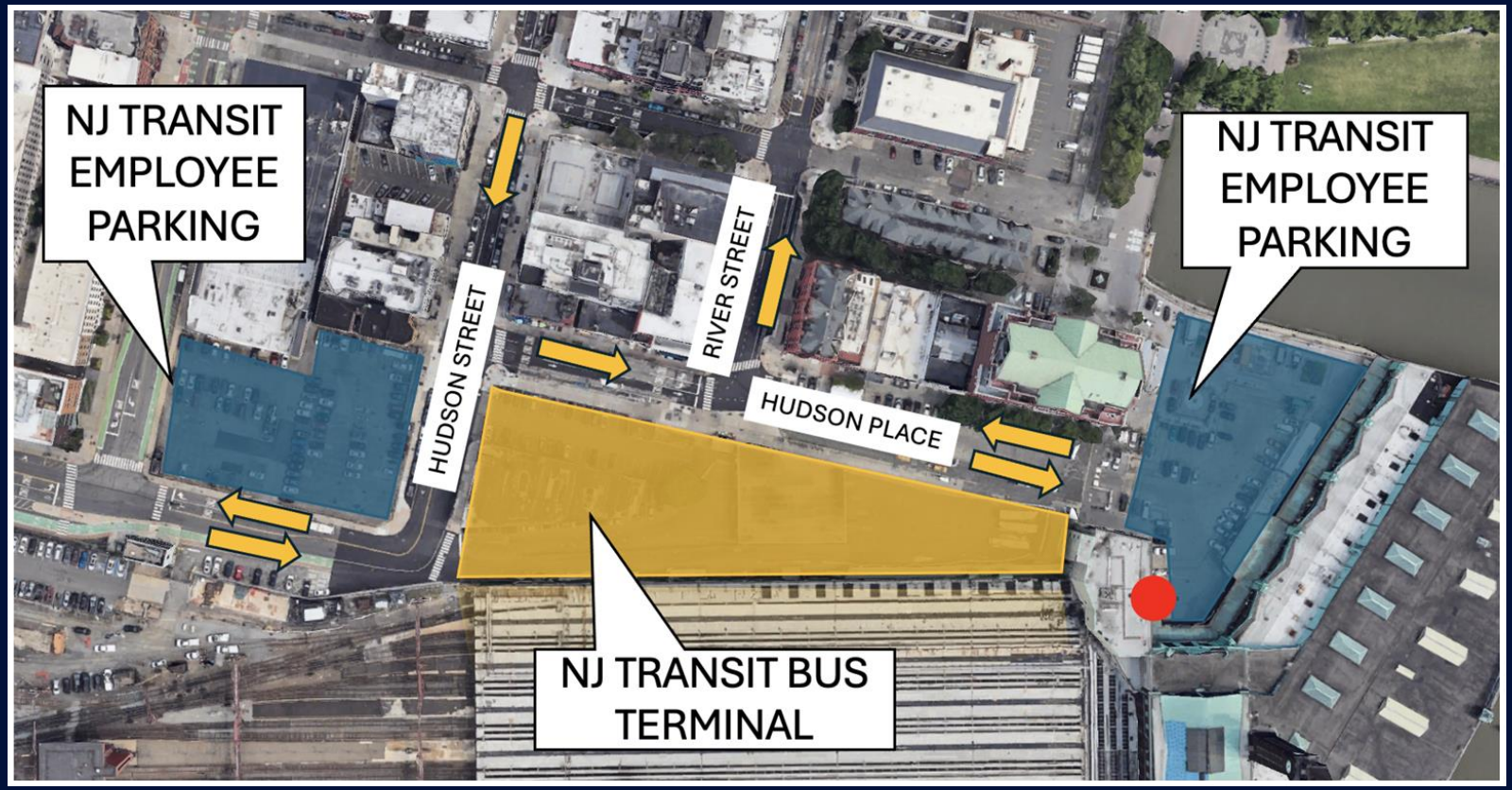
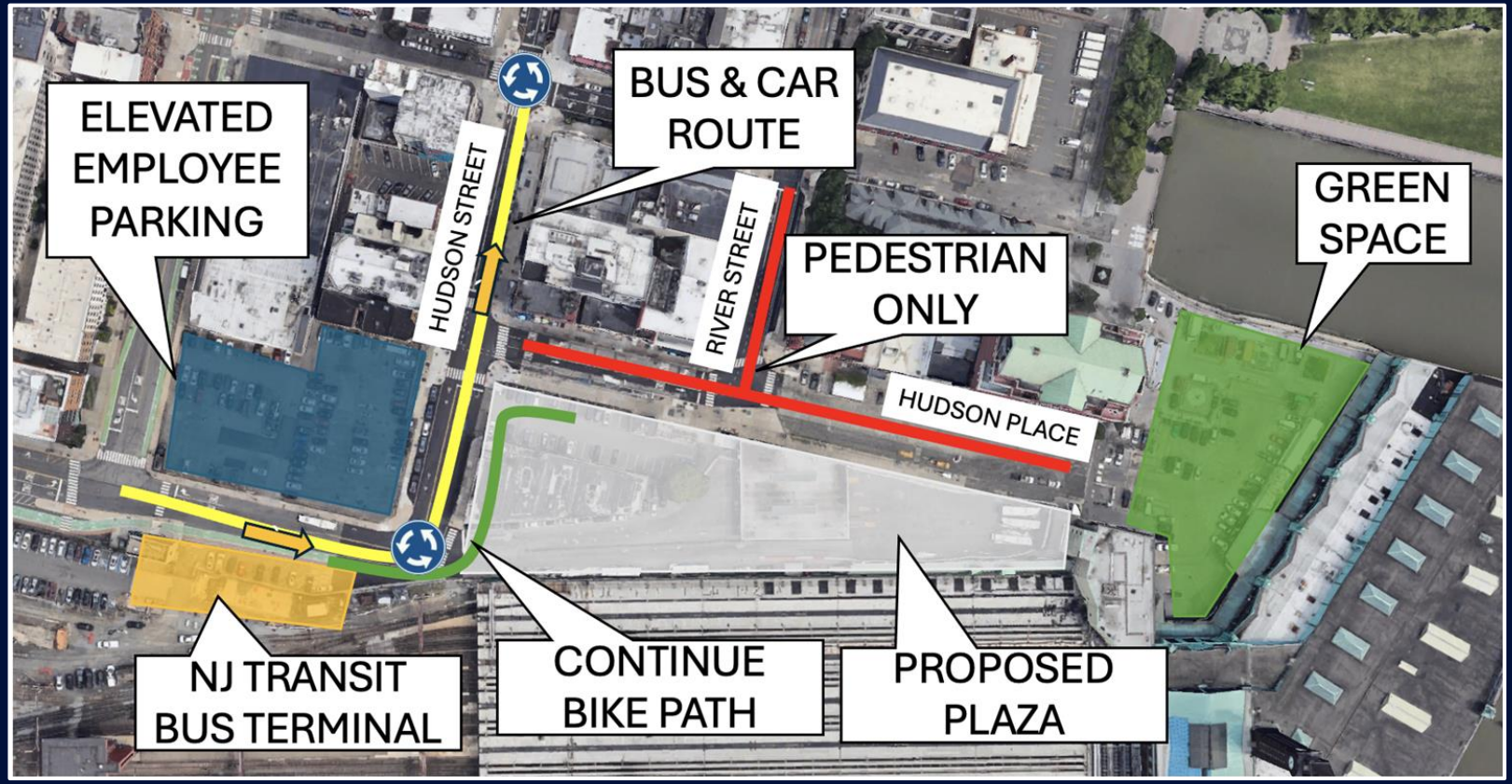
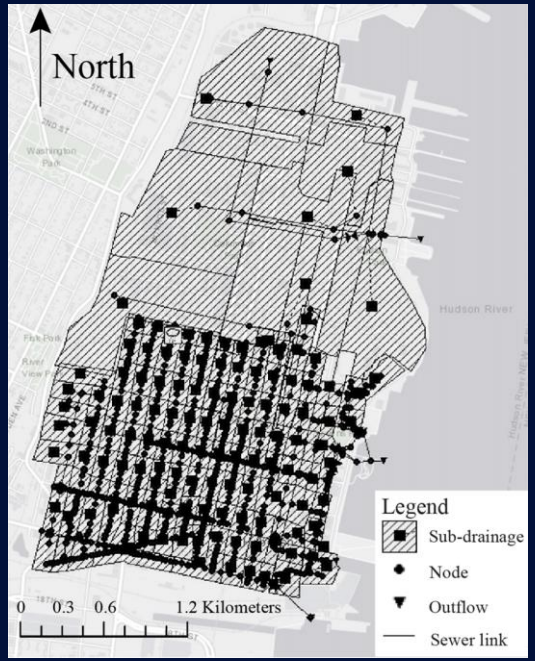


Alternative 3



Hydrologic Design Alternatives

Modify Pipes



Install Basin(s)

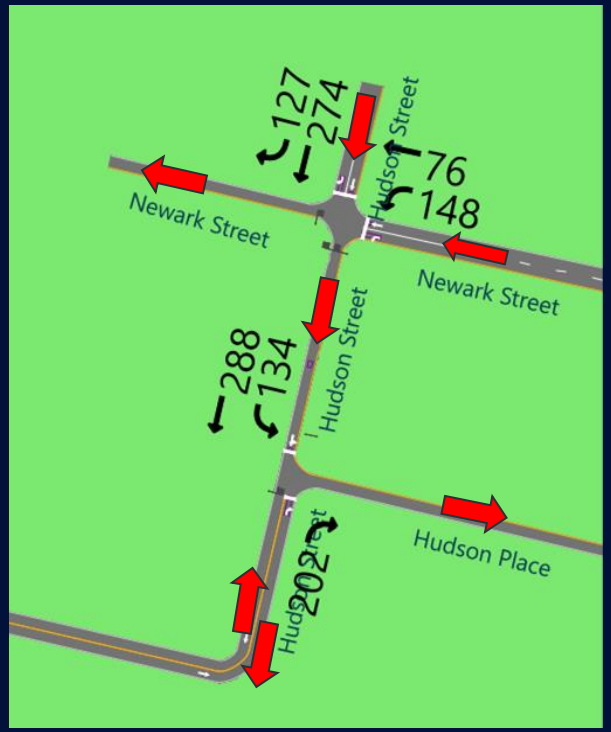
Install Floodwall

Design Selection Matrix

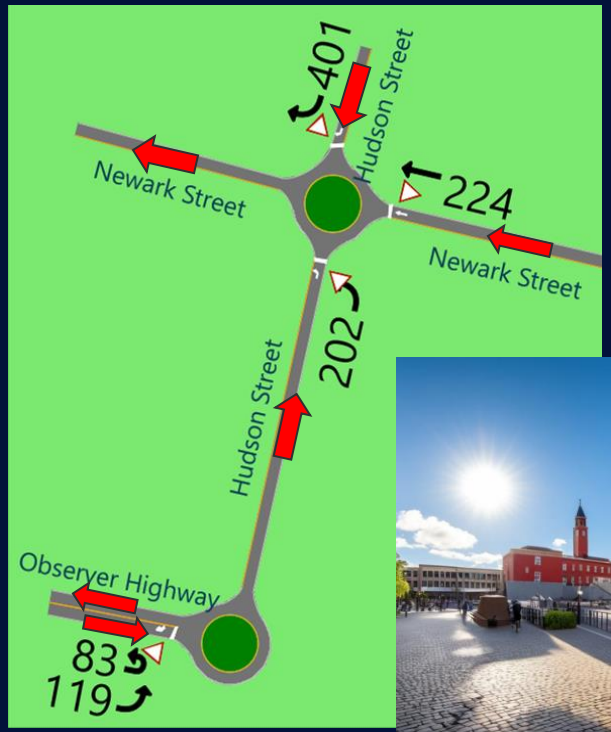
Criteria	Weight	Alternative 1	Alternative 2	Alternative 3
Traffic Flow Improvements	5	3	2	1
Sustainability	4	1	2	3
Pedestrian Accessibility	3	1	2	3
Vehicular Accessibility	2	3	2	1
Constructability	1	2	1	3
Total Score		**30**	**29**	**31**

Final Design Selection

Existing Conditions

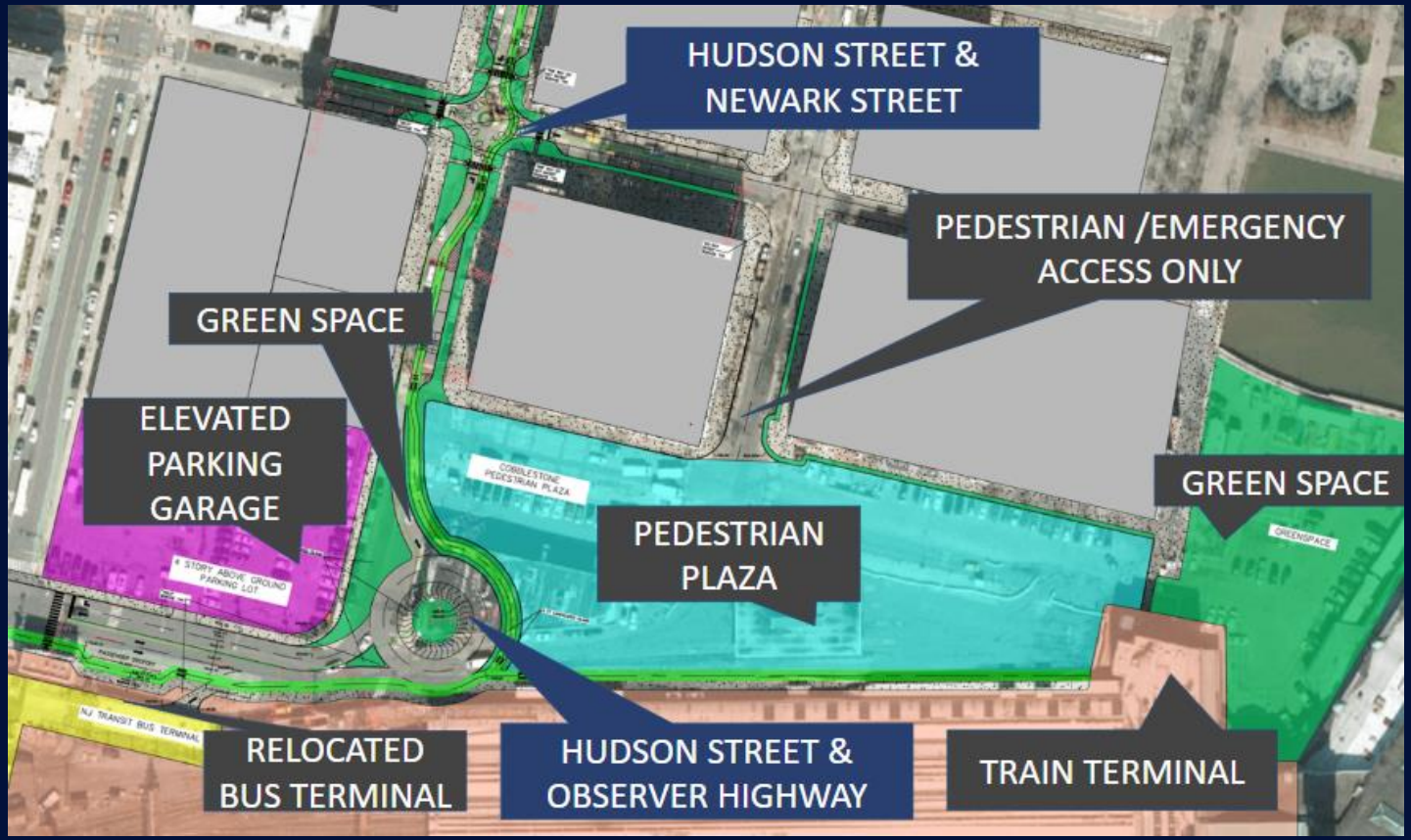


Proposed Geometry

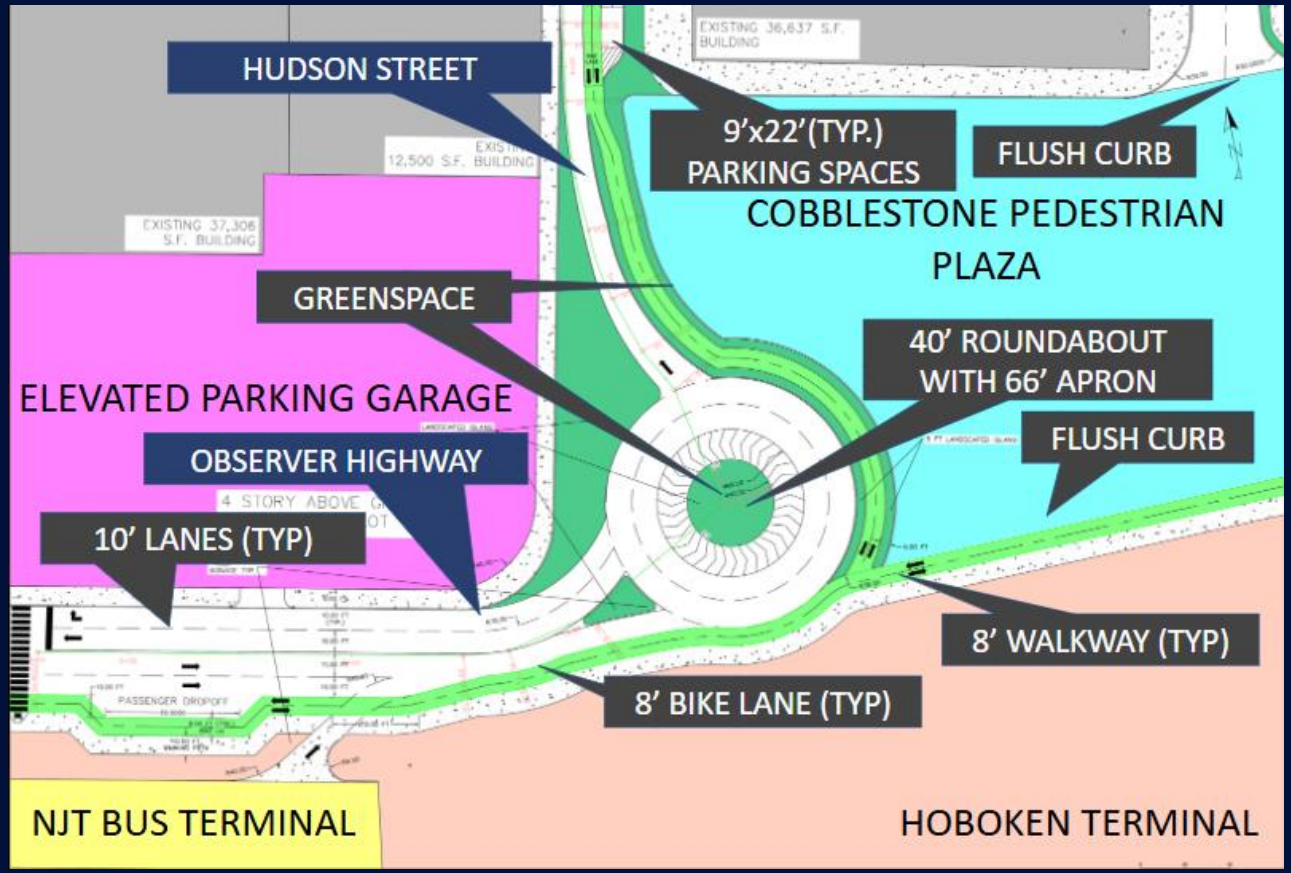


Plaza Rendering

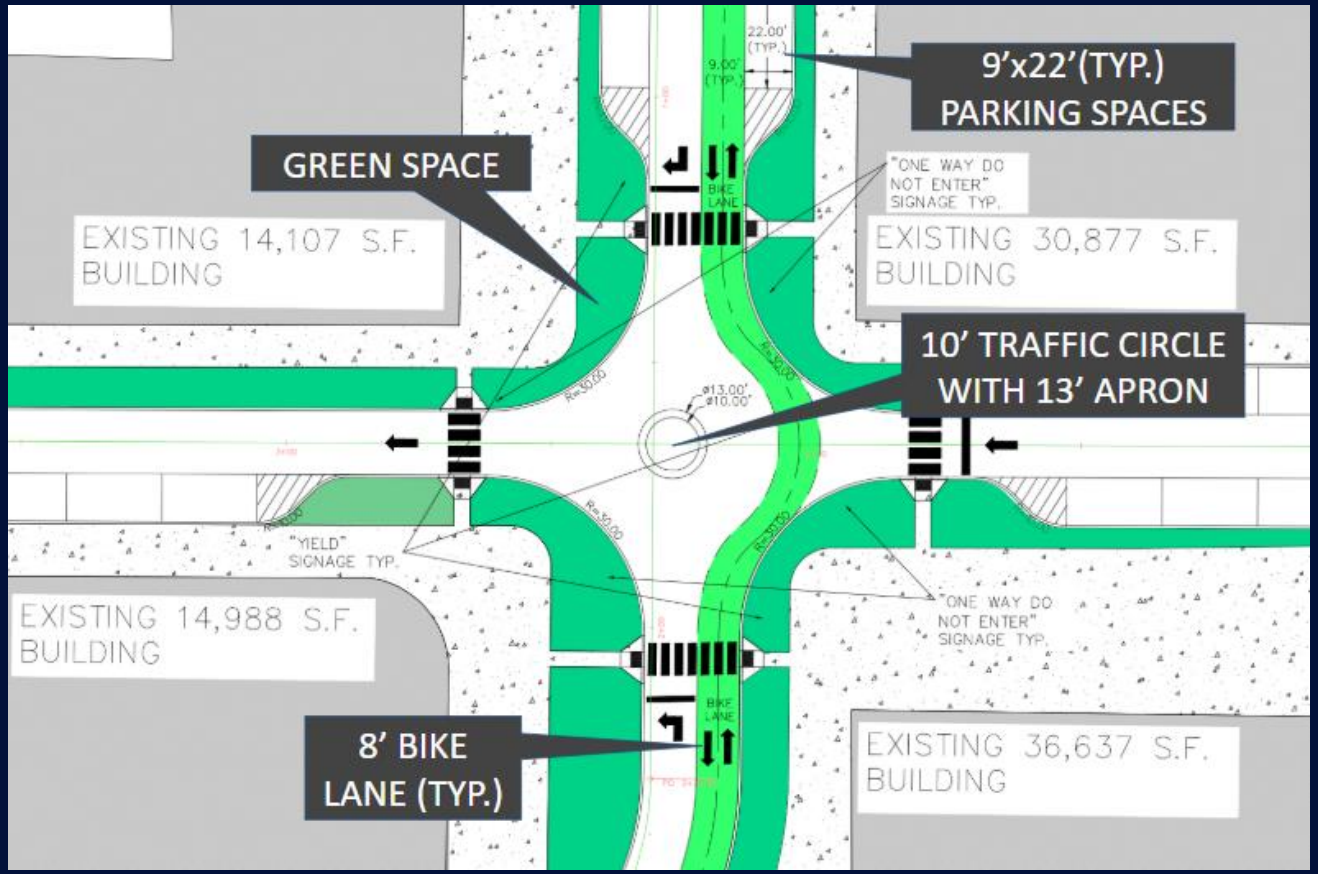
Proposed Site Overview



Observer Hwy. and Hudson St. Redesign

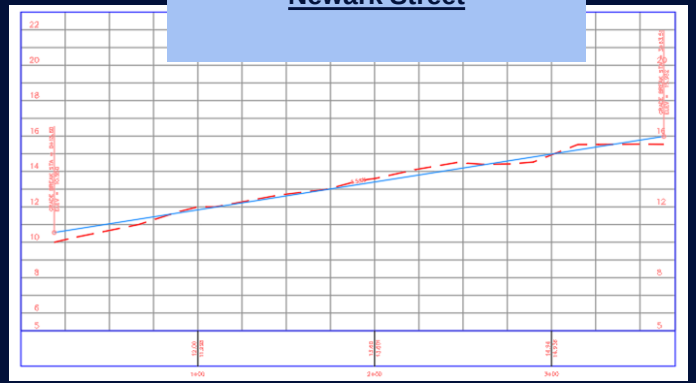


Hudson St. and Newark St. Redesign

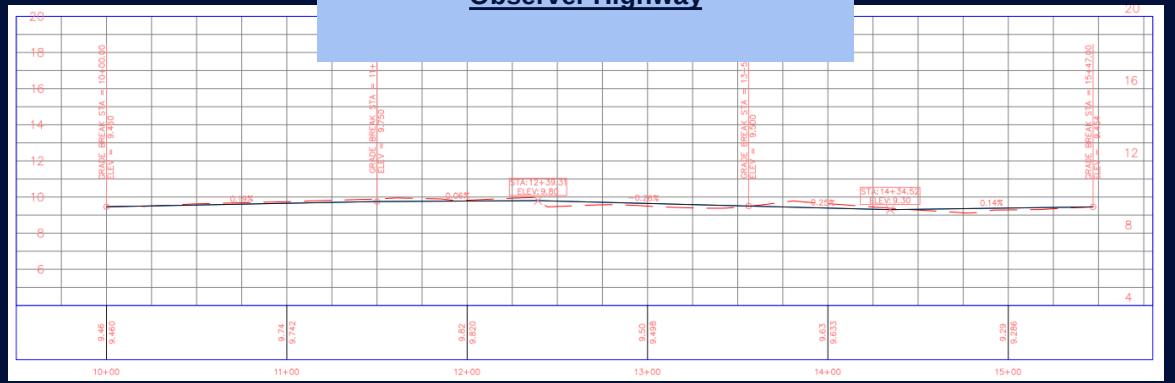


Design Profiles and Cross Sectional View

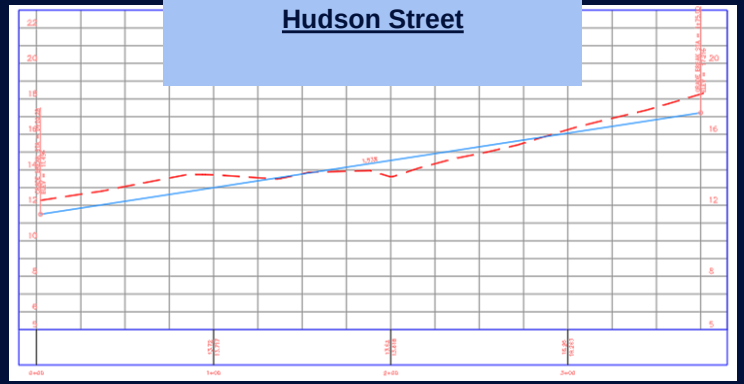
Newark Street



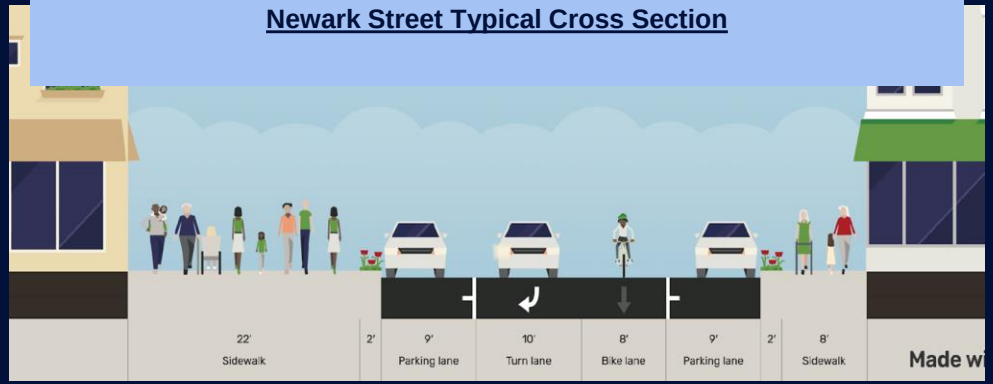
Observer Highway



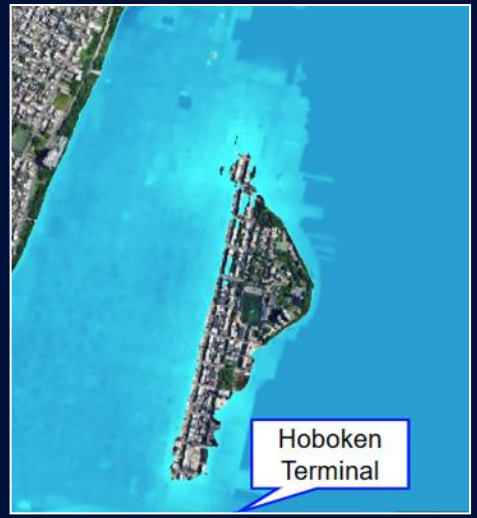
Hudson Street

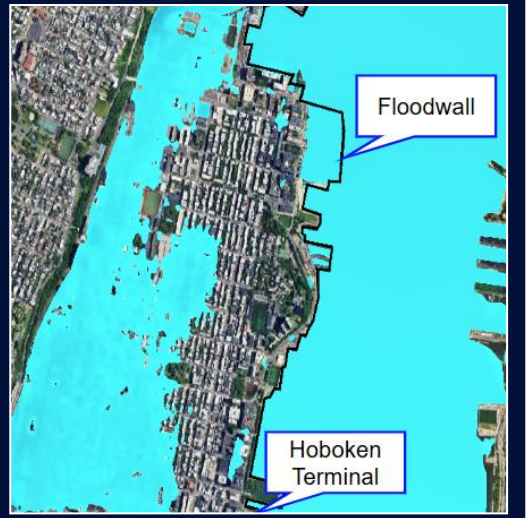


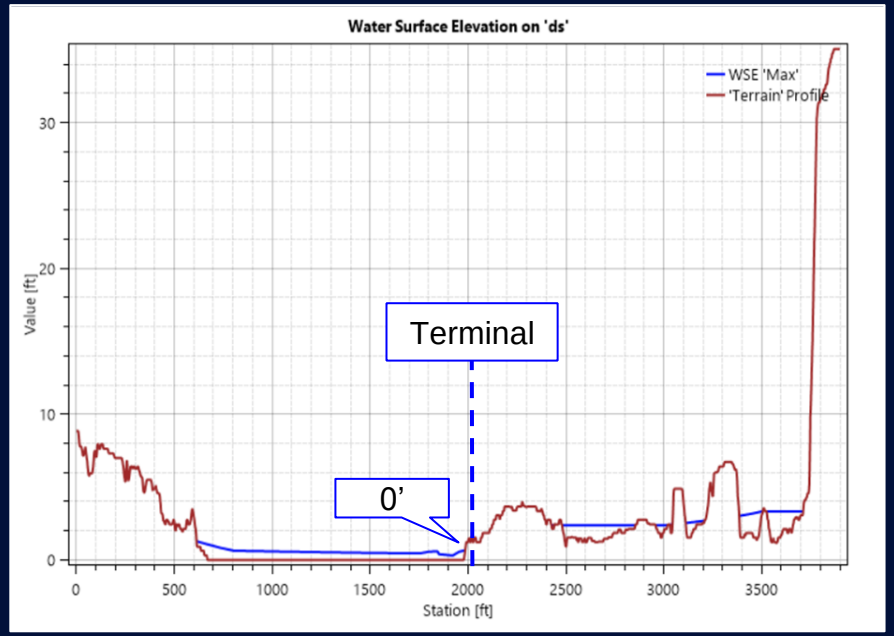
Newark Street Typical Cross Section



Floodwall Design







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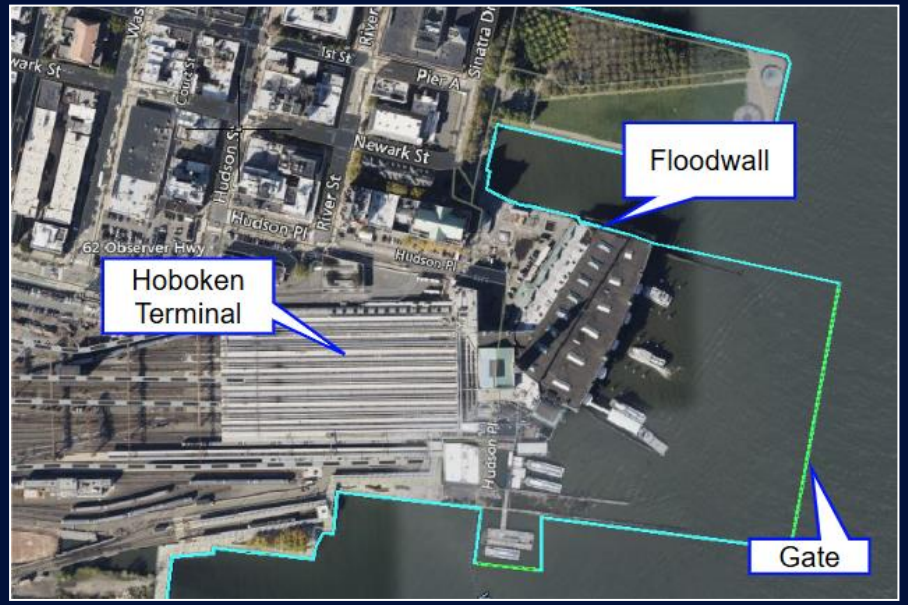
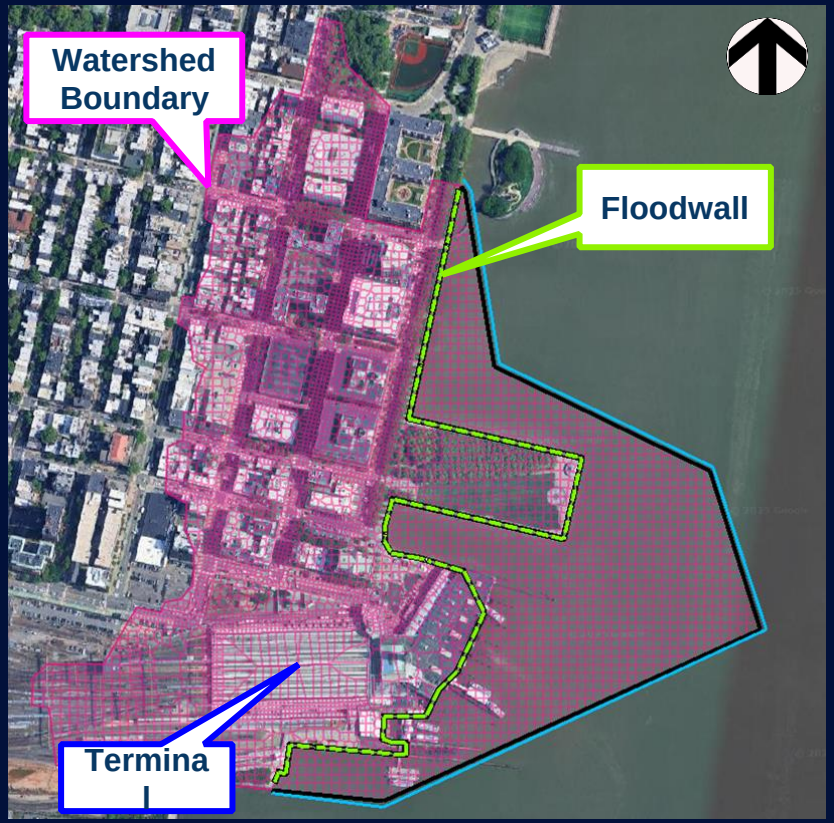


Floodwall Design	
Length	68,036 LF
Width	5 ft
Height	6 ft
QTY. Gates	7

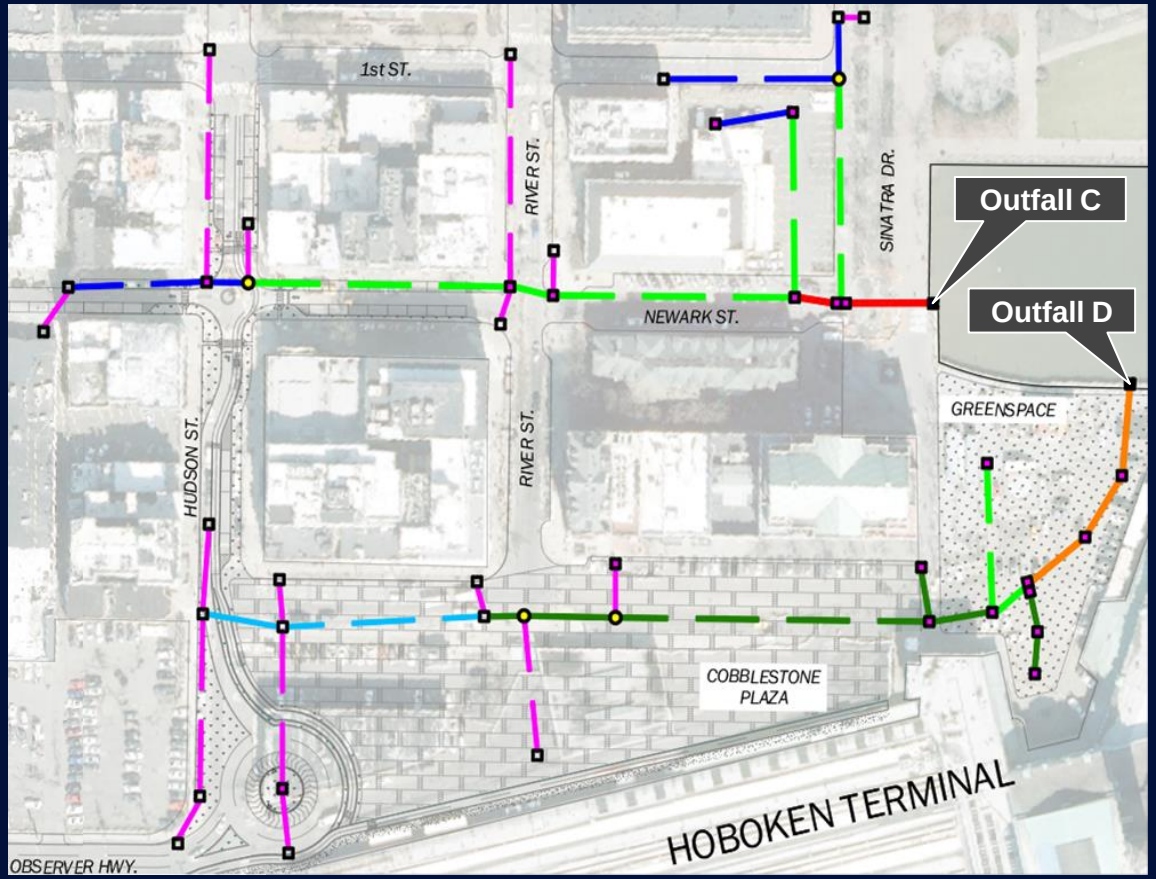
Stormwater Pipe Design Methodology

HEC-RAS 6.7 Model of Conditions



Flood Results (100-yr 24-hr Rainfall)

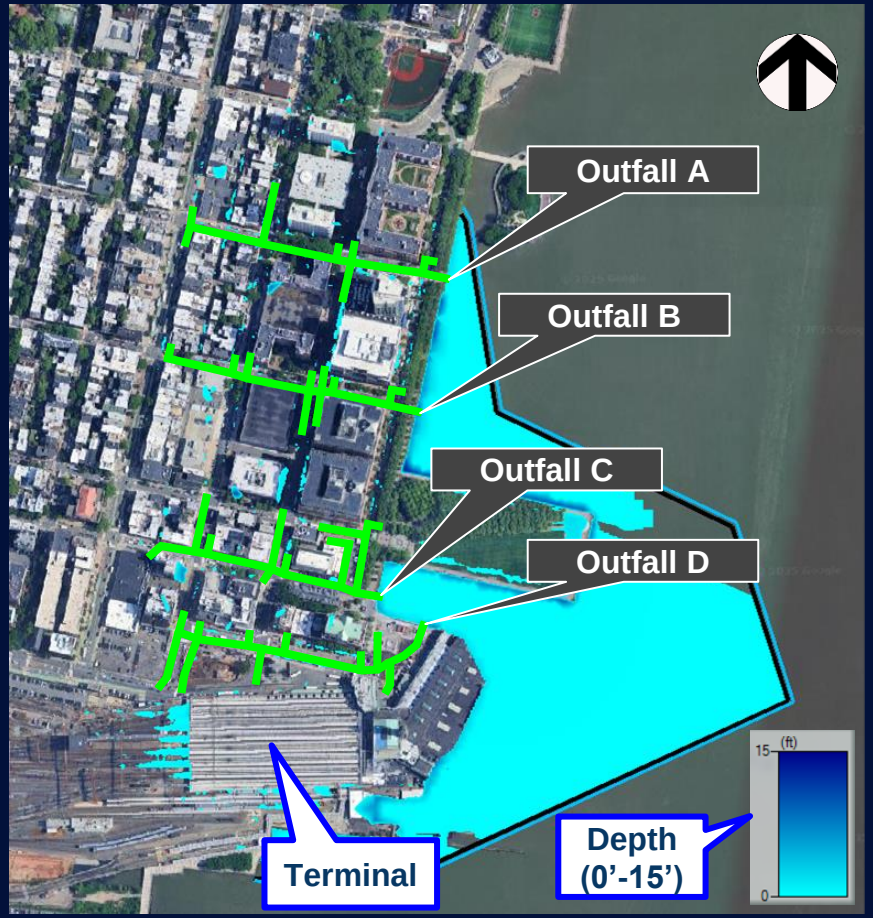
Stormwater Pipe Design Selection



LEGEND

- 18" RCP
- 21" RCP
- 24" RCP
- 27" RCP
- 30" RCP
- 33" RCP
- 36" RCP
- 42" RCP
- B-Inlet
- E-Inlet
- Double E-Inlet
- Manhole
- Outfall

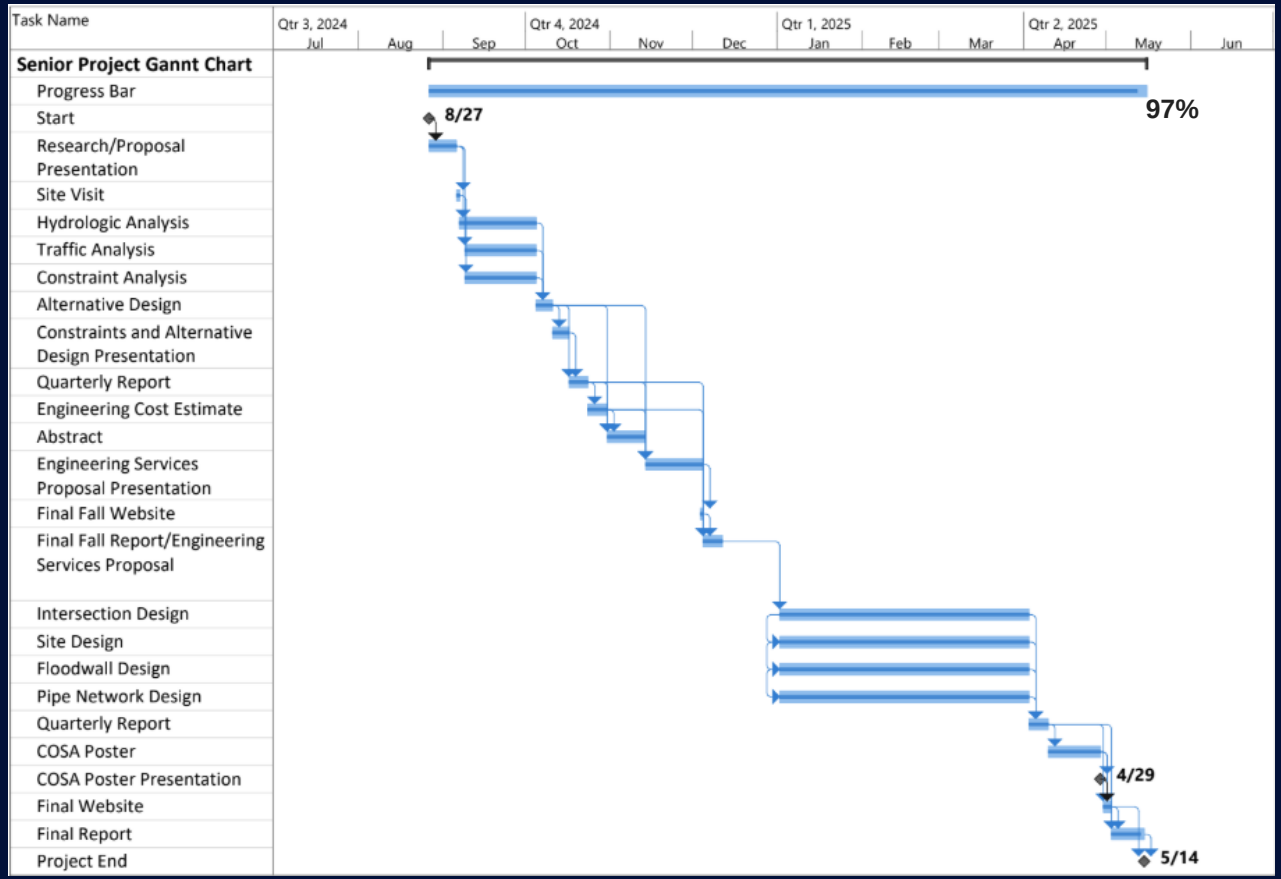
Stormwater Pipe Design Results



Stormwater Pipe Design Summary	
Pipe Size	**QTY**
18" RCP	29
21" RCP	2
24" RCP	16
27" RCP	6
30" RCP	12
33" RCP	4
36" RCP	6
42" RCP	3
Total	**78**

Stormwater Structure Design Summary		
Structure Type	**Structure Size**	**QTY**
B-Inlet (Curb)	48" x 42"	48
E-Inlet (Grate)	48" x 42"	23
Manhole	60" Diam.	8
Outfall A	42" Diam.	1
Outfall B	42" Diam.	1
Outfall C	36" Diam.	1
Outfall D	33" Diam.	1
	Total	**83**

Project Schedule



Engineering Cost - Fall Semester

Task	Dr. Thomas Brennan	Dr. Michael Horst	Kate Neal	Daniel Schiariti	Peter Solomine	Jalissa Colon
	Engineering Dir.	Engineering Dir.	Project Engineer	Design Engineer	Design Engineer	Design Engineer
Fall						
Site Visit	0	0	5	5	5	5
Research	1	0	2	2	2	2
Proposal Presentation	0	0	3	3	3	3
Hydrologic Analysis	0	2	0	15	0	16
Traffic Analysis	1	0	6	0	8	0
Constraint Analysis	0	0	3	1	2	2
Alternative Design	1	1	12	0	10	0
Constraints and Alternative Design Presentation	1	1	6	6	6	6
Design Selection	0	0	2	1	2	0
Quarterly Report	0	0	5	3	3	3
Estimate of Engineering Cost and Schedule	0	0	1	1	1	1
Engineering Services Proposal	2	2	8	8	8	8
Engineeering Services Proposal Presentation	2	1	10	10	10	10
Total						
Total Hours	8	7	63	55	60	56
Hourly Rate	$95.00	$95.00	$35.00	$31.00	$31.00	$31.00
Total Individual Cost	$760.00	$665.00	$2,205.00	$1,705.00	$1,860.00	$1,736.00

Total Cost		$8,931.00
Overhead	150%	$13,397.00
Fixed Fee	10%	$2,233.00
Total		$24,600.00

Engineering Cost - Spring Semester

Task	Dr. Thomas Brennan	Dr. Michael Horst	Kate Neal	Daniel Schiariti	Peter Solomine	Jalissa Colon
	Engineering Dir.	Engineering Dir.	Project Engineer	Design Engineer	Design Engineer	Design Engineer
Spring						
Intersection Design	5	0	8	0	8	0
Transit Terminal Design	5	0	6	0	6	0
Corridor Design	5	0	6	0	6	0
Stormwater Design	0	10	0	10	0	10
Final Report	1	3	10	10	10	10
Final Presentation	1	2	5	5	5	5
Total						
Total Hours	17	15	35	25	35	25
Hourly Rate	$95.00	$95.00	$35.00	$31.00	$31.00	$31.00
Total Individual Cost	$1,615.00	$1,425.00	$1,225.00	$775.00	$1,085.00	$775.00

Total Cost		$6,900.00
Overhead	150%	$10,350.00
Fixed Fee	10%	$1,725.00
Total		$19,000.00
Fall & Spring Total		$43,600.00

Construction Cost Estimate - Water Resources

Material	Quantity	Unit	Unit Price (Materials & Labor)	Cost
FloodWall				
Aluminum panel sheeting, incl. concrete cap and anchor: Coarse Compact Sand, 6' high, 5-6" embedment	68,036	L.F	$202.00	$13,743,272.00
Flap gate - Aluminum, 30" diameter	66	E.A	$3,951.00	$260,766.00
Floodgate - slide gate: steel, self contained., 72" x 72"	7	E.A	$17,375.00	$121,625.00
Storm Drainage				
18" Reinforced Concrete Pipe	1,860	L.F.	$34.00	$63,240.00
21" Reinforced Concrete Pipe	270	L.F.	$39.00	$10,530.00
24" Reinforced Concrete Pipe	1,440	L.F.	$42.00	$60,480.00
27" Reinforced Concrete Pipe	560	L.F.	$59.00	$33,040.00
30" Reinforced Concrete Pipe	1,500	L.F.	$87.00	$130,500.00
33" Reinforced Concrete Pipe	490	L.F.	$100.00	$49,000.00
36" Reinforced Concrete Pipe	550	L.F.	$122.00	$67,100.00
42" Reinforced Concrete Pipe	370	L.F.	$185.00	$68,450.00
Inlet, Type 'B'	48	E.A.	$3,000.00	$144,000.00
Inlet, Type 'E'	23	E.A.	$3,500.00	$80,500.00
Outfall Culvert 33"	1	E.A.	$2,968.00	$2,968.00
Outfall Culvert 36"	1	E.A.	$2,770.00	$2,770.00
Outfall Culvert 42"	2	E.A.	$4,990.00	$9,980.00
Flap gate - Aluminum, 18" diameter	3	E.A.	$2,789.00	$8,367.00
Flap gate - Aluminum, 24" diameter	9	E.A.	$3,362.00	$30,258.00
Flap gate - Aluminum, 27" diameter	3	E.A.	$3,776.00	$11,328.00
Flap gate - Aluminum, 30" diameter	6	E.A.	$3,951.00	$23,706.00
Flap gate - Aluminum, 33" diameter	1	E.A.	$4,509.00	$4,509.00
Flap gate - Aluminum, 36" diameter	2	E.A.	$4,949.00	$9,898.00
Flap gate - Aluminum, 42" diameter	2	E.A.	$5,661.00	$11,322.00
			Total Cost of Flood and Storm Work	$14,947,600

Floodwall:
$14,000,000

Storm Drainage:
$1,000,000

Total Cost (Hydrology):
$15,000,000

Construction Cost Estimate - Site Development

Material		Quantity	Unit	Unit Price (Materials & Labor)	Cost
Site Work					
Pavement Removal		567	S.Y.	$13.00	$7,371.00
Demolition					
	Exitsing Building	360	S.F	$4.80	$1,728.00
	Bus Terminal	9200	S.F	$4.80	$44,160.00
Field Office (Setup and Maitennce)		24	MONTH	$748.98	$17,975.52
Topsoil Import		1260	C.Y	$20.00	$25,200.00
Grass Seed		34000	S.Y	$0.30	$10,200.00
Cobblestone Restoration		1650	S.F.	$18.00	$29,700.00
Bike Rack		2	EA.	$734.56	$1,469.12
Trash and Recycling Receplicle		8	EA.	$56.00	$448.00
Outdoor Table Set		8	EA.	$1,133.00	$9,064.00
Prefabricated Steel Bus Terminl		9200	S.F.	$130.00	$1,196,000.00
4 Story Comcrete Parking Garage (to be designed by others)		41070	S.F.	$73.00	$2,998,110.00
Lightposts		30	E.A.	$3,570.00	$107,100.00
Mobilization		1	L.S.	$415,000.00	$415,000.00
Demobilization and Cleanup		1	L.S.	$150,000.00	$150,000.00
Roadway					
6" Striping (white/yellow/green)		5000	L.F.	$0.30	$1,500.00
4" Hot Mix Asphalt Surface Course		1000	TON	$50.00	$50,000.00
6" Hot Mix Asphalt Base Course		1500	TON	$50.00	$75,000.00
Milling		42000	S.F.	$0.50	$21,000.00
4" Concrete Sidewalk		8044	S.Y.	$23.13	$186,068.00
6" Vertical Curb		3000	L.F.	$9.34	$28,020.00
Flush Curb		750	L.F.	$7.34	$5,505.00
Long Life Epoxy ADA Traffic Symbo		3	E.A.	$21.03	$63.09
Parking and Regulatory Signage					
	"Yield"	6	E.A.	$52.00	$312.00
	"Do Not Enter"	4	E.A.	$69.00	$276.00
	Other Misc.	6	E.A.	$69.00	$414.00
Detectable Warning Surface		10	E.A.	$81.00	$810.00
				Total Cost of Roadway and Site Work	$5,382,500.00
				Grand Total	$20,300,000.00

Site Work:
$5,000,000

Roadway:
$300,000

Total Cost (Transportation)
$5,300,000

Grand Total
$20,300,000

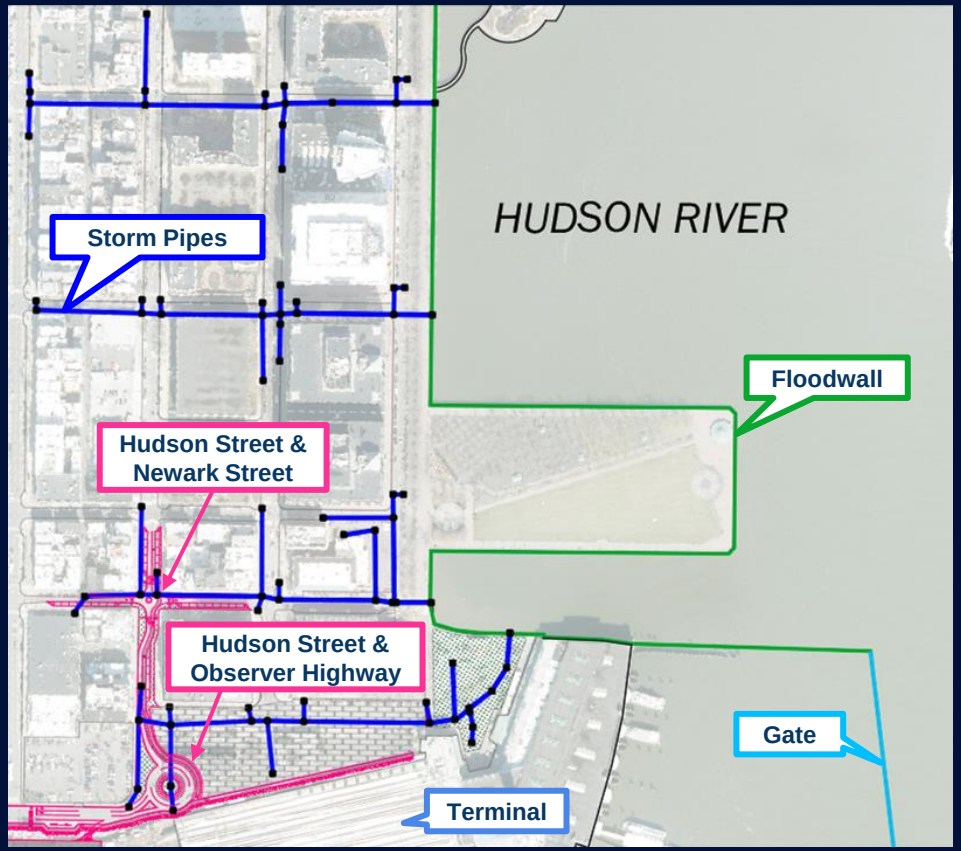
Project Summary

Key Solutions:

- Pedestrian plaza with improved corridor geometry
- Floodwall installation
- Storm pipe improvements

Final Cost Estimates

- Engineering Services: $43,600
- Construction: $20,300,000



Questions?