APPENDIX E

Water and Sewer Analysis

E.1 Near Surface Isolation Analysis

Impacts to Adjacent Areas – SUMMARY RESULTS TABLE (1 of 7)

Tidal Boundary	NOAA 2Q Rainfall Storm	SBPCR Alternative	North of SBPCR			FiDi		
			Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)	Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)
MHW (2.5 ft NAVD88)	5yr-24hr	No isolation	NO STREET FLOODING					
		NSI						
	2yr-24hr	No isolation						
		NSI						
	5yr-6hr	No isolation						
		NSI						
	2yr-6hr	No isolation						
		NSI						

Impacts to Adjacent Areas – SUMMARY RESULTS TABLE (2 of 7)

Tidal Boundary	Regulator	Max HGL at Regulators (ft NAVD88)							
		5yr-24hr		2yr-24hr		5yr-6hr		2yr-6hr	
		No Isolation	NSI	No Isolation	NSI	No Isolation	NSI	No Isolation	NSI
MHW (2.5 ft NAVD88)	R-M01	2.92	2.92	2.79	2.79	3.40	3.41	3.15	3.15
	R-M02	2.67	2.67	2.62	2.62	2.87	2.88	2.77	2.77
	R-M03	2.68	2.69	2.62	2.62	2.95	2.97	2.81	2.83
	R-M04	2.75	2.76	2.67	2.68	3.10	3.11	2.92	2.93
	R-M05	2.60	2.61	2.56	2.56	2.81	2.82	2.70	2.71
	R-M06	2.58	2.58	2.55	2.55	2.71	2.70	2.65	2.64
	R-M07	2.58	2.56	2.55	2.54	2.67	2.64	2.63	2.60
	R-M08	2.58	2.55	2.56	2.53	2.70	2.64	2.64	2.60
	R-M09	2.60	2.57	2.57	2.55	2.71	2.66	2.66	2.62
	R-M10	2.72	2.73	2.65	2.65	3.04	3.07	2.87	2.89
	R-M11	2.50	2.50	2.49	2.49	2.53	2.53	2.51	2.51
	R-M12	2.50	2.50	2.49	2.49	2.53	2.54	2.52	2.52
	R-M13	2.67	2.67	2.62	2.63	2.81	2.81	2.75	2.75
	R-M16	2.91	2.91	2.83	2.83	3.27	3.30	3.06	3.07

Impacts to Adjacent Areas – SUMMARY RESULTS TABLE (3 of 7)

Tidal Boundary	NOAA 2Q Rainfall Storm	SBPCR Alternative	North of SBPCR			FiDi		
			Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)	Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)
100yr Surge minus 6 ft (5.4 ft NAVD88)	5yr-24hr	No isolation	0.20	1.08	5.60	1.05	4.82	5.44
		NSI	0.19	1.07	5.59	1.04	4.80	5.44
	2yr-24hr	No isolation	0.17	1.01	5.54	0.88	4.34	5.41
		NSI	0.17	0.99	5.54	0.88	4.33	5.41
	5yr-6hr	No isolation	0.24	1.19	5.75	1.33	5.54	5.51
		NSI	0.24	1.18	5.75	1.33	5.53	5.50
	2yr-6hr	No isolation	0.21	1.12	5.65	1.18	5.16	5.47
		NSI	0.21	1.11	5.65	1.17	5.13	5.46

Impacts to Adjacent Areas – SUMMARY RESULTS TABLE (4 of 7)

Tidal Boundary	Regulator	Max HGL at Regulators (ft NAVD88)							
		5yr-24hr		2yr-24hr		5yr-6hr		2yr-6hr	
		No Isolation	NSI	No Isolation	NSI	No Isolation	NSI	No Isolation	NSI
100yr Surge minus 6 ft (5.4 ft NAVD88)	R-M01	5.60	5.59	5.54	5.54	5.75	5.75	5.65	5.65
	R-M02	5.47	5.47	5.45	5.45	5.52	5.52	5.49	5.49
	R-M03	5.49	5.48	5.46	5.46	5.55	5.55	5.51	5.51
	R-M04	5.53	5.53	5.50	5.49	5.63	5.63	5.57	5.56
	R-M05	5.25	5.23	5.18	5.17	5.34	5.33	5.29	5.28
	R-M06	5.39	5.40	5.38	5.38	5.41	5.42	5.40	5.40
	R-M07	5.41	5.42	5.40	5.40	5.44	5.45	5.42	5.43
	R-M08	5.42	5.45	5.41	5.43	5.45	5.47	5.43	5.46
	R-M09	5.44	5.46	5.42	5.44	5.46	5.49	5.45	5.47
	R-M10	5.44	5.44	5.41	5.41	5.51	5.50	5.47	5.46
	R-M11	5.39	5.38	5.37	5.37	5.39	5.39	5.39	5.39
	R-M12	5.39	5.39	5.38	5.37	5.41	5.41	5.40	5.40
	R-M13	5.11	5.10	5.04	5.03	5.22	5.22	5.16	5.15
	R-M16	4.76	4.76	4.66	4.66	4.91	4.91	4.83	4.83

Impacts to Adjacent Areas – SUMMARY RESULTS TABLE (5 of 7)

Tidal Boundary	NOAA 2Q Rainfall Storm	SBPCR Alternative	North of SBPCR			FiDi		
			Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)	Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)
100yr Surge minus 2 ft (9.4 ft NAVD88)	5yr-24hr	No isolation	25.46	52.98	9.87	56.98	60.53	10.05
		NSI	25.52	52.46	9.87	56.98	60.53	10.05
	2yr-24hr	No isolation	25.15	51.95	9.87	56.97	60.53	10.05
		NSI	25.21	51.81	9.87	56.98	60.53	10.05
	5yr-6hr	No isolation	26.02	54.72	9.88	57.00	60.54	10.05
		NSI	26.08	53.98	9.88	57.00	60.54	10.05
	2yr-6hr	No isolation	25.71	53.81	9.87	56.99	60.54	10.05
		NSI	25.77	52.99	9.88	56.99	60.54	10.05

Impacts to Adjacent Areas – SUMMARY RESULTS TABLE (6 of 7)

Tidal Boundary	Regulator	Max HGL at Regulators (ft NAVD88)							
		5yr-24hr		2yr-24hr		5yr-6hr		2yr-6hr	
		No Isolation	NSI	No Isolation	NSI	No Isolation	NSI	No Isolation	NSI
100yr Surge minus 2 ft (9.4 ft NAVD88)	R-M01	8.87	8.87	8.80	8.80	9.02	9.02	8.93	8.93
	R-M02	9.22	9.22	9.12	9.12	9.39	9.39	9.31	9.31
	R-M03	9.87	9.87	9.87	9.87	9.88	9.88	9.87	9.88
	R-M04	8.80	8.87	8.68	8.76	9.03	9.10	8.90	8.96
	R-M05	7.51	7.77	7.37	7.65	7.75	7.97	7.61	7.86
	R-M06	7.22	7.07	7.16	7.01	7.34	7.16	7.27	7.10
	R-M07	7.26	7.06	7.20	7.01	7.37	7.16	7.30	7.09
	R-M08	7.69	6.84	7.57	6.79	7.73	6.94	7.75	6.88
	R-M09	7.64	6.84	7.53	6.79	7.69	6.93	7.68	6.88
	R-M10	9.45	9.45	9.45	9.45	9.45	9.45	9.45	9.45
	R-M11	9.47	9.47	9.47	9.47	9.47	9.47	9.47	9.47
	R-M12	9.54	9.56	9.54	9.54	9.56	9.56	9.54	9.54
	R-M13	9.65	9.65	9.65	9.65	9.65	9.65	9.65	9.65
	R-M16	10.05	10.05	10.05	10.05	10.05	10.05	10.05	10.05

Impacts to Adjacent Areas – SUMMARY RESULTS TABLE (7 of 7)

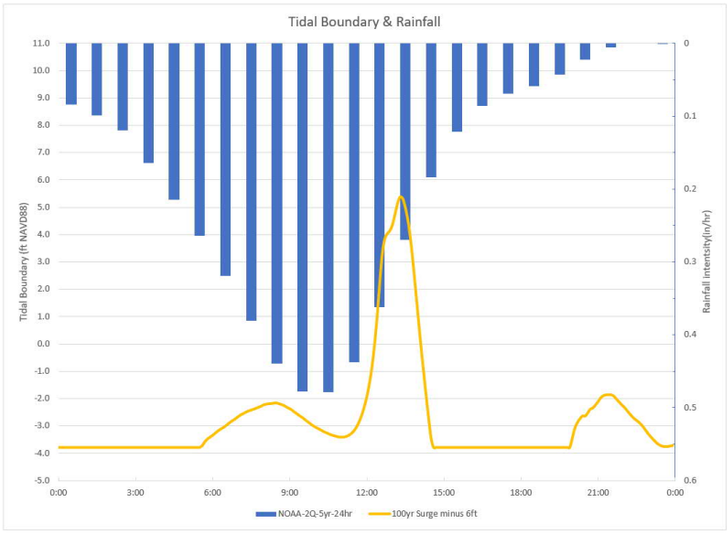
System-wide (1) (2)	NOAA 2Q Rainfall Storm	SBPCR Alternative	CSO Volume (MG) (3)		
			MHW (2.5 ft NAVD88)	100yr Surge minus 6 ft (5.3 ft NAVD88)	100yr Surge minus 2 ft (9.3 ft NAVD88)
	5yr-24hr	No isolation	137.2	140.8	150.5
		NSI	137.0	140.8	149.9
	2yr-24hr	No isolation	108.8	112.4	123.8
		NSI	108.8	112.3	123.2
	5yr-6hr	No isolation	96.1	99.6	106.5
		NSI	96.2	99.5	106.0
	2yr-6hr	No isolation	79.7	83.2	92.0
		NSI	79.8	83.0	91.6

1) Regulators M1 through M16
2) Excludes ESCR/BMCR regulators as corresponding drainage area is hydraulically isolated through the BMCR interceptor isolation gate and coastal barrier.
3) Computed for the period between 13 hours ahead of peak surge and the end of the corresponding rain event.

100yr minus 6ft Coastal

Impacts to Adjacent Areas - 100yr minus 6ft Coastal/5yr-24hr Rain

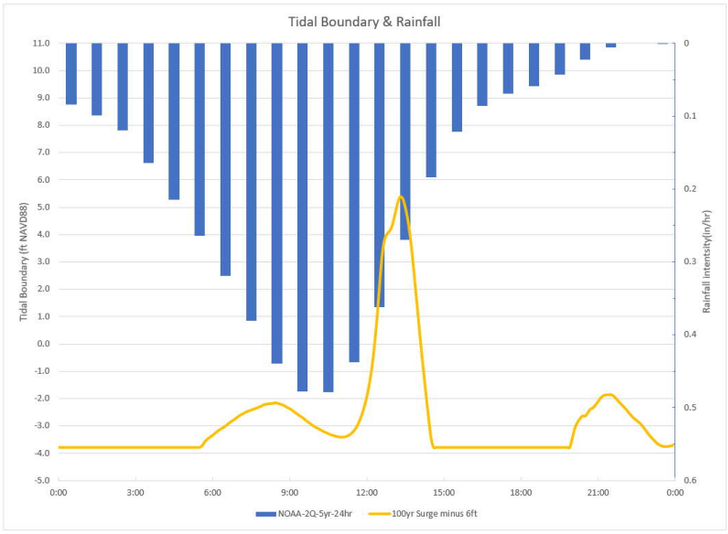
Alternative	North of SBPCR		
	Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)
No isolation	0.20	1.08	5.60
NSI	0.19	1.07	5.59
NSI/No isolation % difference	-5	-1	0



NO SBPCR ISOLATION SCENARIO SHOWN

Impacts to Adjacent Areas - 100yr minus 6ft Coastal/5yr-24hr Rain

Alternative	FiDi		
	Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)
No isolation	1.05	4.82	5.44
NSI	1.04	4.80	5.44
NSI/No isolation % difference	-1	0	0



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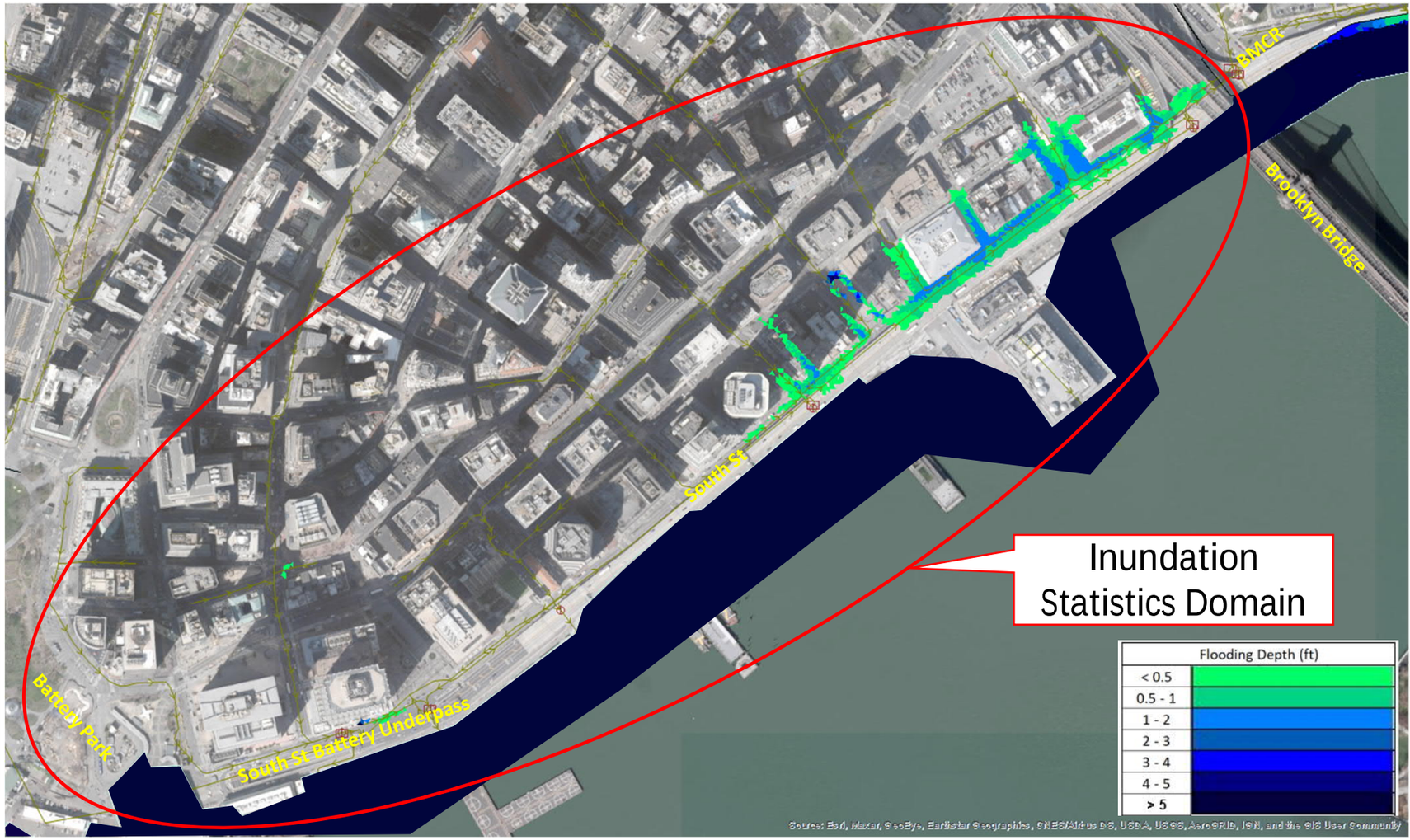
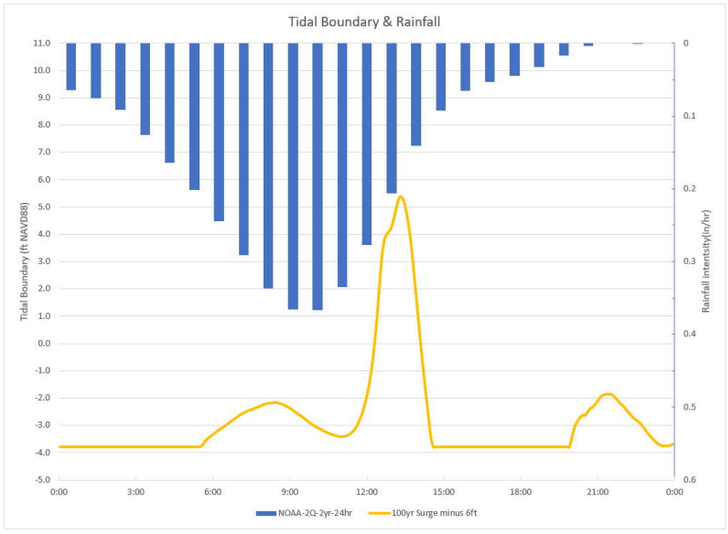


Impacts to Adjacent Areas - 100yr minus 6ft Coastal/2yr-24hr Rain

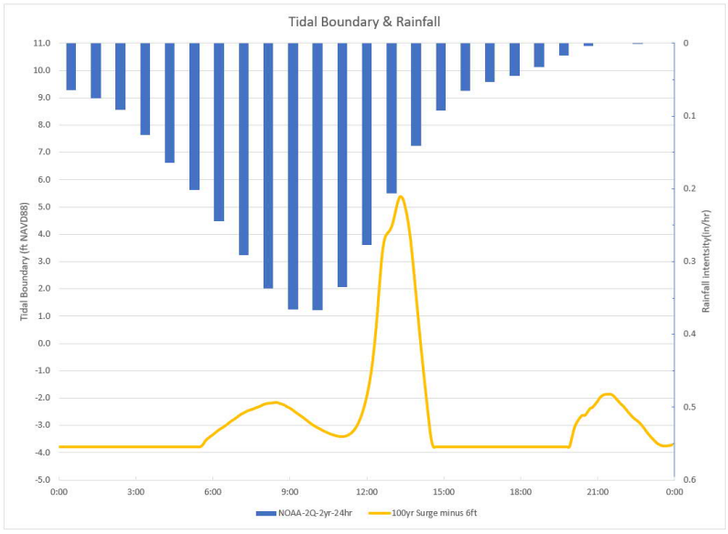
Alternative	North of SBPCR		
	Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)
No isolation	0.17	1.01	5.54
NSI	0.17	0.99	5.54
NSI/No isolation % difference	0	-2	0



NO SBPCR ISOLATION SCENARIO SHOWN

Impacts to Adjacent Areas - 100yr minus 6ft Coastal/2yr-24hr Rain

Alternative	FiDi		
	Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)
No isolation	0.88	4.34	5.41
NSI	0.88	4.33	5.41
NSI/No isolation % difference	0	0	0



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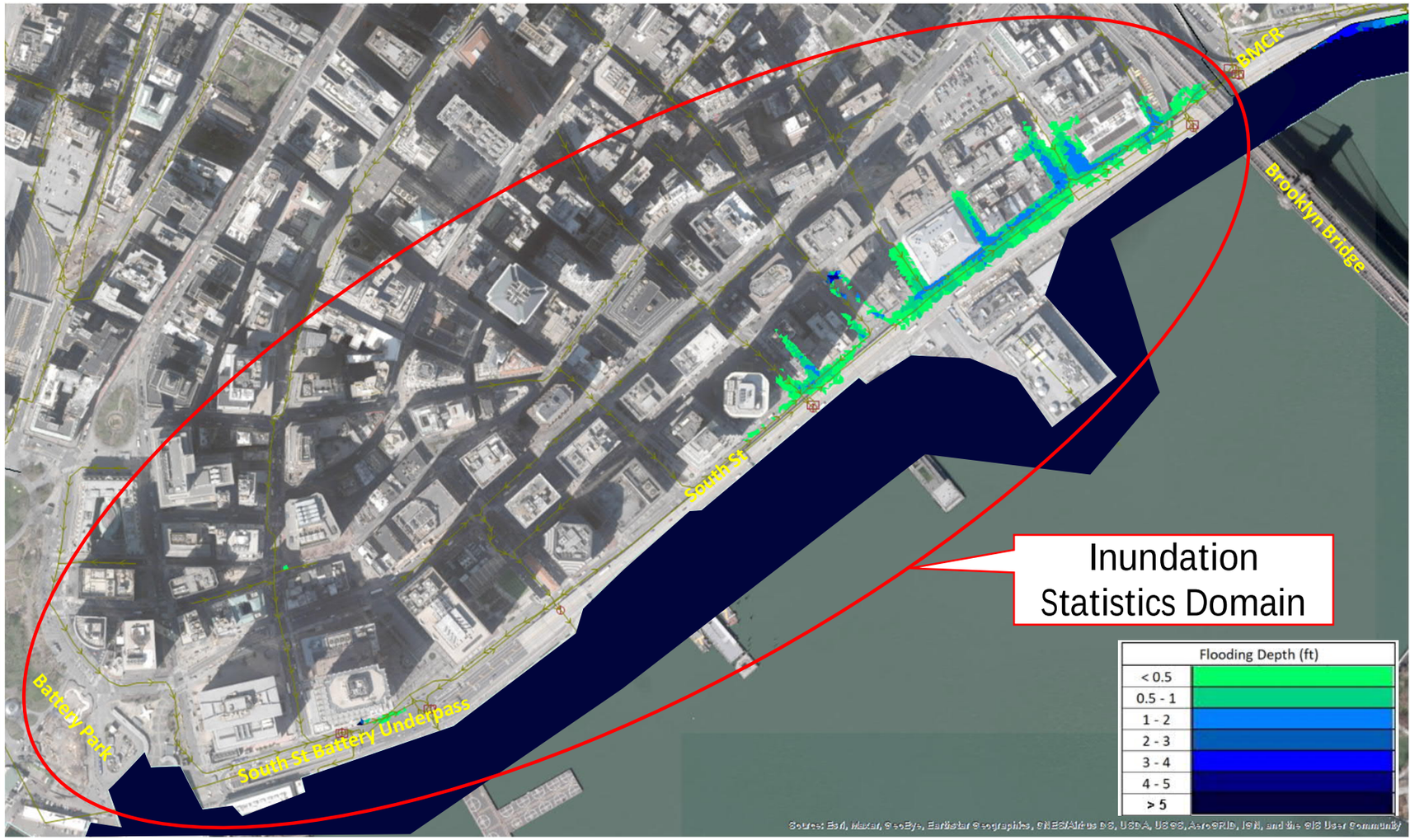
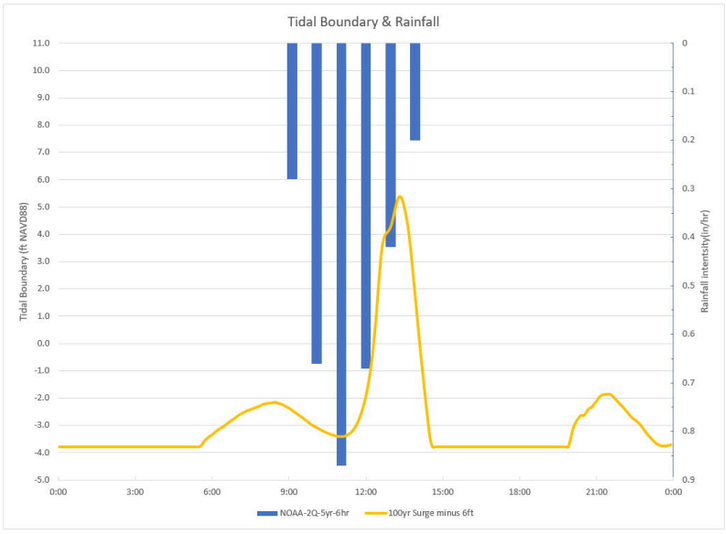


Impacts to Adjacent Areas - 100yr minus 6ft Coastal/5yr-6hr Rain

Alternative	North of SBPCR		
	Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)
No isolation	0.24	1.19	5.75
NSI	0.24	1.18	5.75
NSI/No isolation % difference	0	-1	0



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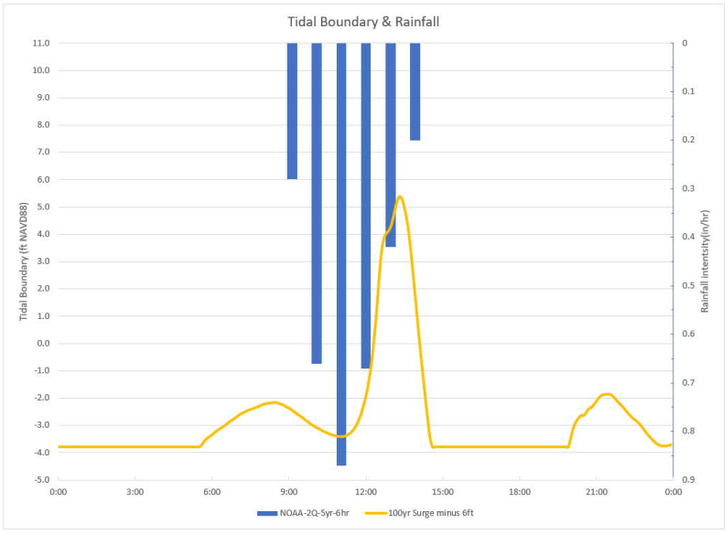
Impacts to Adjacent Areas - 100yr minus 6ft Coastal/5yr-6hr Rain

Alternative	FiDi		
	Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)
No isolation	1.33	5.54	5.51
NSI	1.33	5.53	5.50
NSI/No isolation % difference	0	0	0



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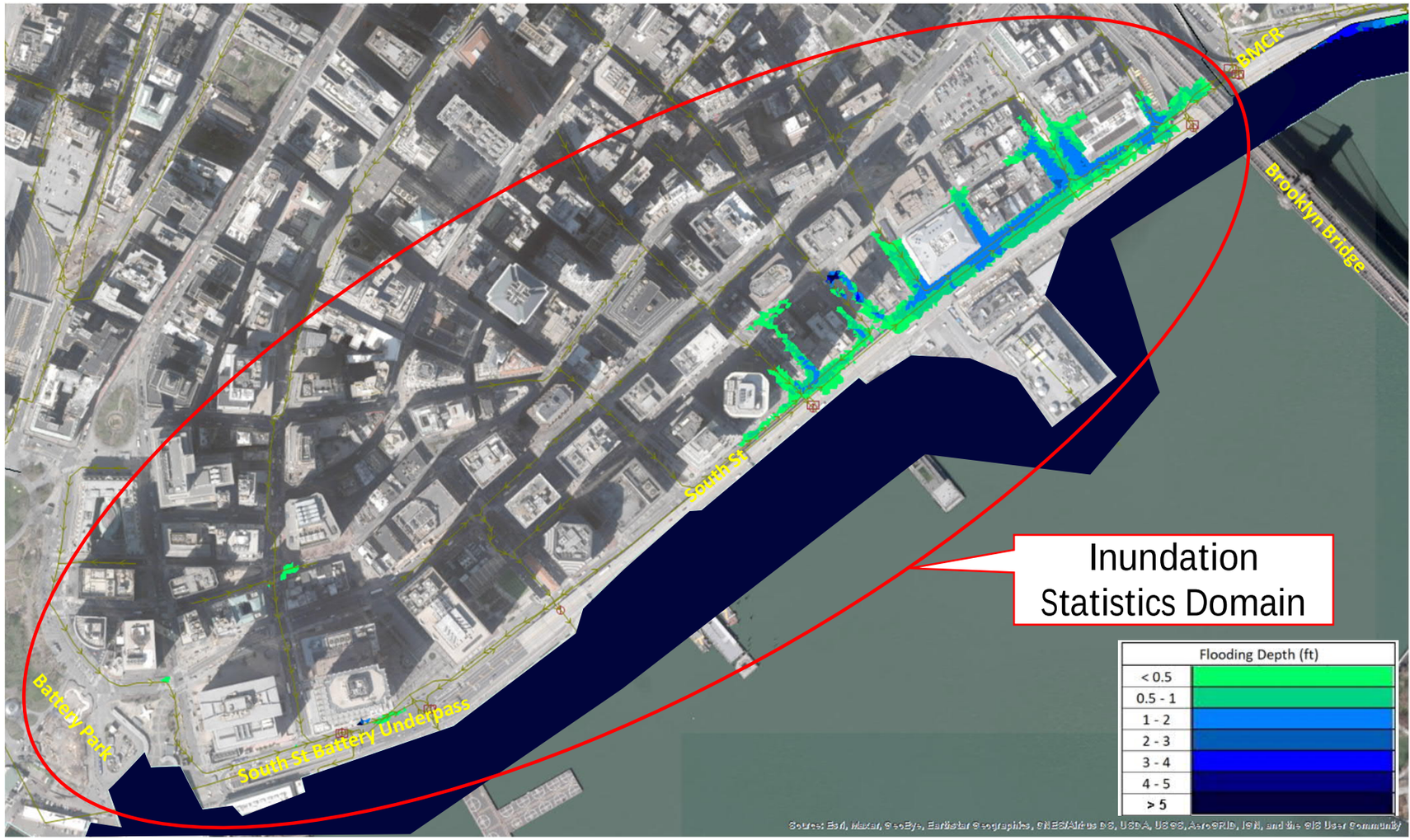
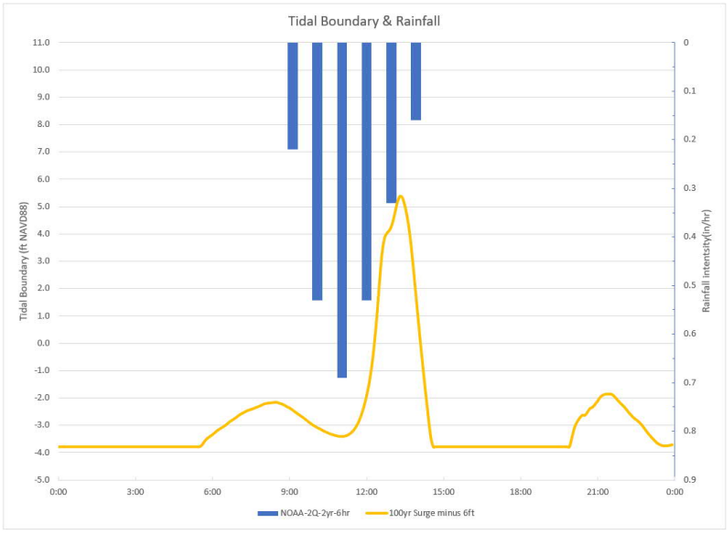


Impacts to Adjacent Areas - 100yr minus 6ft Coastal/2yr-6hr Rain

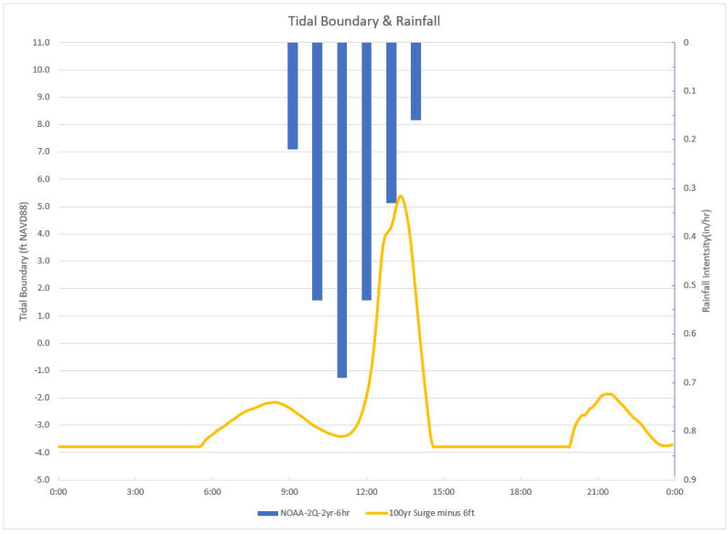
Alternative	North of SBPCR		
	Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)
No isolation	0.21	1.12	5.65
NSI	0.21	1.11	5.65
NSI/No isolation % difference	0	-1	0



NO SBPCR ISOLATION SCENARIO SHOWN

Impacts to Adjacent Areas - 100yr minus 6ft Coastal/2yr-6hr Rain

Alternative	FiDi		
	Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)
No isolation	1.18	5.16	5.47
NSI	1.17	5.13	5.46
NSI/No isolation % difference	-1	-1	0



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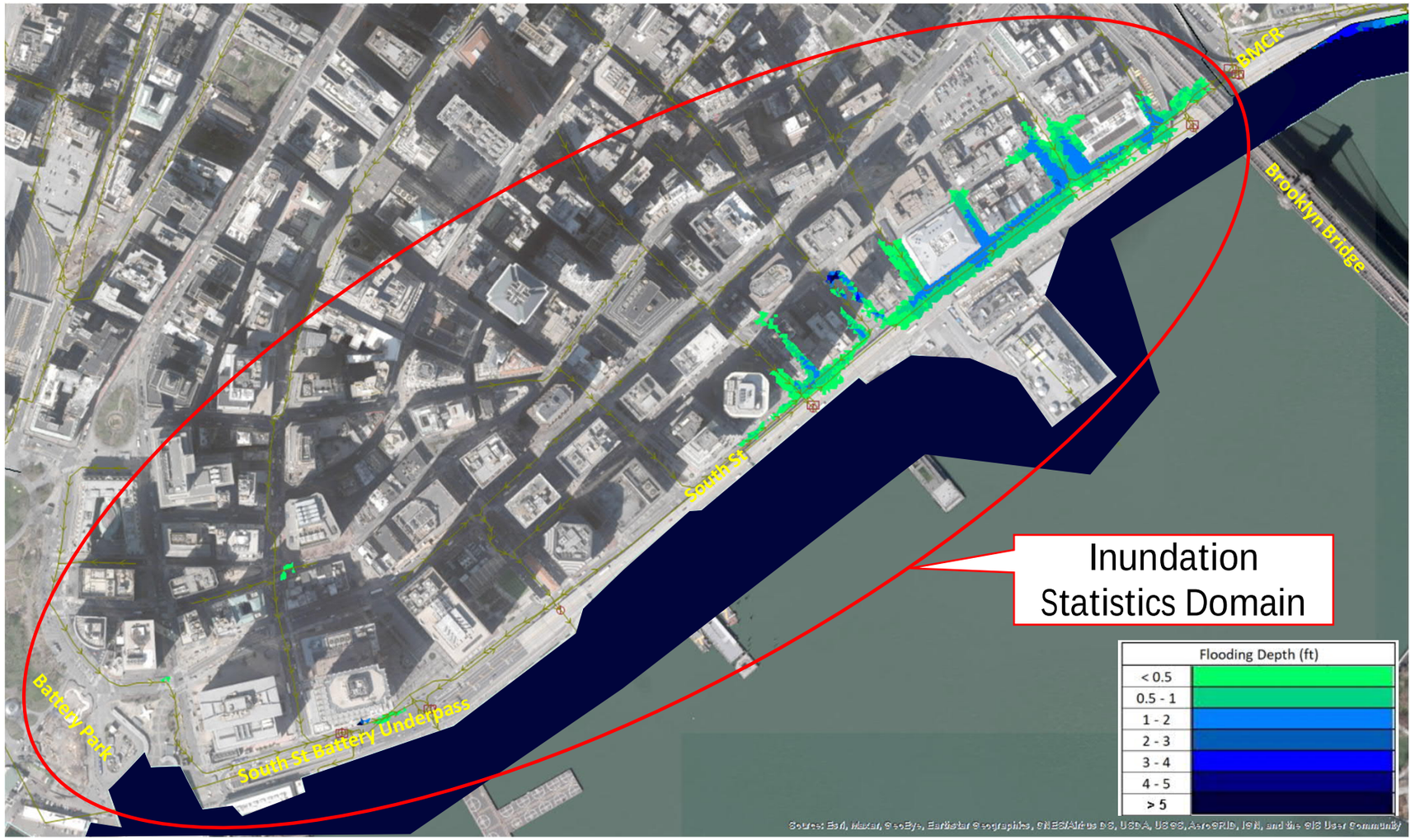
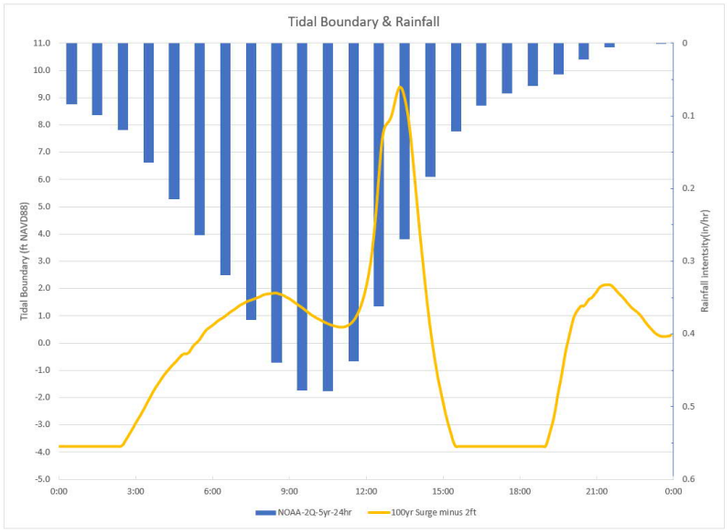


100yr minus 2ft Coastal

Impacts to Adjacent Areas - 100yr minus 2ft Coastal/5yr-24hr Rain

Alternative	North of SBPCR		
	Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)
No isolation	25.46	52.98	9.87
NSI	25.52	52.46	9.87
NSI/No isolation % difference	+1	+1	0



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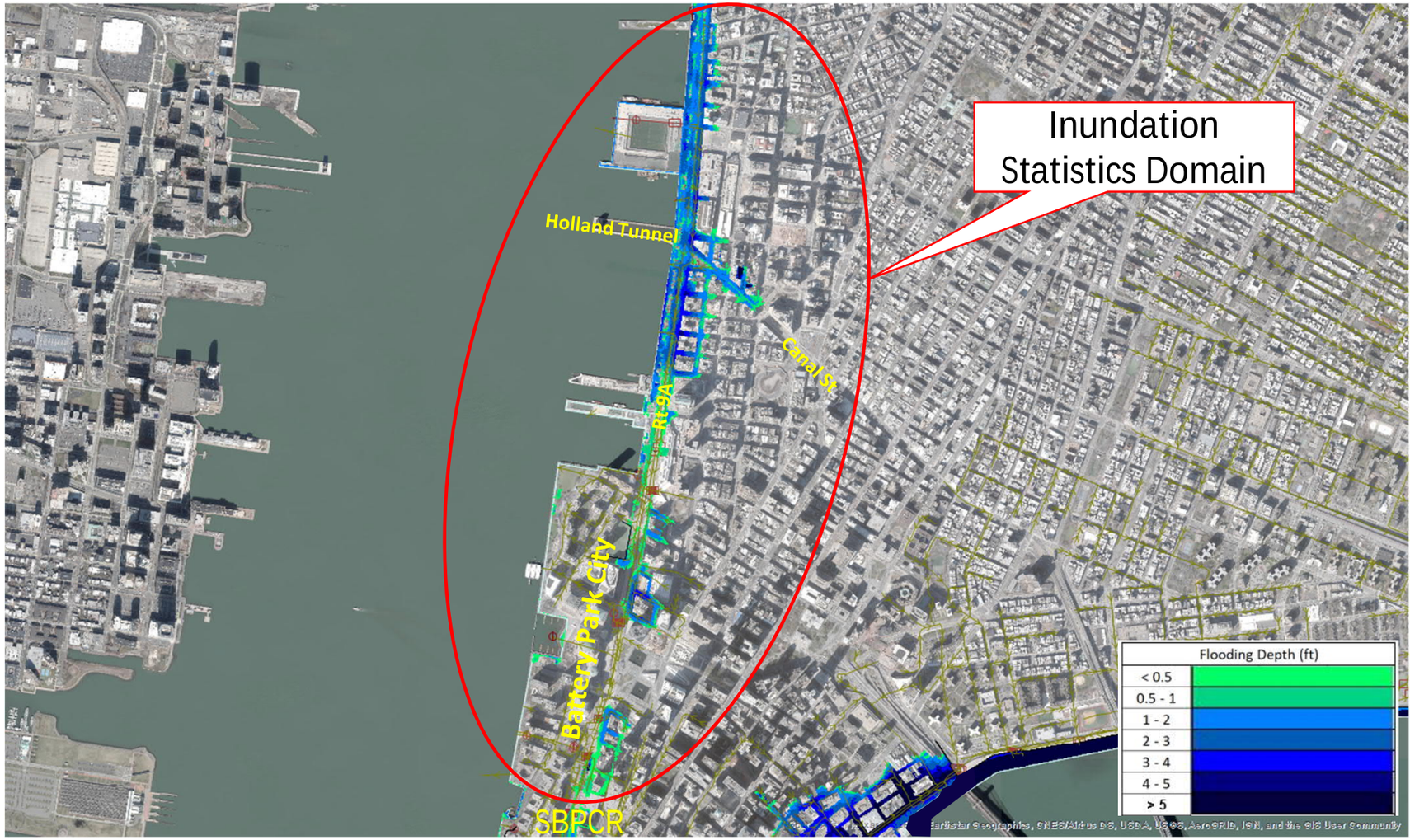
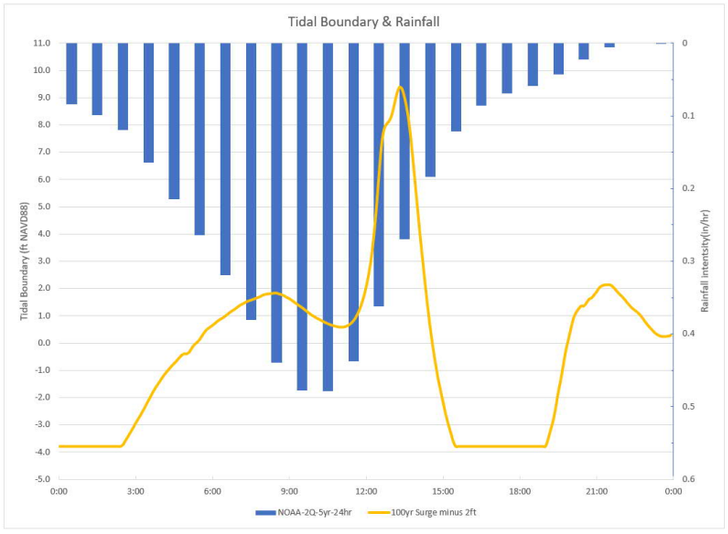


Impacts to Adjacent Areas - 100yr minus 2ft Coastal/5yr-24hr Rain

Alternative	FiDi		
	Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)
No isolation	56.98	60.53	10.05
NSI	56.98	60.53	10.05
NSI/No isolation % difference	0	0	0



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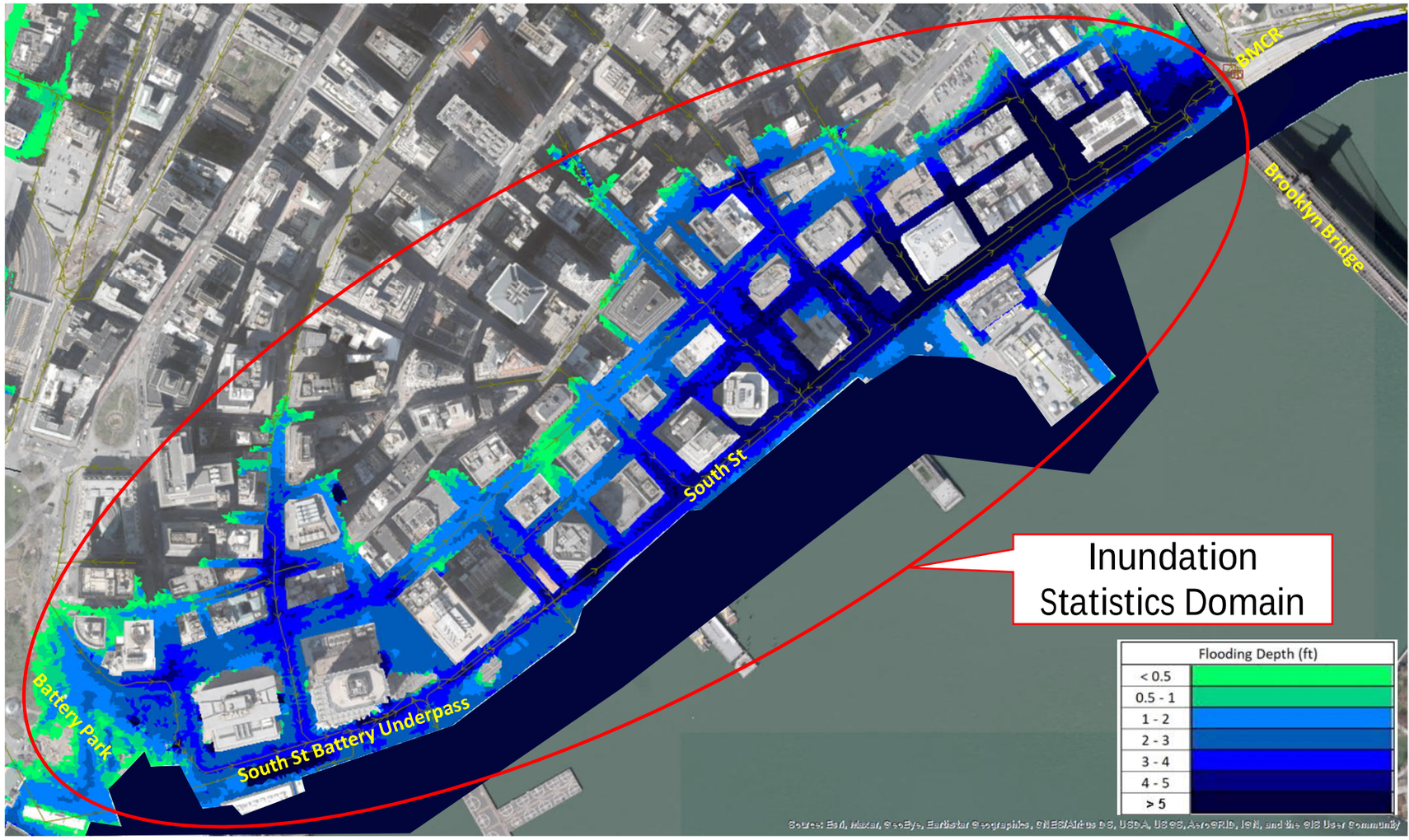
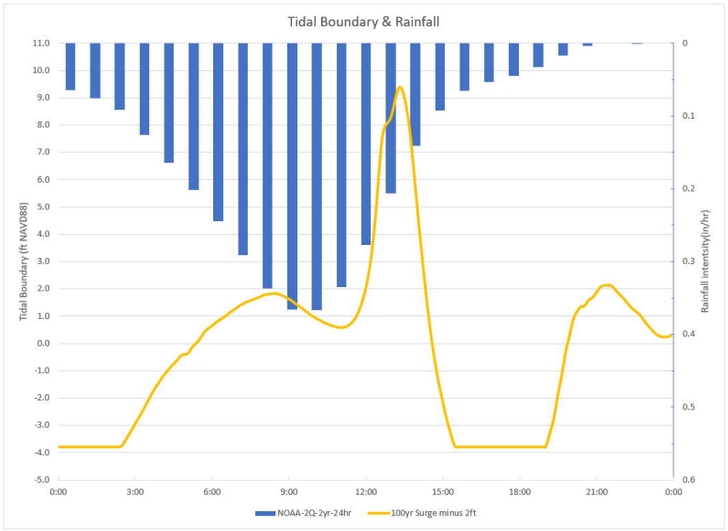


Impacts to Adjacent Areas - 100yr minus 2ft Coastal/2yr-24hr Rain

Alternative	North of SBPCR		
	Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)
No isolation	25.15	51.95	9.87
NSI	25.21	51.81	9.87
NSI/No isolation % difference	0	0	0



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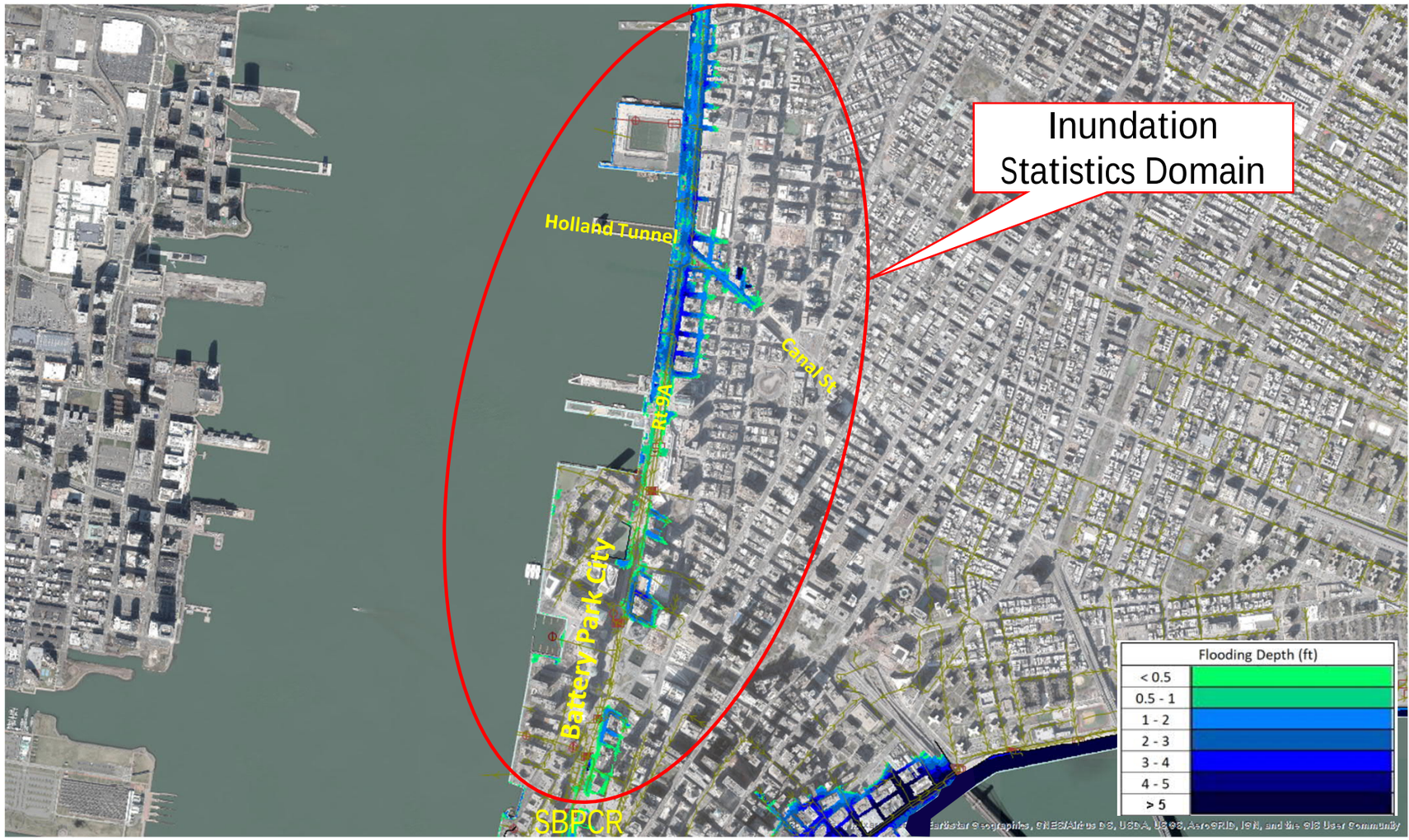
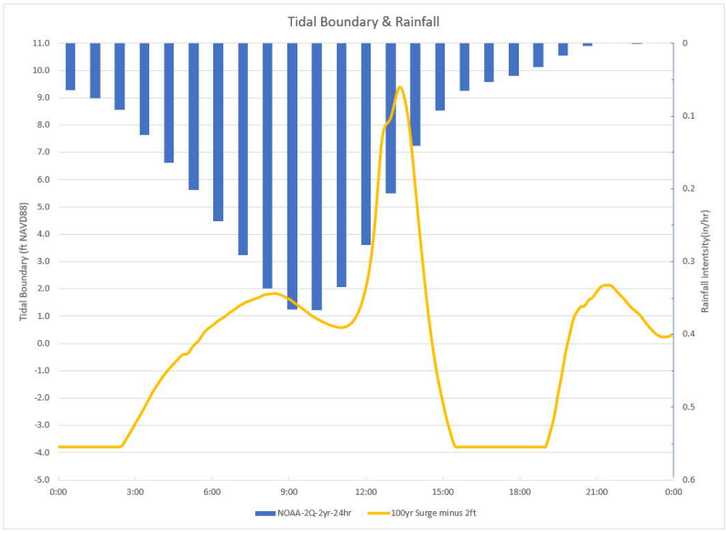


Impacts to Adjacent Areas - 100yr minus 2ft Coastal/2yr-24hr Rain

Alternative	FiDi		
	Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)
No isolation	56.97	60.53	10.05
NSI	56.98	60.53	10.05
NSI/No isolation % difference	0	0	0



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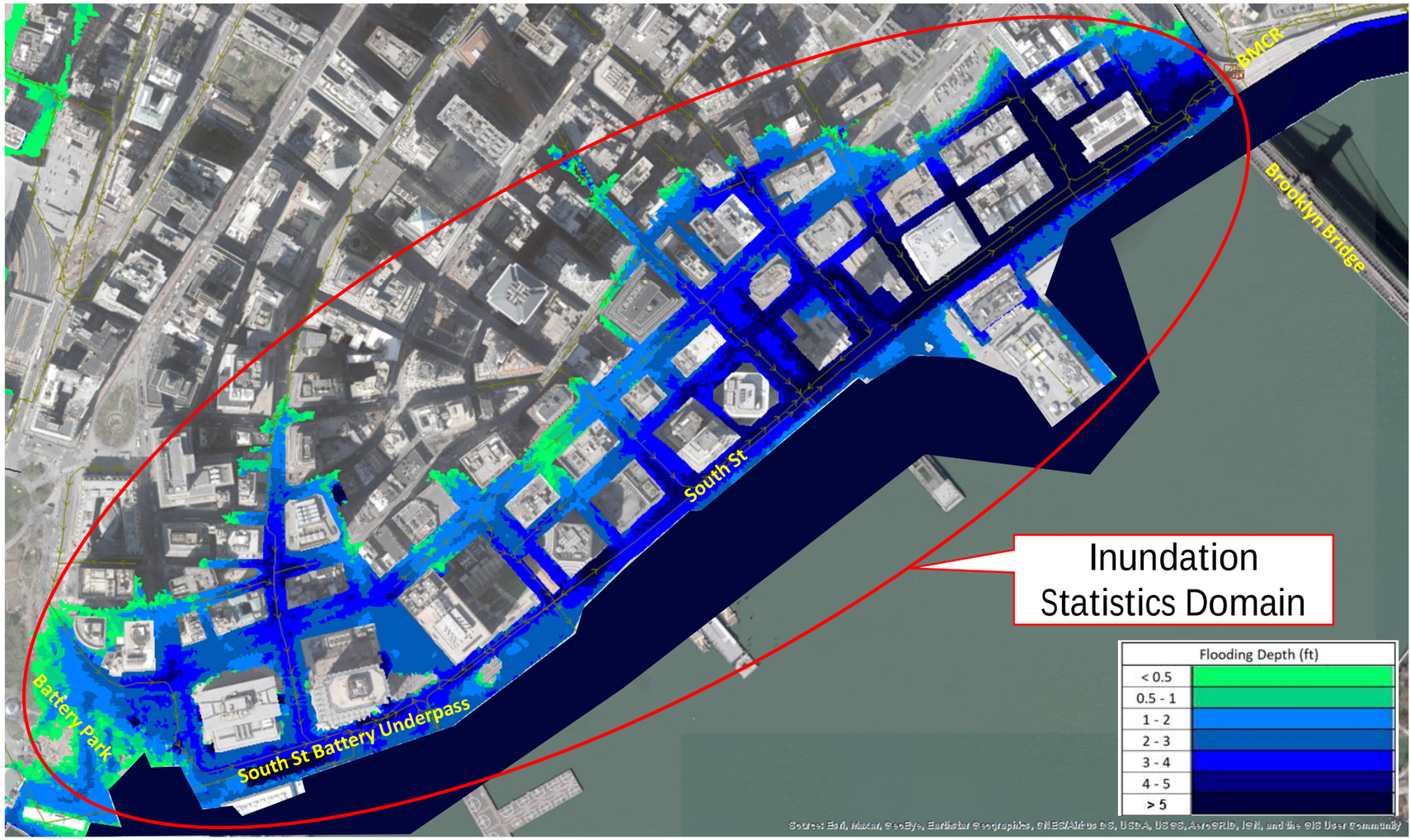
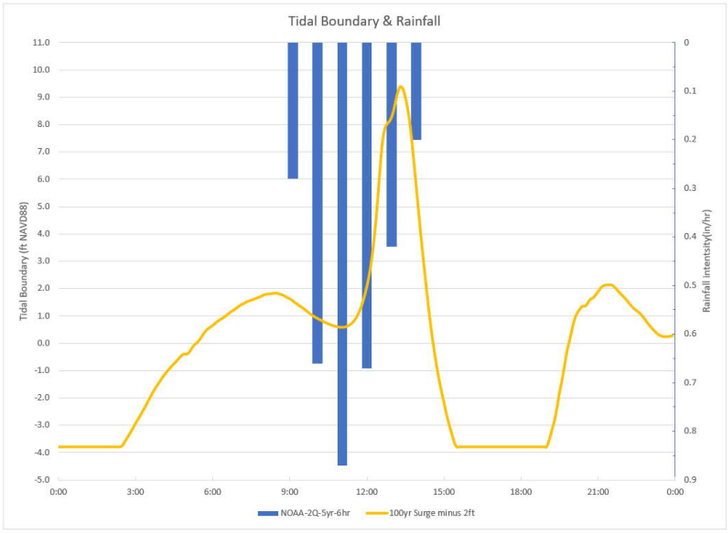


Impacts to Adjacent Areas - 100yr minus 2ft Coastal/5yr-6hr Rain

Alternative	North of SBPCR		
	Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)
No isolation	26.02	54.72	9.88
NSI	26.08	53.98	9.88
NSI/No isolation % difference	0	-2	0



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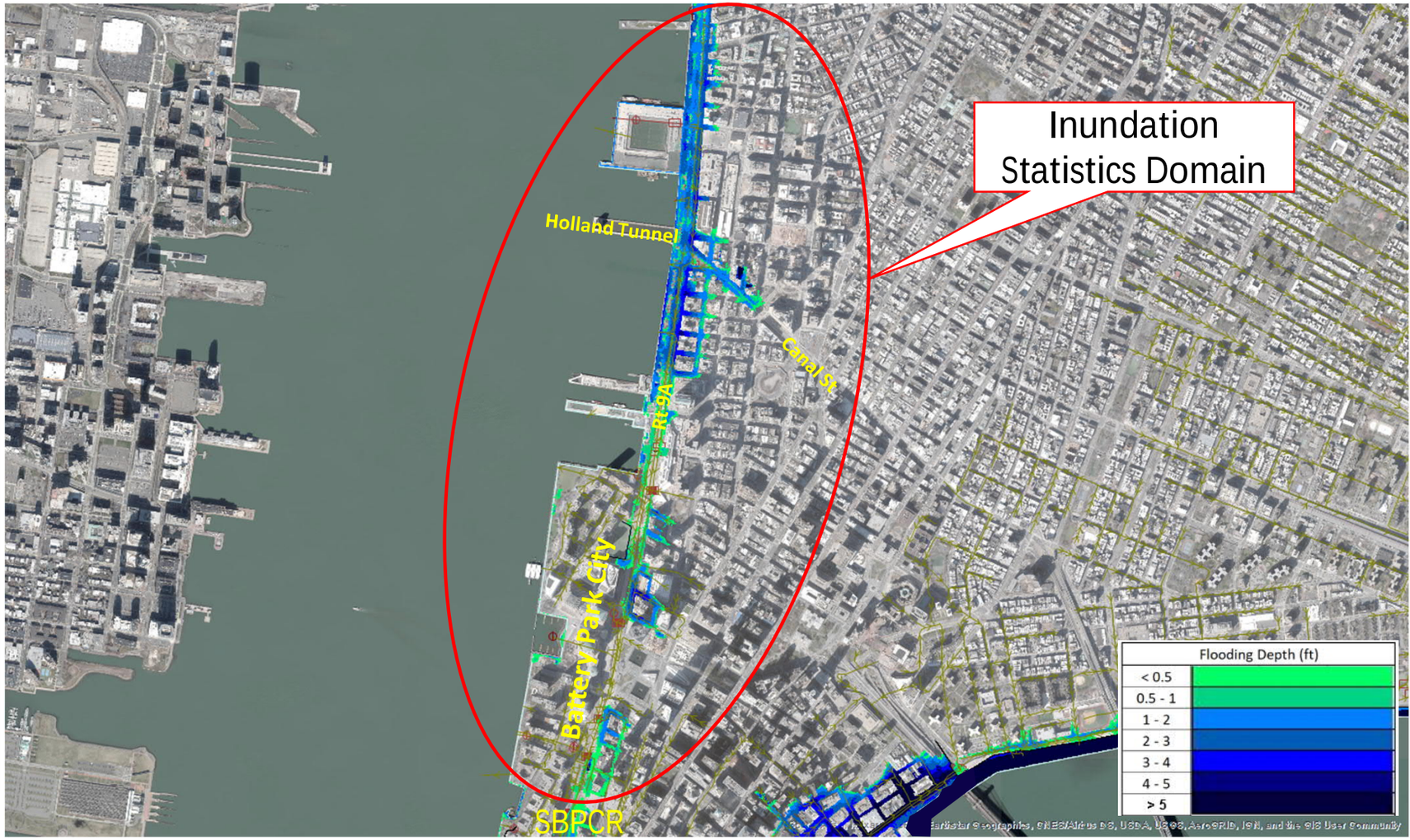
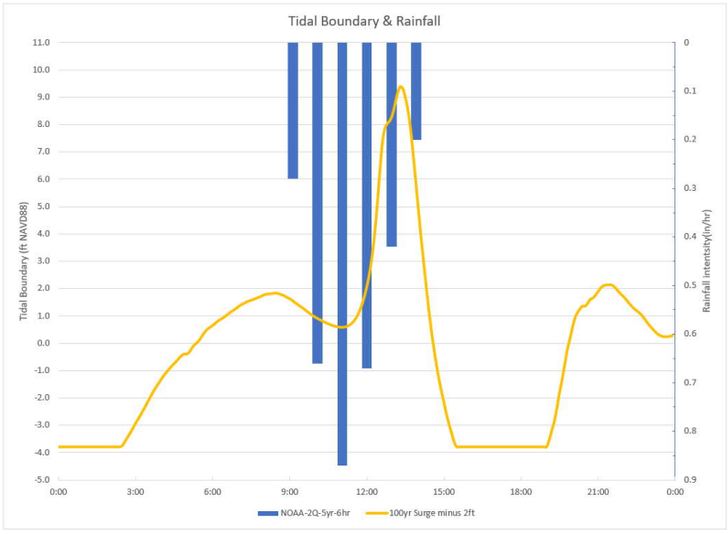


Impacts to Adjacent Areas - 100yr minus 2ft Coastal/5yr-6hr Rain

Alternative	FiDi		
	Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)
No isolation	57.00	60.54	10.05
NSI	57.00	60.54	10.05
NSI/No isolation % difference	0	0	0



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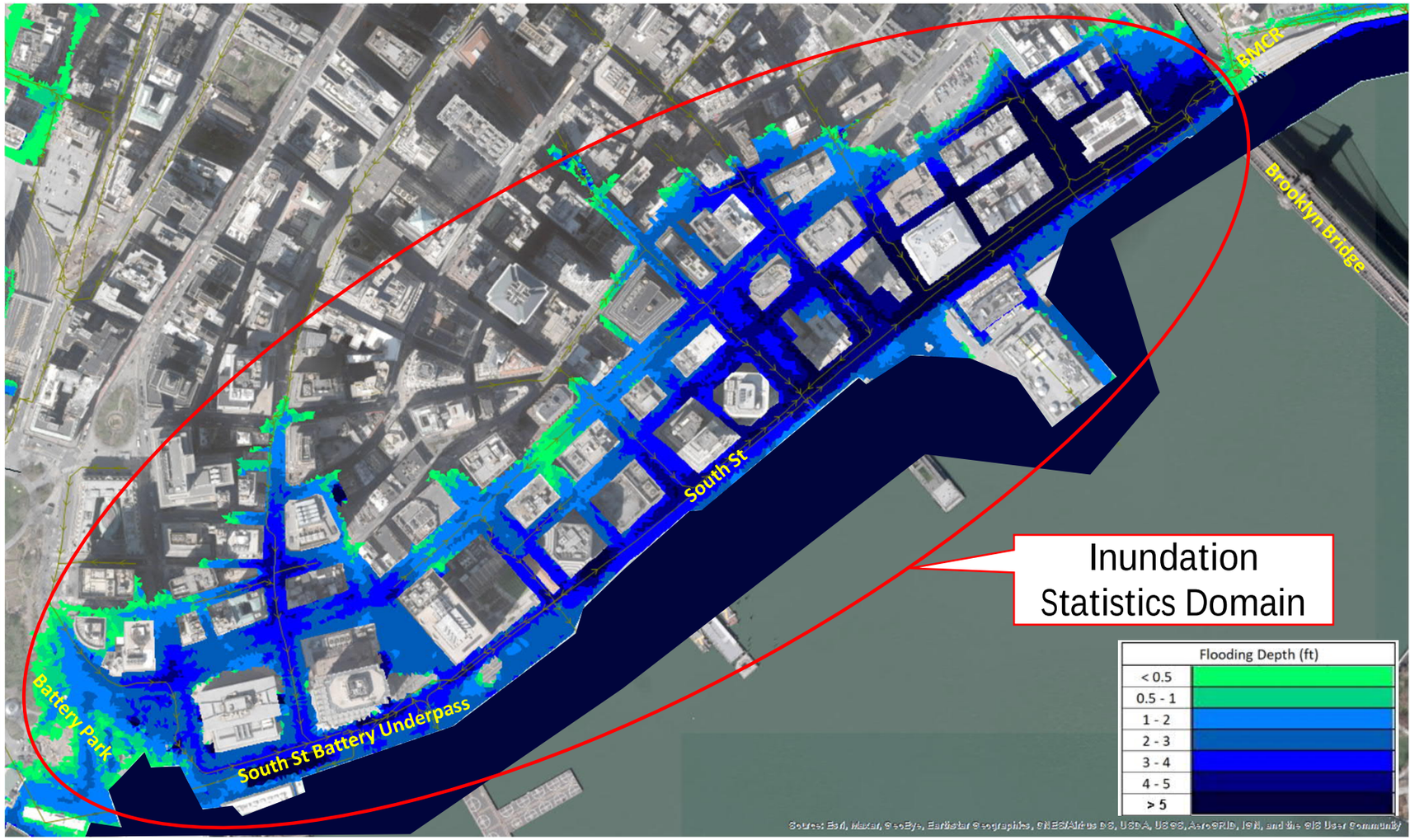
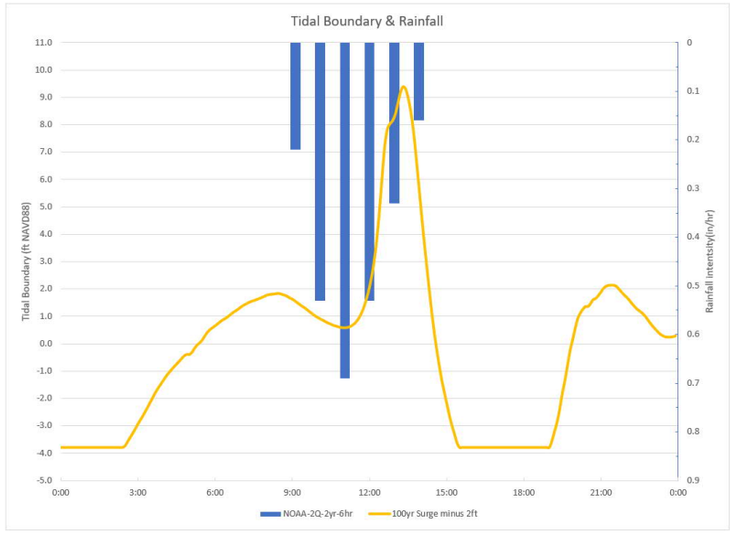
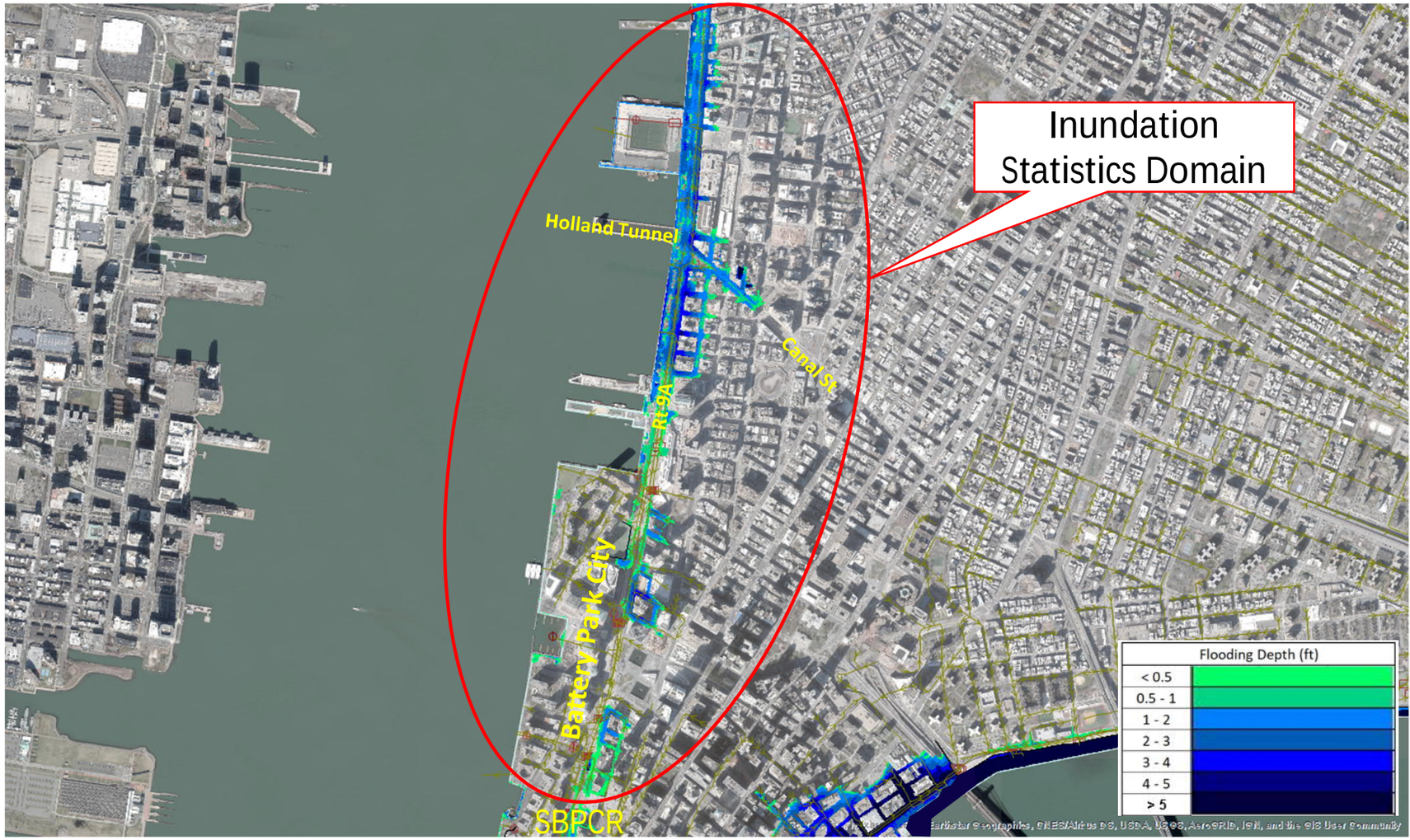


Impacts to Adjacent Areas - 100yr minus 2ft Coastal/2yr-6hr Rain

Alternative	North of SBPCR		
	Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)
No isolation	25.71	53.81	9.87
NSI	25.77	52.99	9.88
NSI/No isolation % difference	0	-2	0

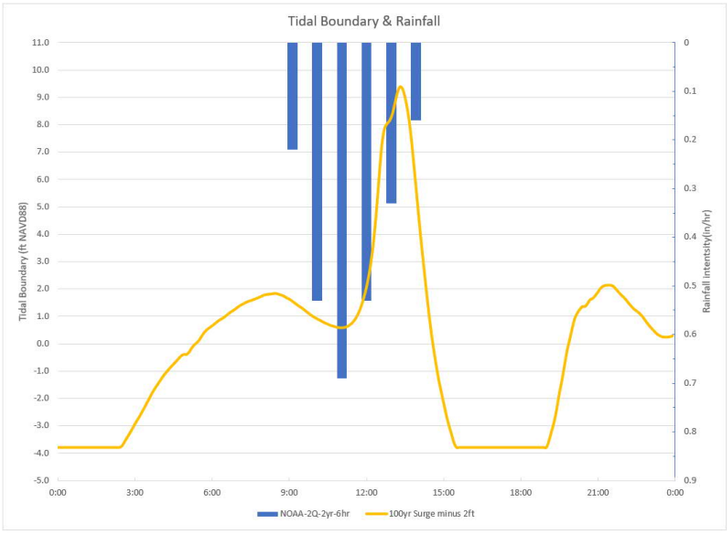


NO SBPCR ISOLATION SCENARIO SHOWN

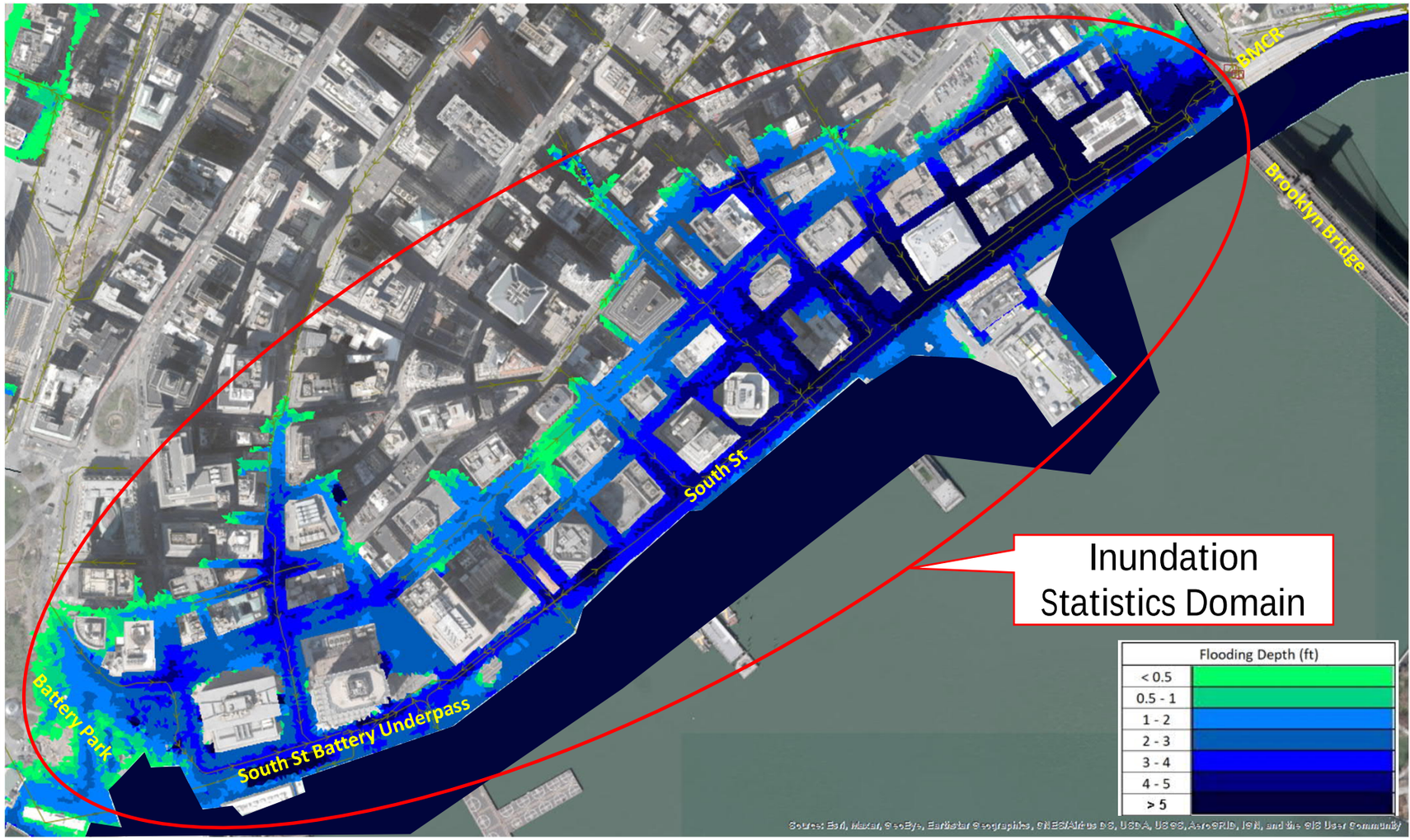


Impacts to Adjacent Areas - 100yr minus 2ft Coastal/2yr-6hr Rain

Alternative	FiDi		
	Inundation Volume (MG)	Inundation Area (ac)	Max Flood Elevation NAVD88 (ft)
No isolation	56.99	60.54	10.05
NSI	56.99	60.54	10.05
NSI/No isolation % difference	0	0	0



NO SBPCR ISOLATION SCENARIO SHOWN



E.2 Isolation Valve Analysis

SOUTH BATTERY PARK CITY RESILIENCY PROJECT

Closure of Proposed 12-Inch and 6-Inch Isolation Valves at The Battery

Evaluation of Impacts

January 12, 2022

SOUTH BATTERY PARK CITY RESILIENCY PROJECT

Evaluation of Impacts From Isolation Valve Closures

Purpose

Identify potential impacts to The Battery Park due to the closure of two proposed isolation valves

- 12-inch isolation valve on a storm drain
- 6-inch isolation valve on a sanitary sewer from the comfort station. Closing this valve has no impacts on flooding within the Park. Only operational impacts for NYCDPR. Not modeled.

The valves will be closed ahead of forecasted large coastal storms.

Scenarios Analyzed

❑ Potential impacts under design storm conditions

- 100-year coastal surge & 5 yr NOAA2Q rainfall

❑ Potential impacts under forecasted coastal storm that does not materialize

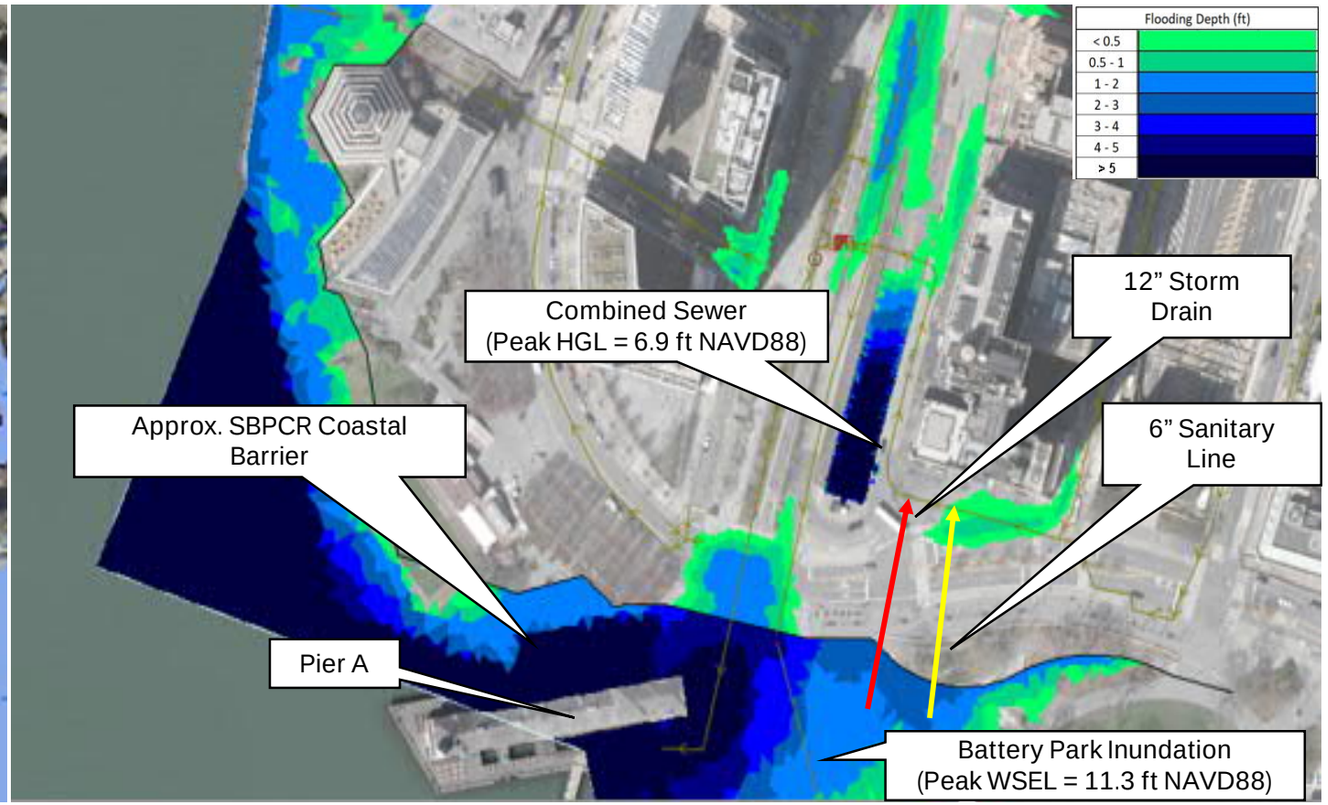
- Mean High Water tide & concurrent rainfall (5-yr & 2-yr NOAA 2Q)
- Valve on 12-inch storm drain to combined sewer is closed when storm is forecasted but is not opened timely after the coastal storm does not materialize (remains closed throughout the 24 hr rainstorm)

SOUTH BATTERY PARK CITY RESILIENCY PROJECT

Potential Impacts Under Design Storm Conditions

- Flooding is controlled by coastal waters, regardless of open/closed position of isolation valves

5-yr 24-hr NOAA2Q rain
100-yr Coastal Surge



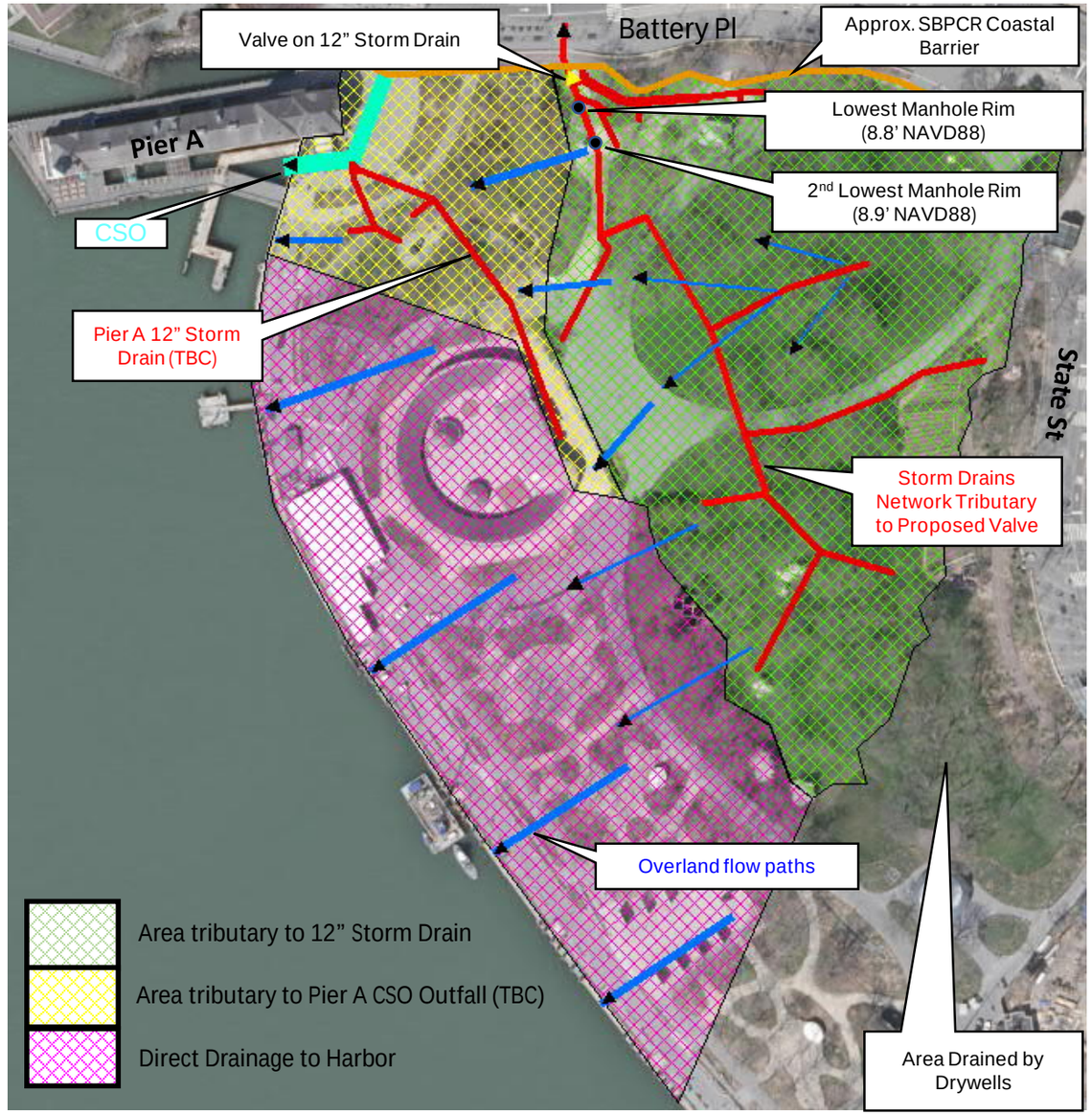
Inundations are shown for stillwater level condition.
Wave effects not included.

SOUTH BATTERY PARK CITY RESILIENCY PROJECT

Potential Impacts Under Forecasted Coastal Storm That Does Not Materialize

- ❑Overland flow initiates at manholes with lowest rim elevations
- ❑Preferential flow paths to Pier A drainage system

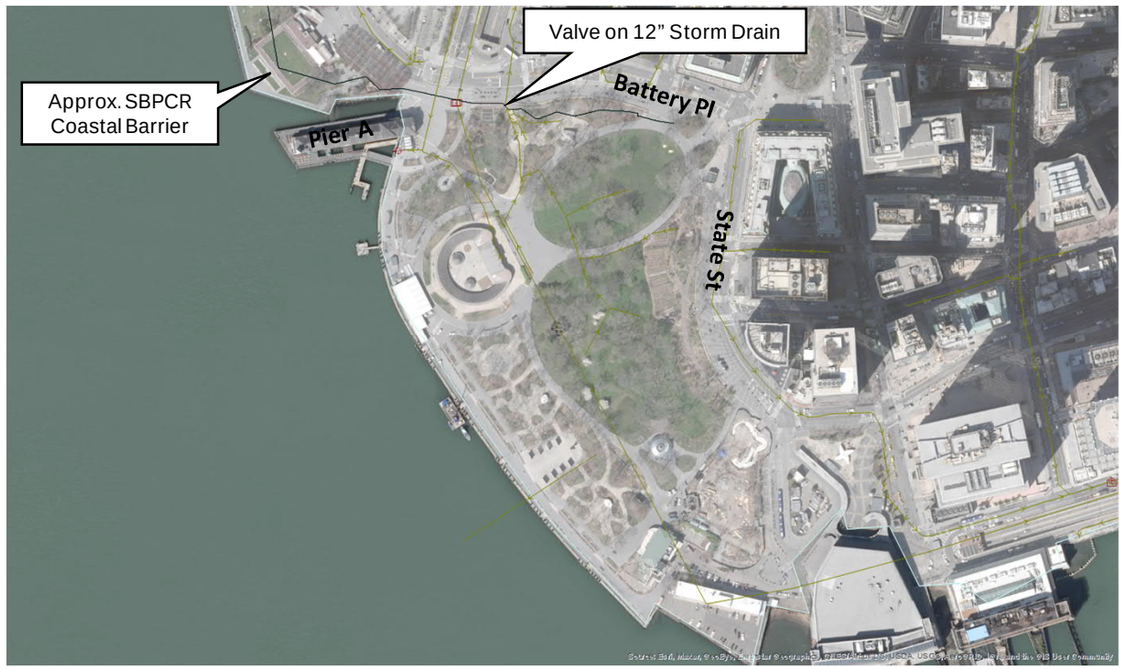
Pier A drainage system/tributary area to be confirmed.



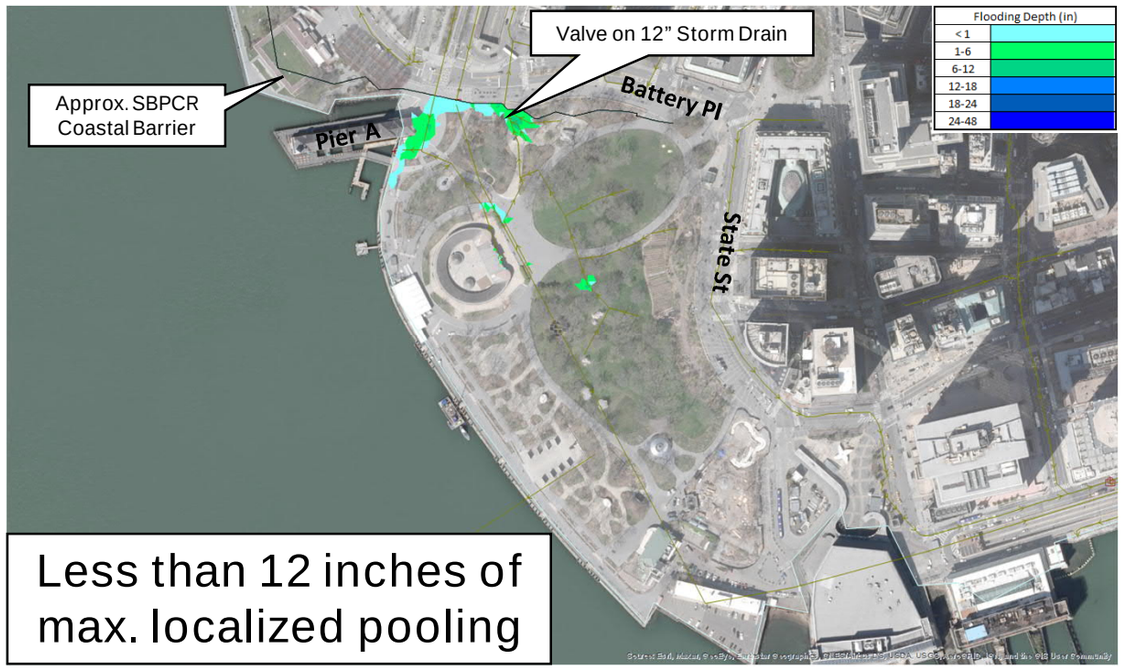
SOUTH BATTERY PARK CITY RESILIENCY PROJECT

Potential Impacts Under Forecasted Coastal Storm That Does Not Materialize

Valve Open



Valve Closed



Less than 12 inches of max. localized pooling

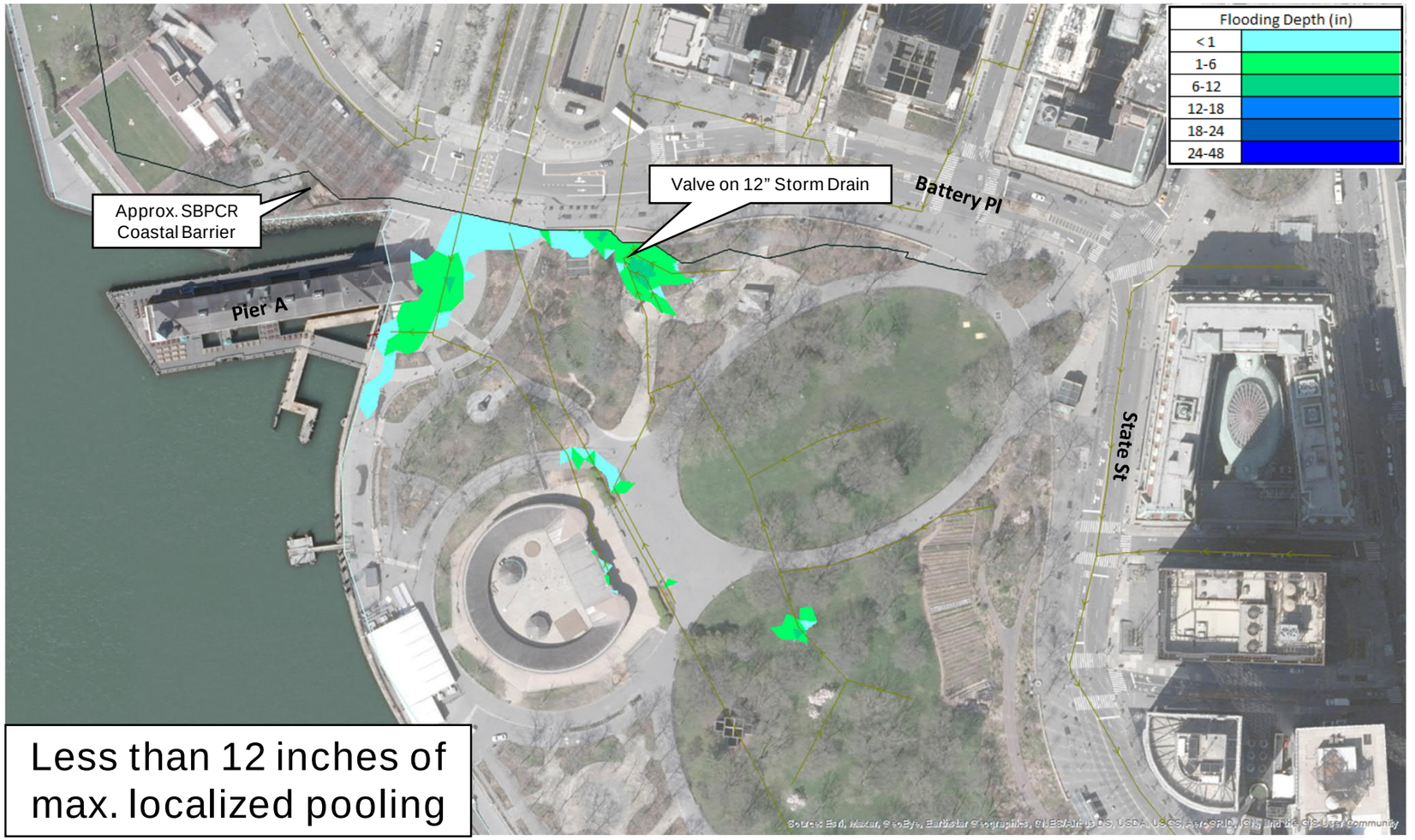
2-yr 24-hr NOAA2Q rain
(3.6 inches total)
MHW
2014 Topo

SOUTH BATTERY PARK CITY RESILIENCY PROJECT

Potential Impacts Under Forecasted Coastal Storm That Does Not Materialize

2-yr 24-hr
NOAA2Q rain
(3.6 inches total)
MHW
2014 Topo

Valve Closed

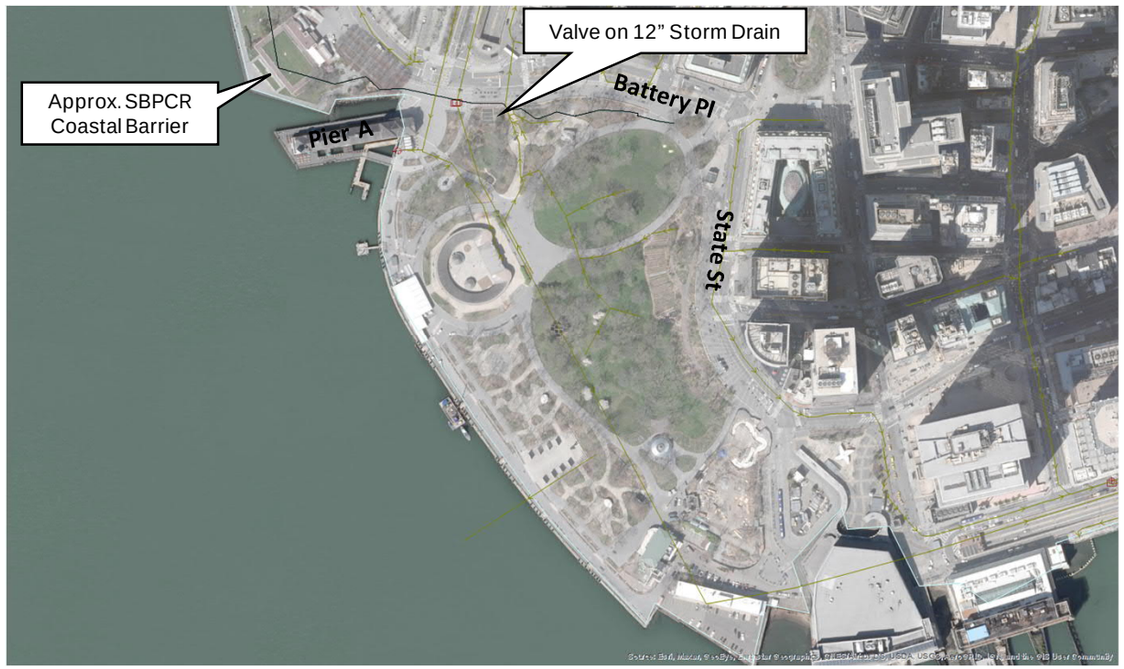


Less than 12 inches of max. localized pooling

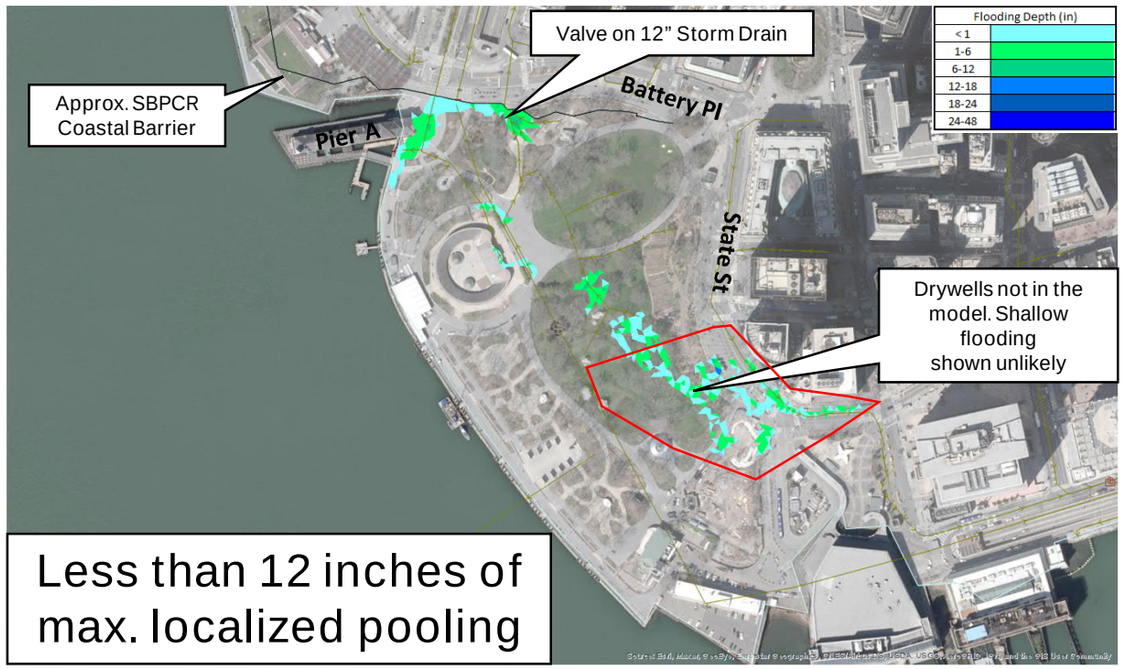
SOUTH BATTERY PARK CITY RESILIENCY PROJECT

Potential Impacts Under Forecasted Coastal Storm That Does Not Materialize

Valve Open



Valve Closed



Less than 12 inches of max. localized pooling

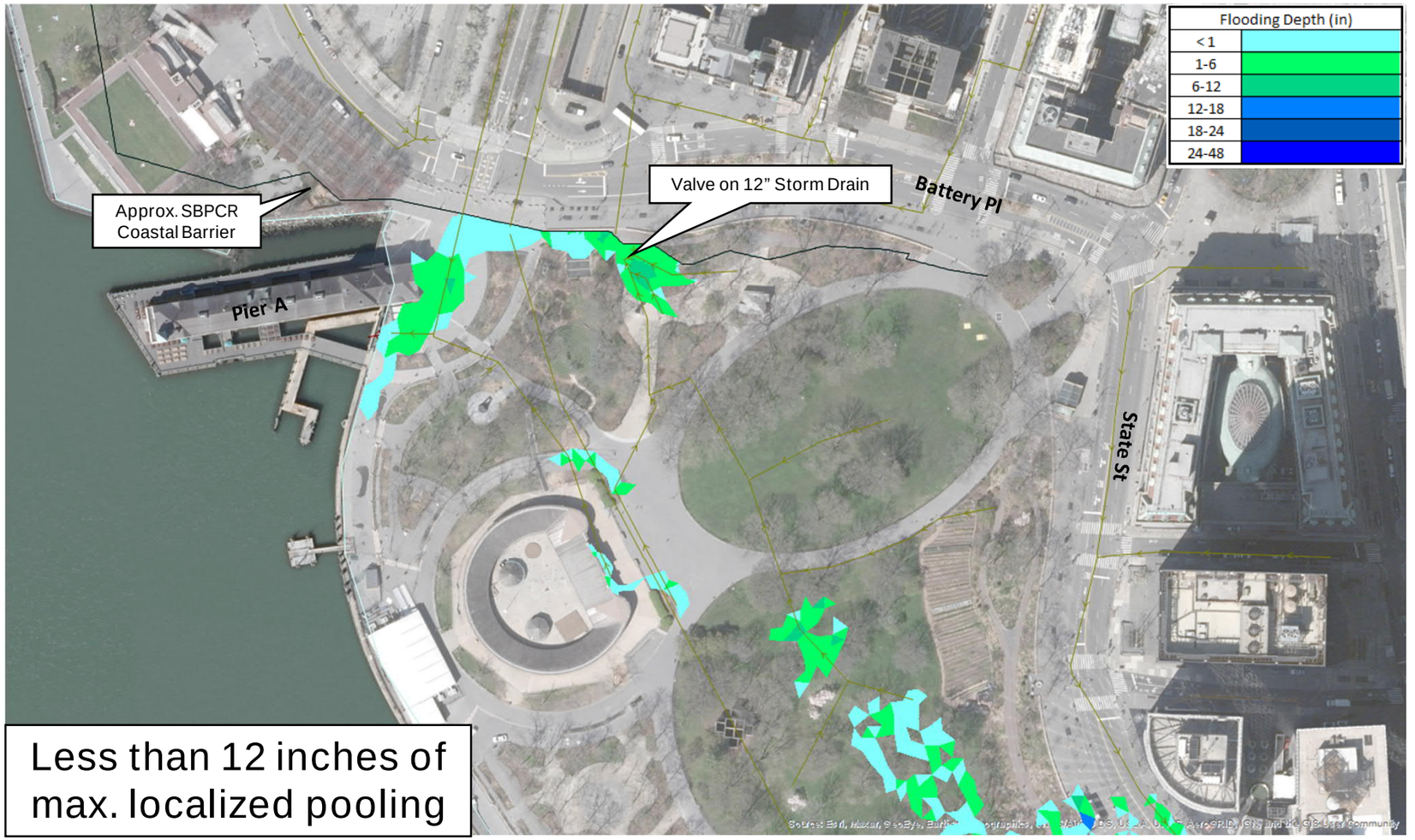
5-yr 24-hr NOAA2Q rain
(4.7 inches total)
MHW
2014 Topo

SOUTH BATTERY PARK CITY RESILIENCY PROJECT

Potential Impacts Under Forecasted Coastal Storm That Does Not Materialize

5-yr 24-hr
NOAA2Q rain
(4.7 inches total)
MHW
2014 Topo

Valve Closed



Less than 12 inches of max. localized pooling

SOUTH BATTERY PARK CITY RESILIENCY PROJECT

Remarks

Valve closure leads to:

- No significant impacts anticipated for The Battery Park under coastal design storm conditions
- Anticipated impacts for the Battery Park under conditions where a coastal storm is forecasted but does not materialize:
  - ❑ Overland shallow flow to Pier A and the Harbor prevent significant inundation build-up within the park (generally less than 12 inches of localized pooling).