When All Else Fails.....Pump

A Case Study
in
the City of St. Pete Beach

Presentation by Madrid-CPWG

At Florida Stormwater Association Winter Conference

December 1, 2022

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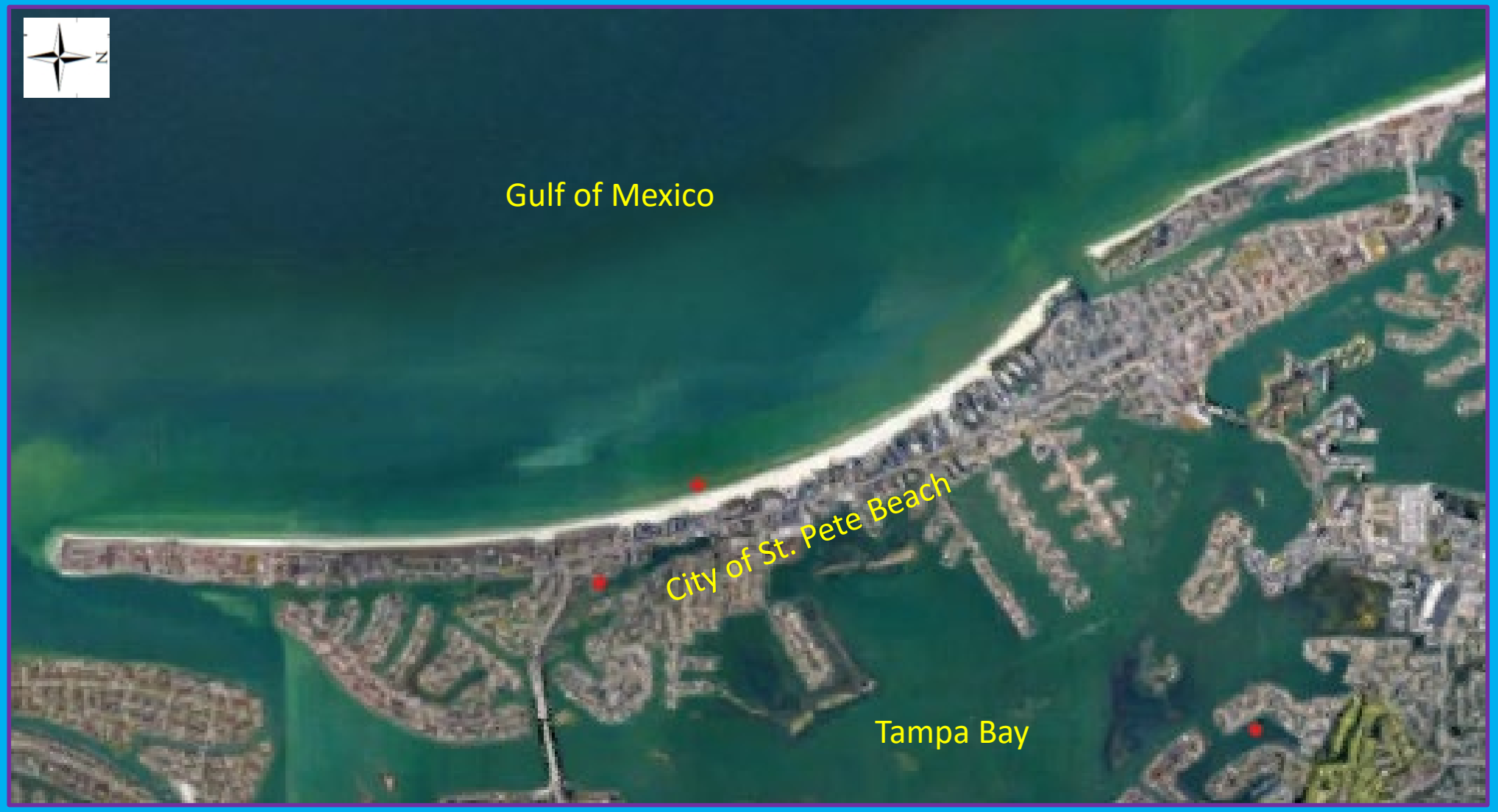
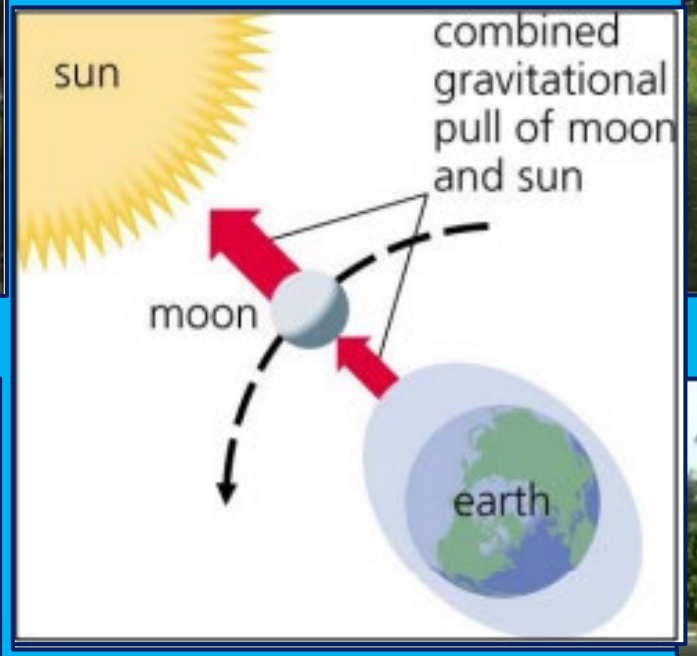

N
Gulf of Mexico
City of St. Pete Beach
Tampa Bay

But……

……This beautiful city, like many island communities in Florida, also faces severe flooding threats from….

- High Tides (King Tides)
- Sea Level Rise
- Large Storm Events
- Hurricanes (Discussed only indirectly herein)

King Tide Flooding in St. Pete Beach in 2017



Highest King Tide in Last 5 Years = 3.91 ft. Above MSL

Sea Level Rise (SLR)

2019 CSAP Projections for Intermediate Sea Level Rise		
Year	SLR (ft.)	Incremental Rise in ft.
2030	0.79	
2040	1.08	0.29
2050	1.44	0.36
2060	1.87	0.43
2070	2.33	0.46
2080	2.82	0.49
2090	3.38	0.52
2100	3.90	0.52

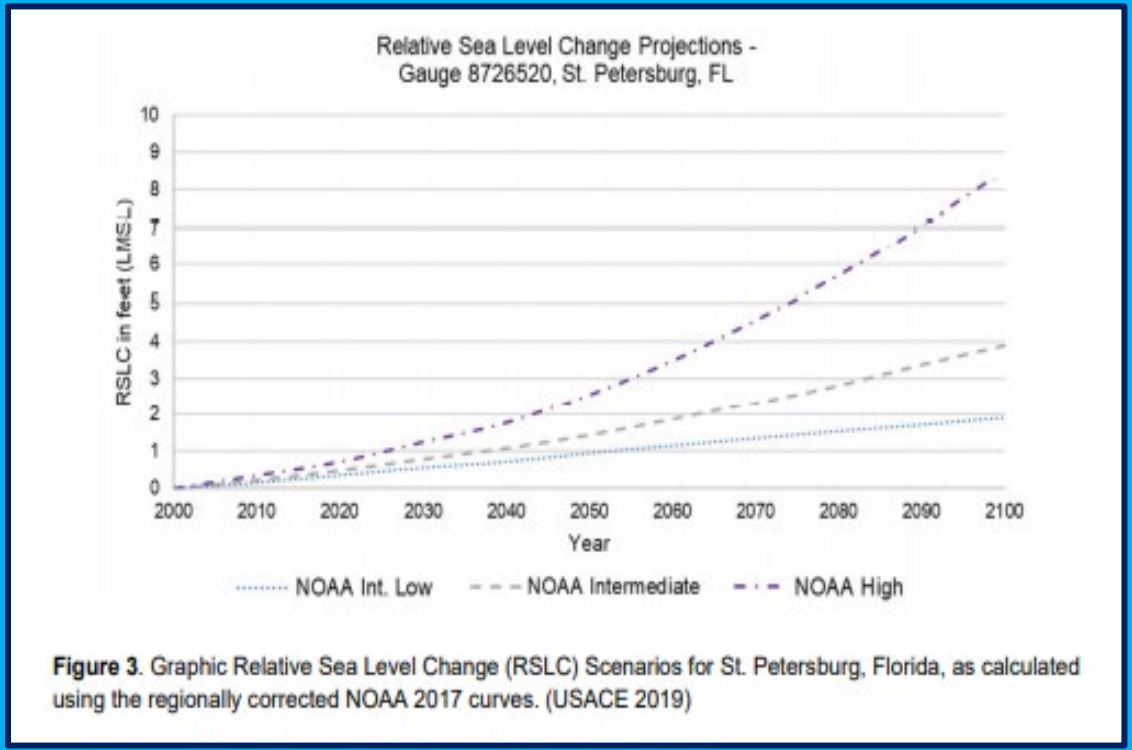
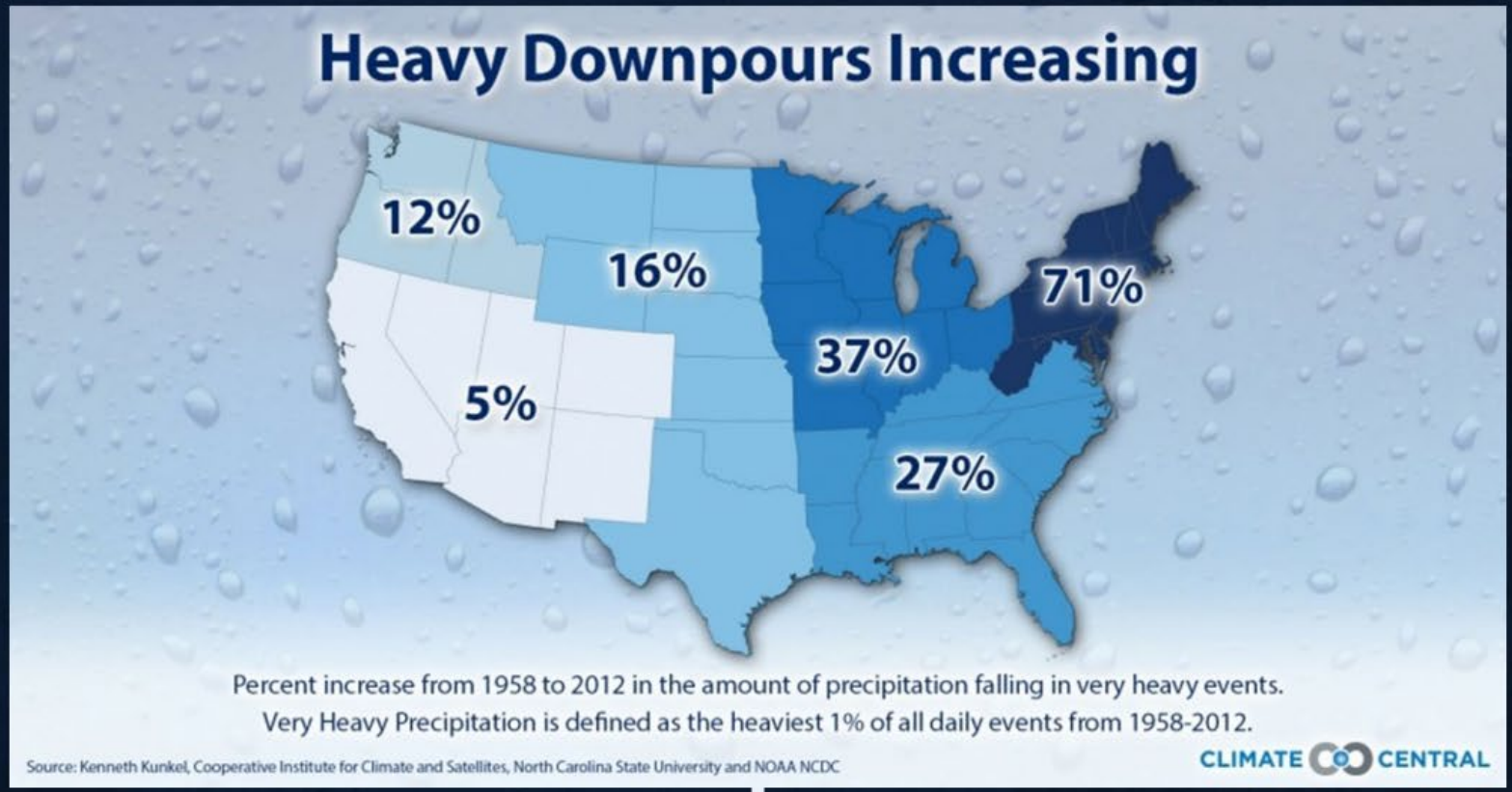


Figure 3. Graphic Relative Sea Level Change (RSLC) Scenarios for St. Petersburg, Florida, as calculated using the regionally corrected NOAA 2017 curves. (USACE 2019)

CAUTION: In less than 5 years, projections were revised by TBCSAP upwards. Therefore, what is projected today for 2050 SLR may possibly occur even earlier than 2050.

CSAP Projections for High Sea Level Rise		
Year	2015 SLR (ft)	2019 SLR (ft)
2030	1.00	1.25
2040	1.40	1.77
2050	2.22	2.56
2060	3.00	3.48
2070	3.80	4.56
2080	4.80	5.71
2090	5.75	7.05
2100	6.89	8.50

"…..It is predicted that by 2025 three-quarters of the world's population will reside in coastal zones, many of which will be exposed or vulnerable to the impacts of flooding." – Edward Barsley



More than 260,000 Virginians live in areas at an elevated risk of inland flooding

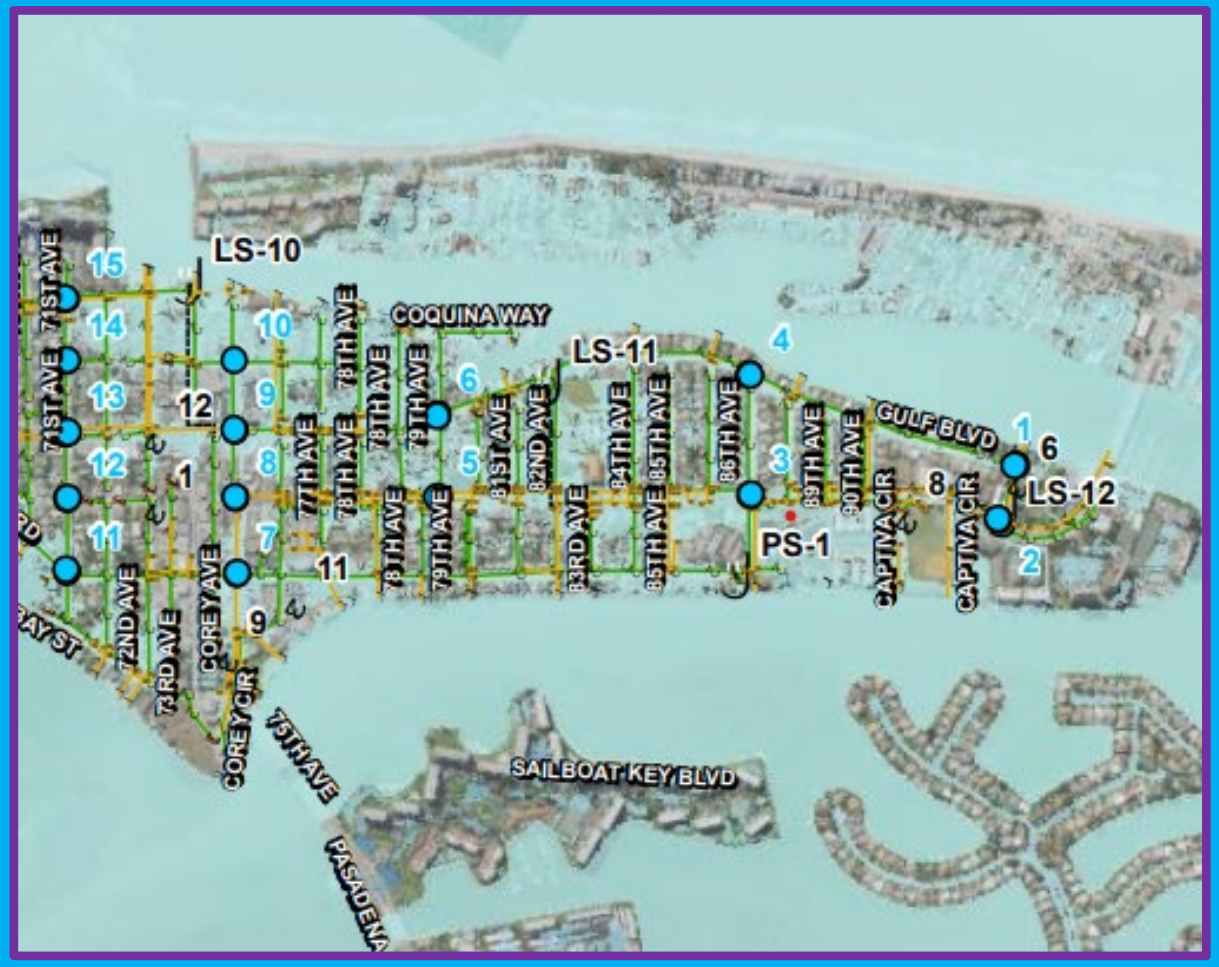
81,000 Maryland cititzens at risk of coastal flooding. 38,000 more by 2050 due to sea level rise

Florida has 3.5 million people at risk of coastal flooding. By 2050, an additional 1.1 million people are projected to be at risk due to sea level rise

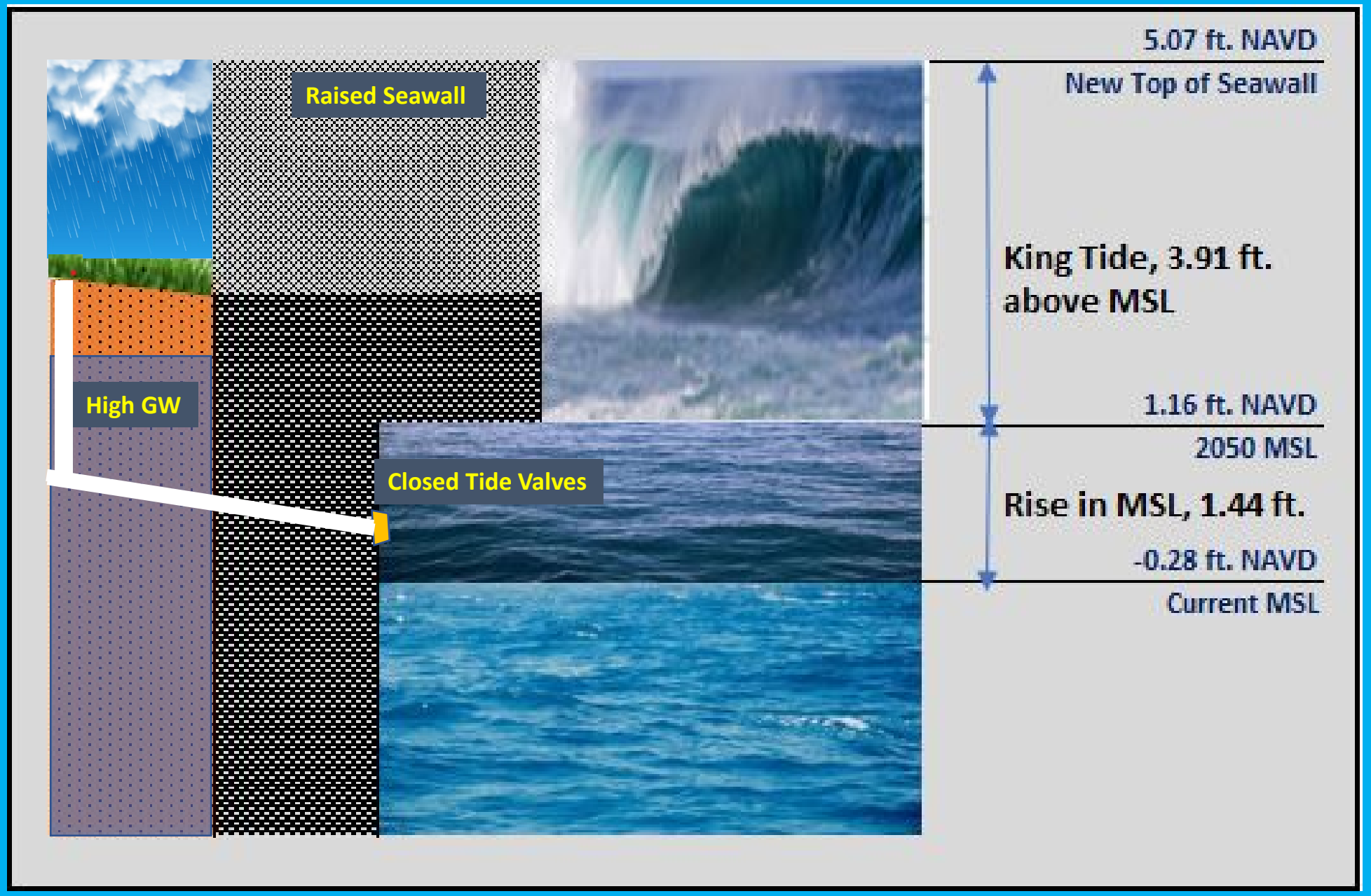
Large Storm Events

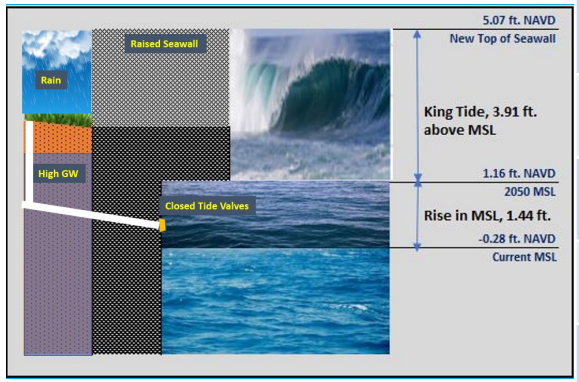
Return Period	24-Hour Rainfall	
(Years)	(inches)	(MG per Acre)
5	6.0 6.23	0.16
10	7.5 7.53	0.20
25	9.0 9.67	0.24
50	10.0 11.6	0.27
100	11.0 13.8	0.30

Impact of 100-Year Rainfall Without King Tide or SLR



SLR + King Tide + High GW + Rain





Options for Disposal of Stormwater	Viability	Reason
Overland Runoff to the Bay	None	High Seawalls
+		+
Through SW Collection System	None	Closed Tide Check Valves
+		+
Infiltration	Little to none	High Ground Water
+		+
Evaporation	Little to none	<< 0.25”/day
+		+
Underground Storage	Not practical	Not enough real estate
=		=
Bowl		Accumulated Rainwater in the “bowl” = flooding
Therefore, when all else fails……Pumping is the only viable option left		

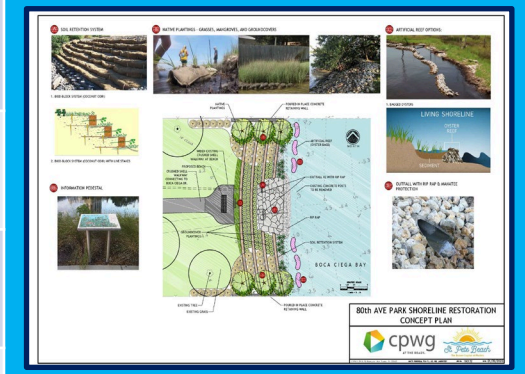
In March, the state Senate established the Statewide Office of Resiliency and the Statewide Sea-Level Rise Task Force to monitor **sea level rises** and push for measures to protect the state from the consequences. The government also faces the possibility of spending **$74 billion** on building **sea walls** along the coast. Additional measures include adding **more pumps** along shorelines and building higher roads along the coast.

Source :https://www.thetravel.com/florida-underwater-soon-stats/

Policy Decisions Impacting Pump Capacity

Policy Decision	Measure			
LOS for Flood Protection	Rainfall Frequency			
	10 Yr.	25 Yr.	50 Yr.	100 Yr.
Green Infrastructure	Runoff Curve No.			
	75	85	90	95
Flooding Tolerance	No. of Hours			
	8 hours	6 hours	4 hours	2 hours
Cost	$ Budget			
	> $1m	> $2m	> $3 m	> $5m

Bioswales are essentially rain gardens placed in long narrow spaces such as the space between the sidewalk and the curb.



100-Year Rainfall +SLR + King Tide

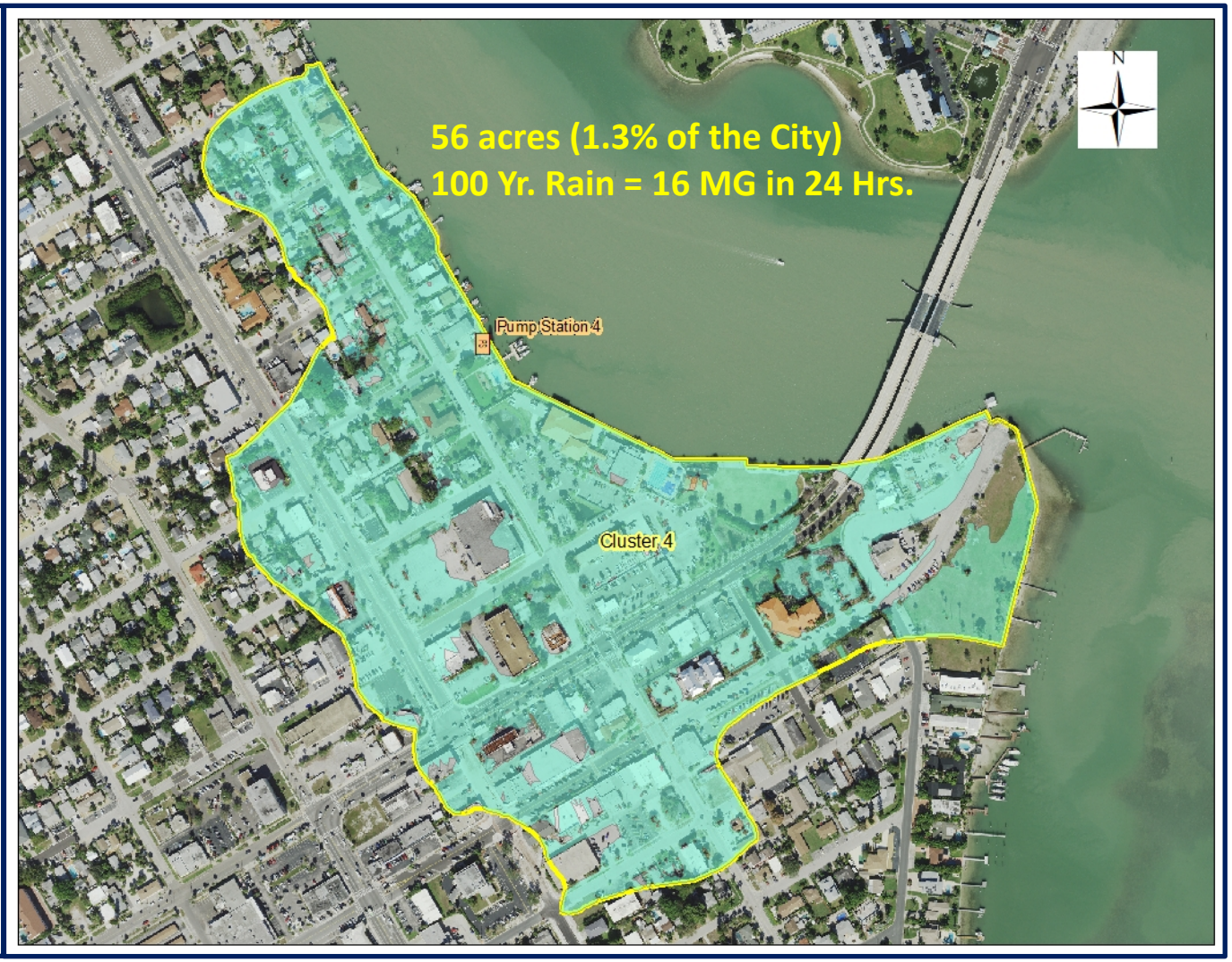
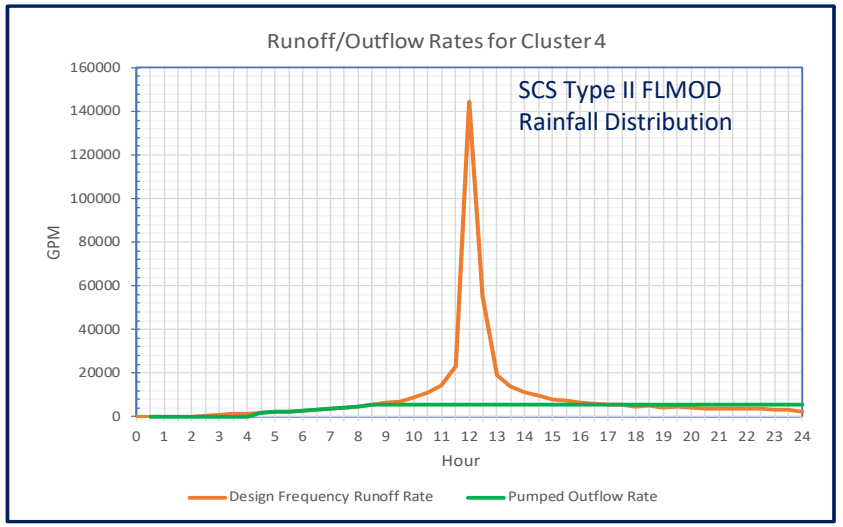
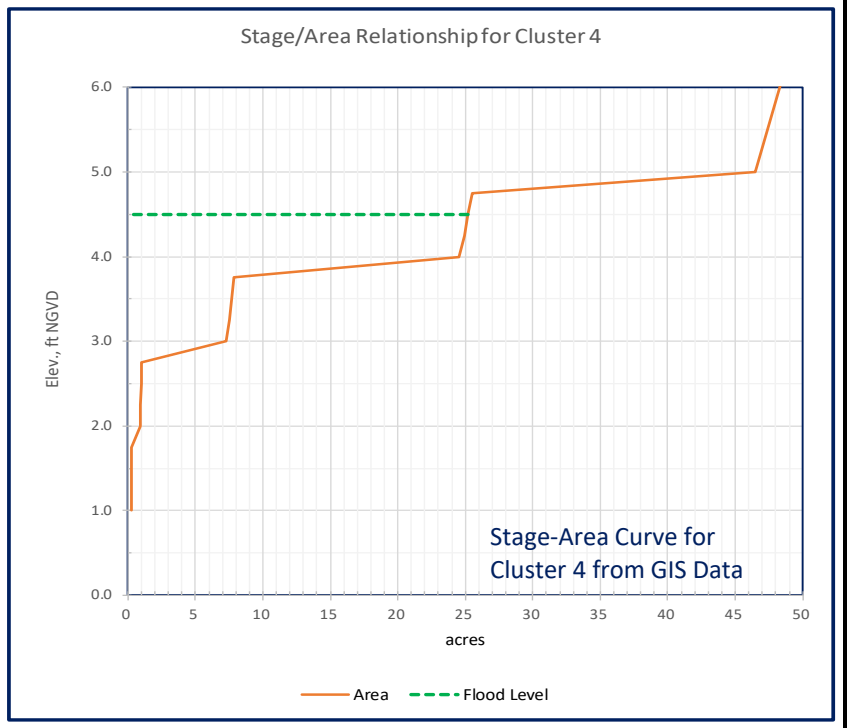


Table 4 -Pump Station Design Table					
Basins Cluster No.	**4**	(6 sub-basins 3C,3D, 3E, 3K,3F, 3P)			
Pump Station Location	In Sub-basin 3K, 78th Ave. & Boca Ciega Dr. (Near east end of 78th Ave.)				
Total Cluster Area	56	Acres			
Flood Level LOS Elevation	2.00	ft.	Flooding & Costs		
Volume/Area Below LOS Elev.	0.32 Ac-ft	/ 1.17 Ac	24.264 ac-ft	4.50 ft	25.227 acres
Flood Protection LOS (Rain Freq.)	50	Year	30.609 ac-ft	4.75 ft	25.537 acres
Total Rainfall Duration	24	Hours	Volume	24.28 ac-ft	7.9 MG
Total 24-Hr. Rainfall	10.0	Inches	Elevation	4.50 ft.	25 acres
Green Infrastructure (Runoff CN)	90.00	Default 96	Depth > LOS	30 Inch.	
Flooding Tolerance, Hrs.	4.00	Default 4	Duration	15.5 Hrs.	
Approx. Peak Pumping Rate Reqd.	32,000	GPM	**P.S. Cost**	**$0.72 M**	
Pumping Capacity	**5,700**	**GPM**	30 ft. tall tank	of 275 ' dia.	13.3 MG
	= 8	MGD			





Total Pump Station Cost = Variable Speed Pumps + Electrical Panel + Dry Well / Wet Well + Standby Power + Piping from 6 Sub-basins to the Pump Station

Total Pipe Length = 5,100 lf

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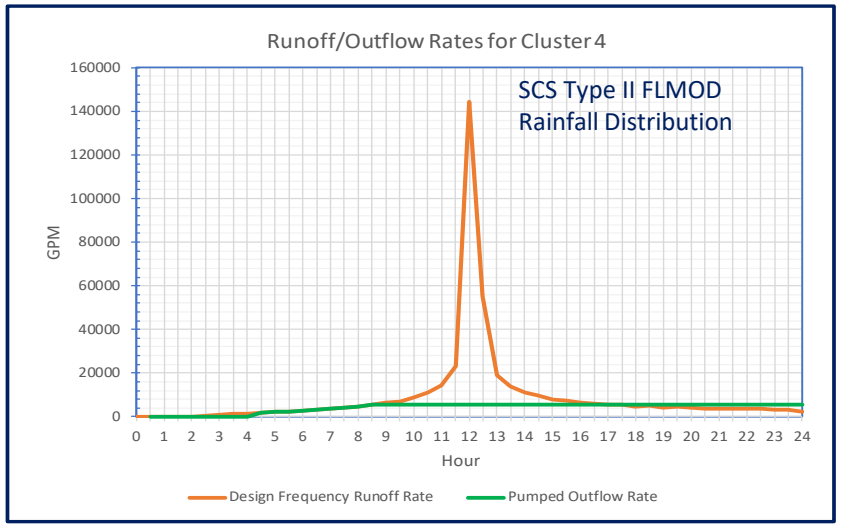

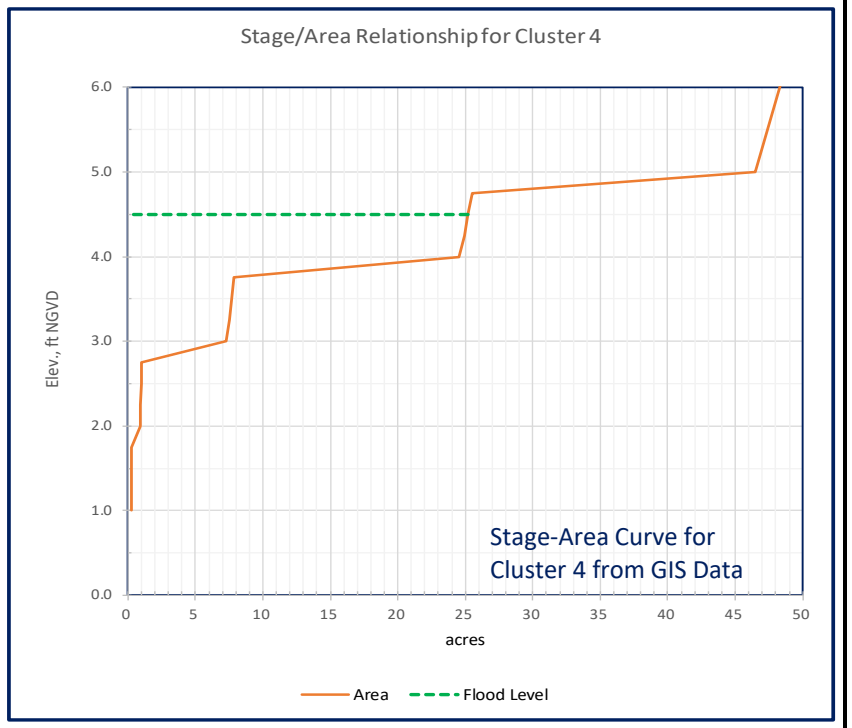

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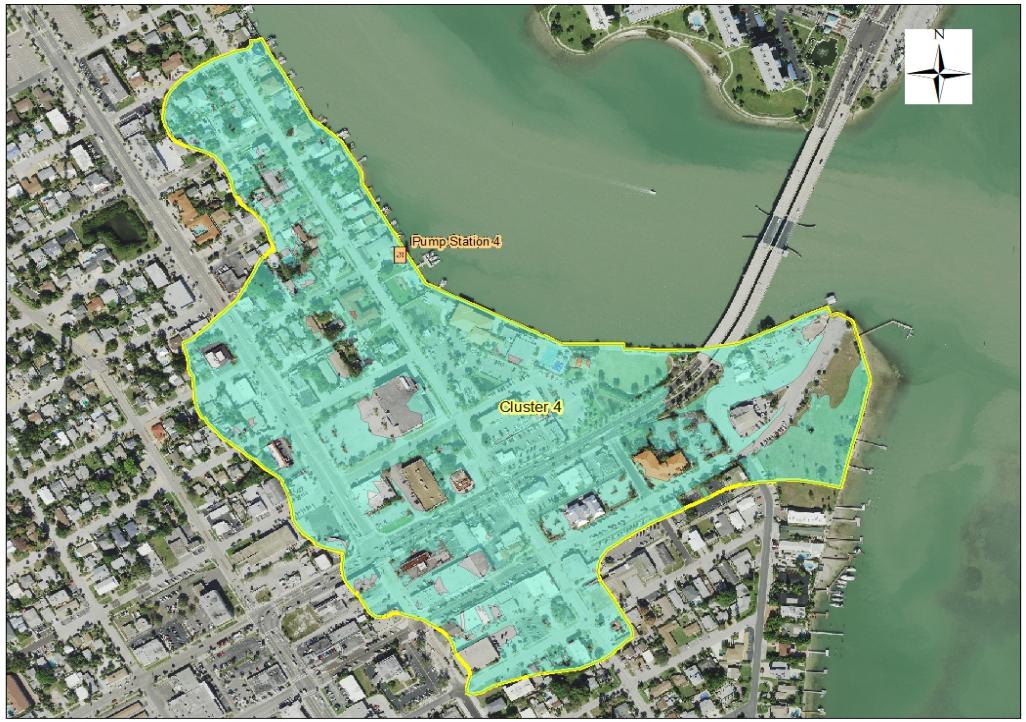
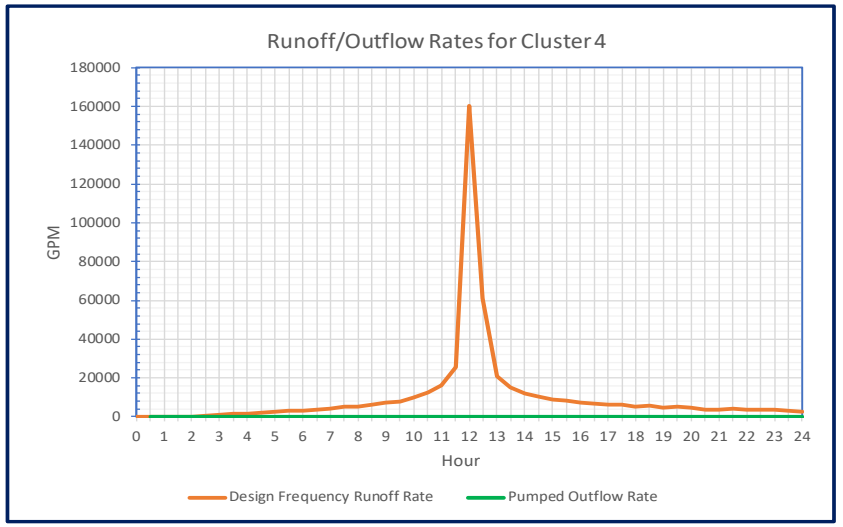
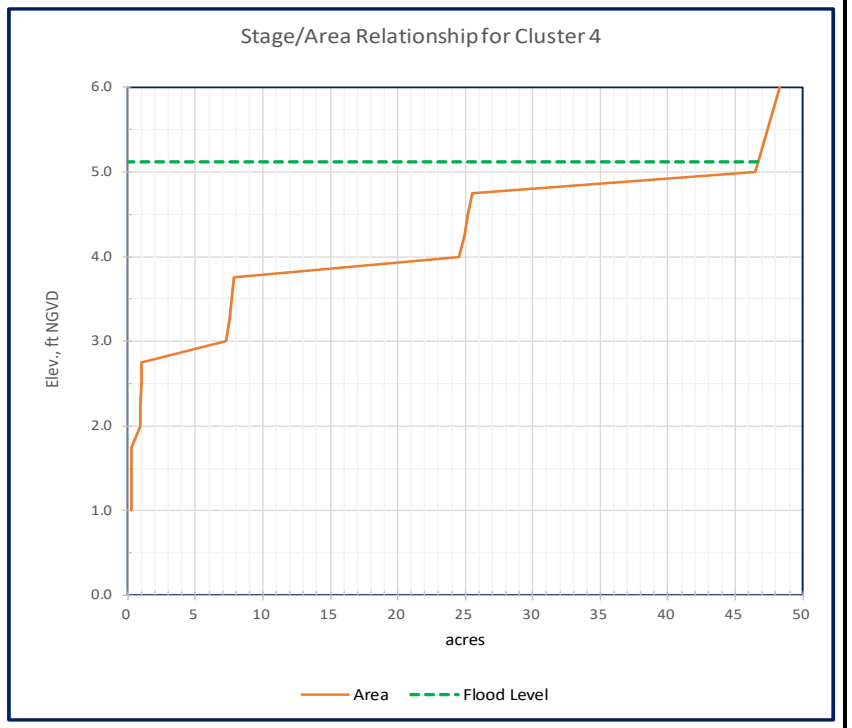
Total Cluster Area	56	Acres			
Flood Level LOS Elevation	2.00	ft.	Flooding & Costs		
Volume/Area Below LOS Elev.	0.32 Ac-ft	/ 1.17 Ac	39.607 ac-ft	5.00 ft	46.445 acres
Flood Protection LOS (Rain Freq.)	100	Year	294.676 ac-ft	10.00 ft	55.583 acres
Total Rainfall Duration	24	Hours	Volume	45.52 ac-ft	14.8 MG
Total 24-Hr. Rainfall	11.0	Inches	Elevation	5.12 ft.	47 acres
Green Infrastructure (Runoff CN)	90.00	Default 96	Depth > LOS	37 Inch.	
Flooding Tolerance, Hrs.	4.00	Default 4	Duration	20.5 Hrs.	
Approx. Peak Pumping Rate Reqd.	34,000	GPM	**P.S. Cost**	**$0.00 M**	
Pumping Capacity	**0**	**GPM**	30 ft. tall tank	of 290 ' dia.	14.8 MG
	= 0	MGD			







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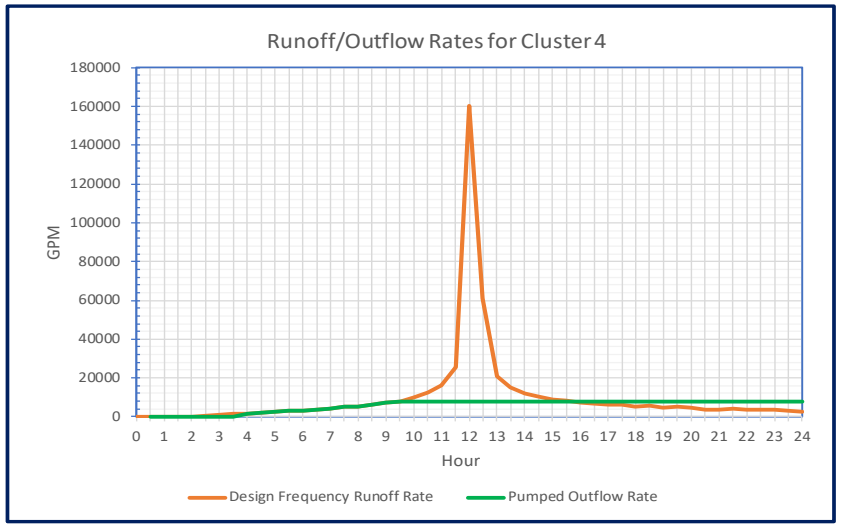
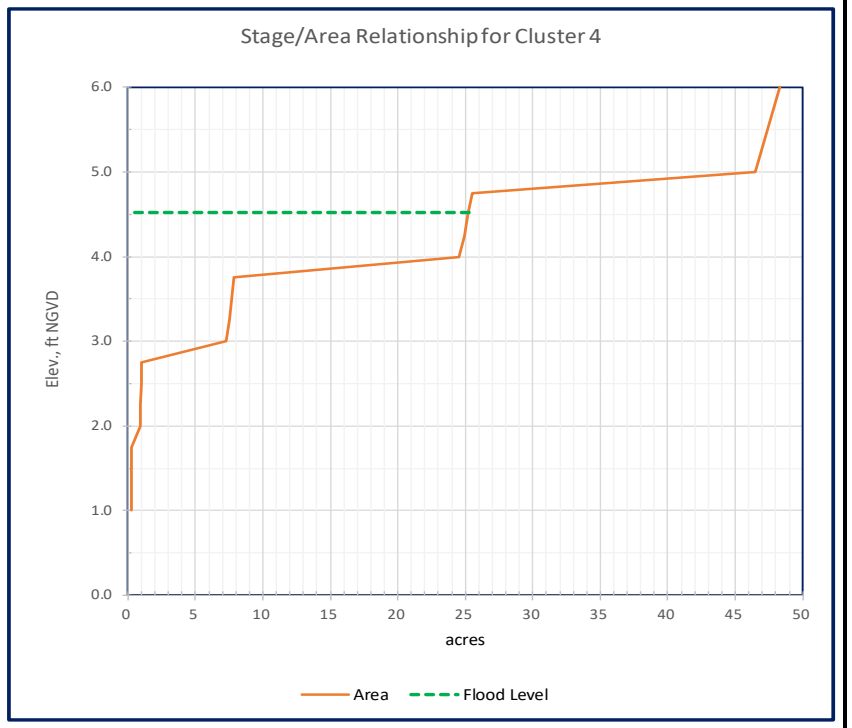
Flood Protection LOS (Rain Freq.)	100	Year	30.609 ac-ft	4.75 ft	25.537 acres
Total Rainfall Duration	24	Hours	Volume	24.68 ac-ft	8.0 MG
Total 24-Hr. Rainfall	11.0	Inches	Elevation	4.52 ft.	25 acres
Green Infrastructure (Runoff CN)	90.00	Default 96	Depth > LOS	30 Inch.	
Flooding Tolerance, Hrs.	4.00	Default 4	Duration	14.5 Hrs.	
Approx. Peak Pumping Rate Reqd.	34,000	GPM	**P.S. Cost**	**$0.72 M**	
Pumping Capacity	**8,000**	**GPM**	30 ft. tall tank	of 290 ' dia.	14.8 MG
	= 12	MGD			





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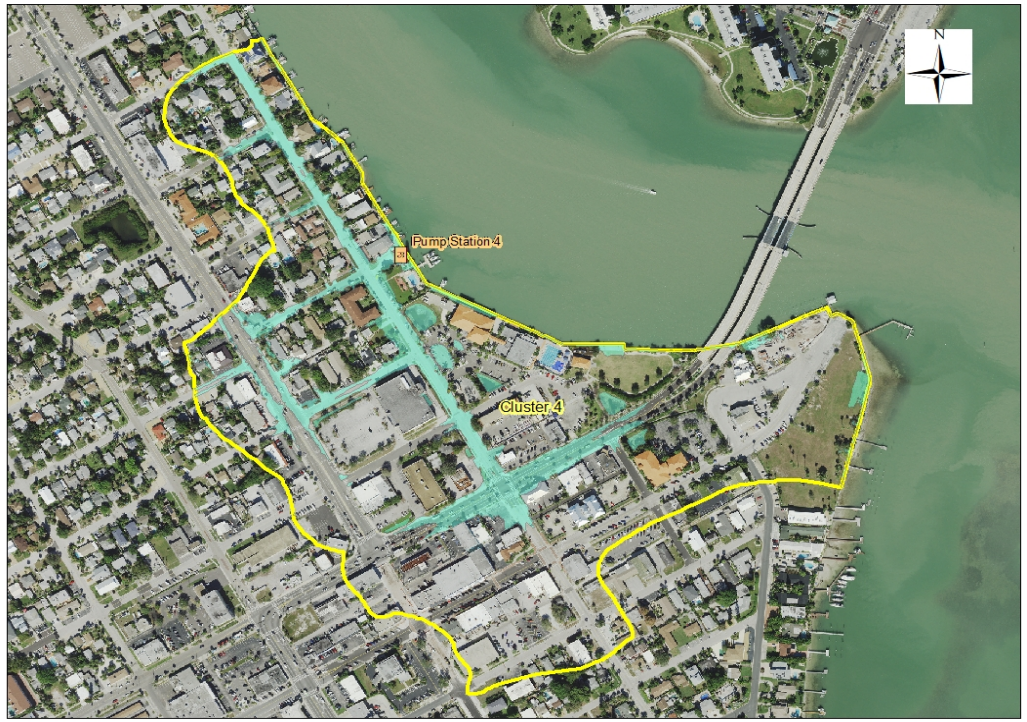
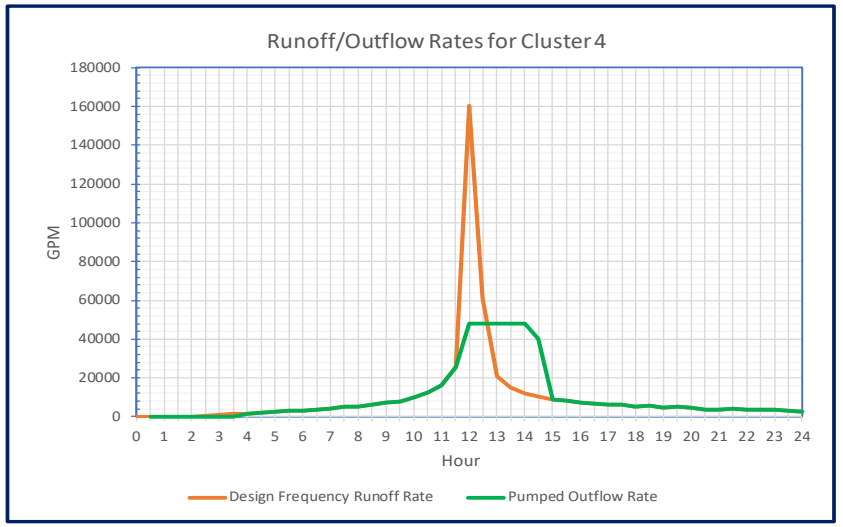
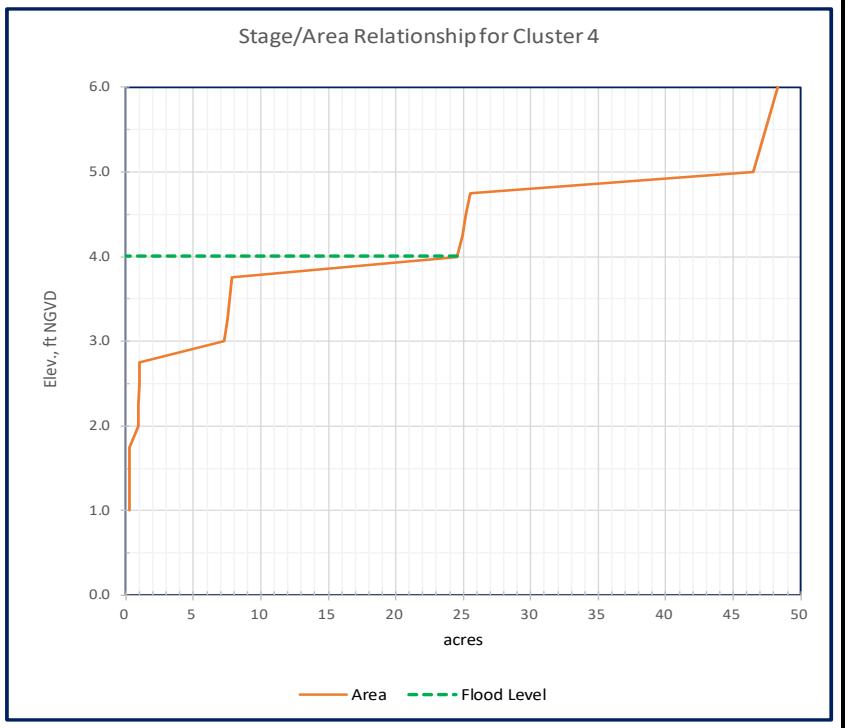
Volume/Area Below LOS Elev.	0.32 Ac-ft	/ 1.17 Ac	11.814 ac-ft	4.00 ft	24.544 acres
Flood Protection LOS (Rain Freq.)	100	Year	17.996 ac-ft	4.25 ft	24.915 acres
Total Rainfall Duration	24	Hours	Volume	11.85 ac-ft	3.9 MG
Total 24-Hr. Rainfall	11.0	Inches	Elevation	4.00 ft.	25 acres
Green Infrastructure (Runoff CN)	90.00	Default 96	Depth > LOS	24 Inch.	
Flooding Tolerance, Hrs.	4.00	Default 4	Duration	2.5 Hrs.	
Approx. Peak Pumping Rate Reqd.	34,000	GPM	**P.S. Cost**	**$2.12 M**	
Pumping Capacity	**48,000**	**GPM**	30 ft. tall tank	of 290 ' dia.	14.8 MG
	= 69	MGD			







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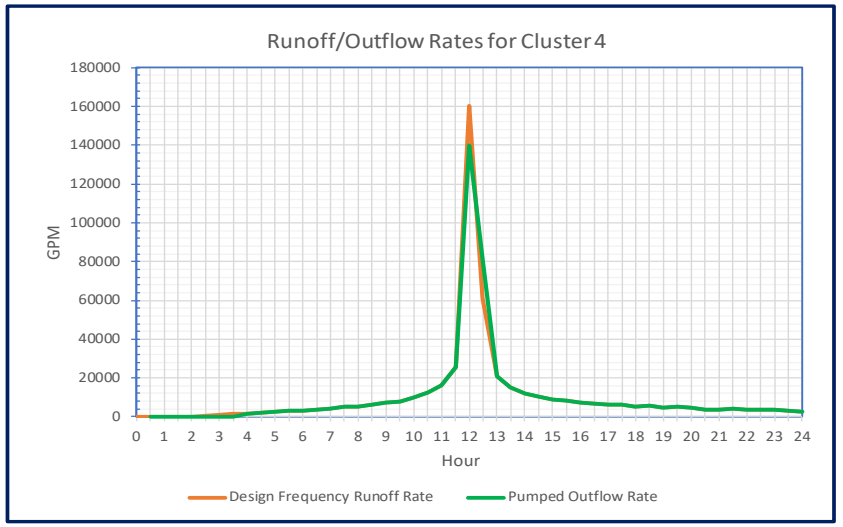
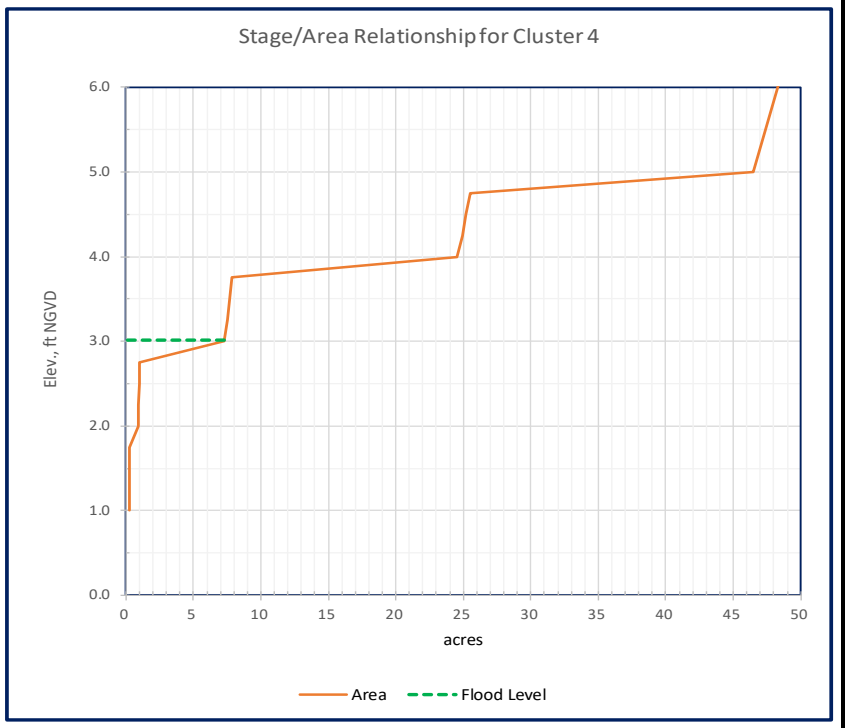
Volume/Area Below LOS Elev.	0.32 Ac-ft	/ 1.17 Ac	2.079 ac-ft	3.00 ft	7.289 acres
Flood Protection LOS (Rain Freq.)	100	Year	3.927 ac-ft	3.25 ft	7.498 acres
Total Rainfall Duration	24	Hours	Volume	2.16 ac-ft	0.7 MG
Total 24-Hr. Rainfall	11.0	Inches	Elevation	3.01 ft.	7 acres
Green Infrastructure (Runoff CN)	90.00	Default 96	Depth > LOS	12 Inch.	
Flooding Tolerance, Hrs.	4.00	Default 4	Duration	0.5 Hrs.	
Approx. Peak Pumping Rate Reqd.	34,000	GPM	**P.S. Cost**	**$5.29 M**	
Pumping Capacity	**140,000**	**GPM**	30 ft. tall tank	of 290 ' dia.	14.8 MG
	= 202	MGD			





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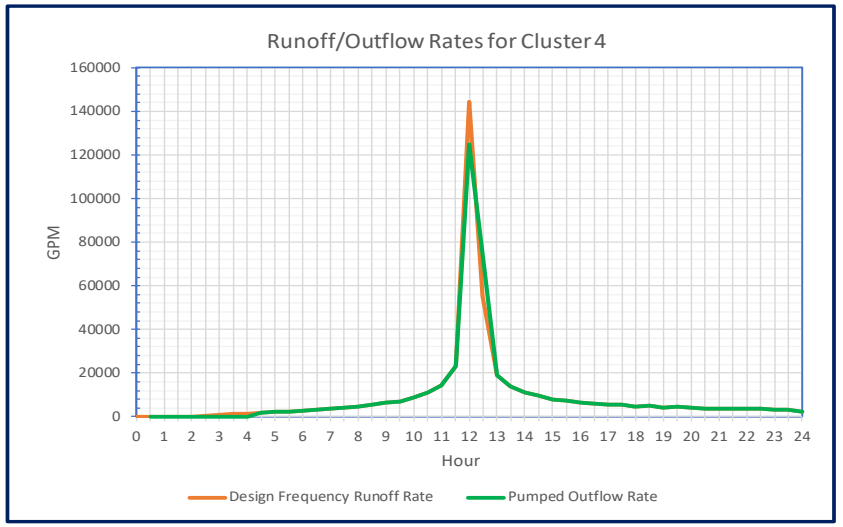
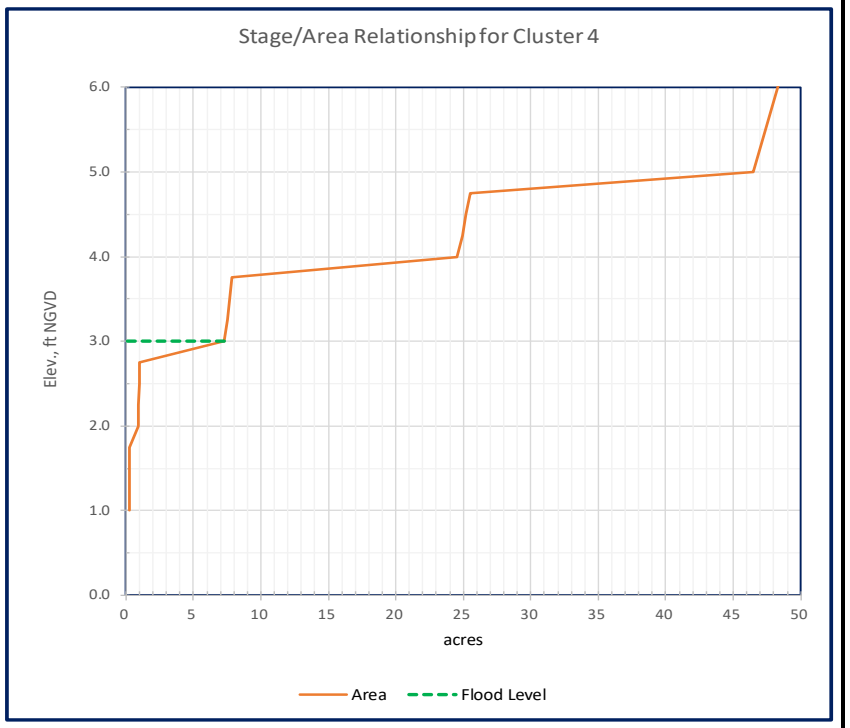
Flood Protection LOS (Rain Freq.)	50	Year	3.927 ac-ft	3.25 ft	7.498 acres
Total Rainfall Duration	24	Hours	Volume	2.11 ac-ft	0.7 MG
Total 24-Hr. Rainfall	10.0	Inches	Elevation	3.00 ft.	7 acres
Green Infrastructure (Runoff CN)	90.00	Default 96	Depth > LOS	12 Inch.	
Flooding Tolerance, Hrs.	4.00	Default 4	Duration	0.5 Hrs.	
Approx. Peak Pumping Rate Reqd.	32,000	GPM	**P.S. Cost**	**$5.05 M**	
Pumping Capacity	**125,000**	**GPM**	30 ft. tall tank	of 275 ' dia.	13.3 MG
	= 180	MGD			





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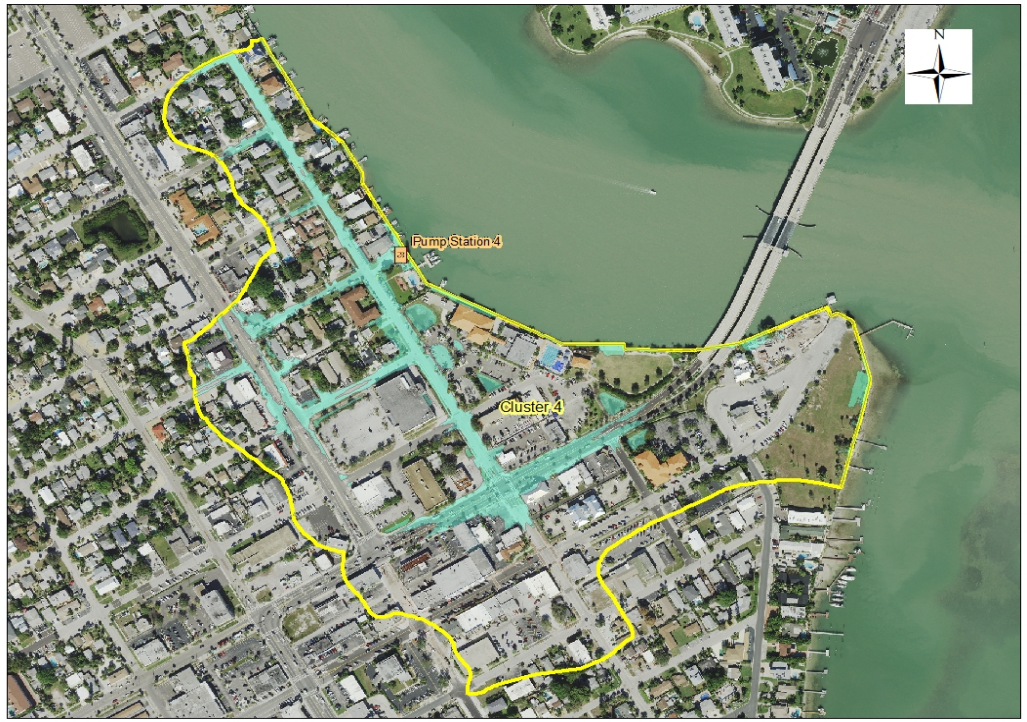
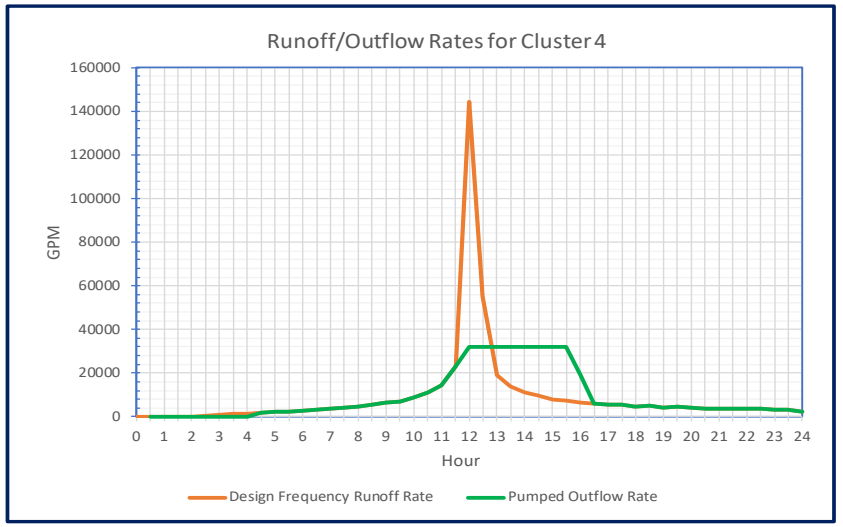
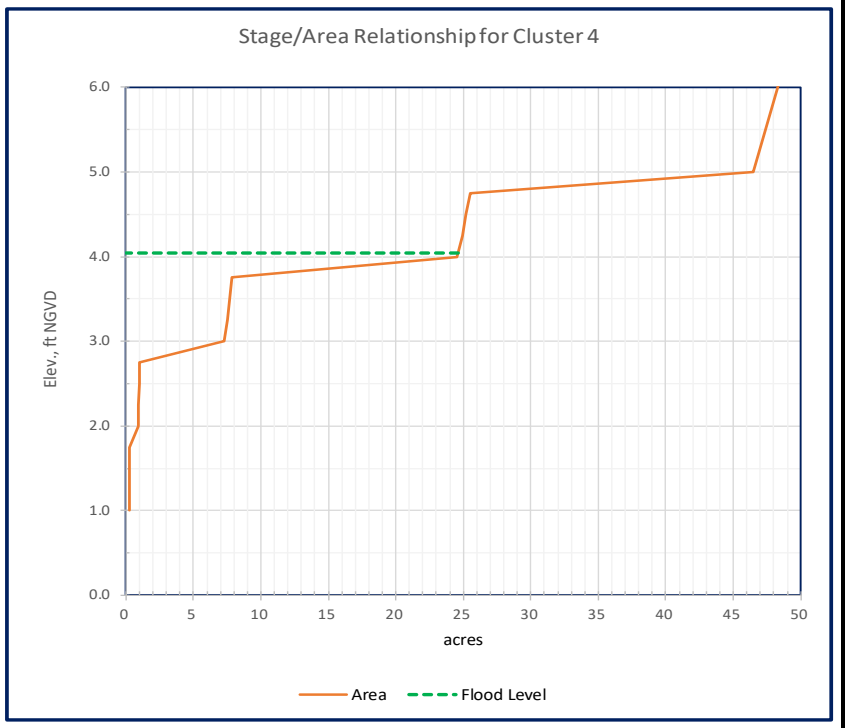
Flood Protection LOS (Rain Freq.)	50	Year	17.996 ac-ft	4.25 ft	24.915 acres
Total Rainfall Duration	24	Hours	Volume	12.83 ac-ft	4.2 MG
Total 24-Hr. Rainfall	10.0	Inches	Elevation	4.04 ft.	25 acres
Green Infrastructure (Runoff CN)	90.00	Default 96	Depth > LOS	24 Inch.	
Flooding Tolerance, Hrs.	4.00	Default 4	Duration	4.0 Hrs.	
Approx. Peak Pumping Rate Reqd.	32,000	GPM	**P.S. Cost**	**$1.90 M**	
Pumping Capacity	**32,000**	**GPM**	30 ft. tall tank	of 275 ' dia.	13.3 MG
	= 46	MGD			







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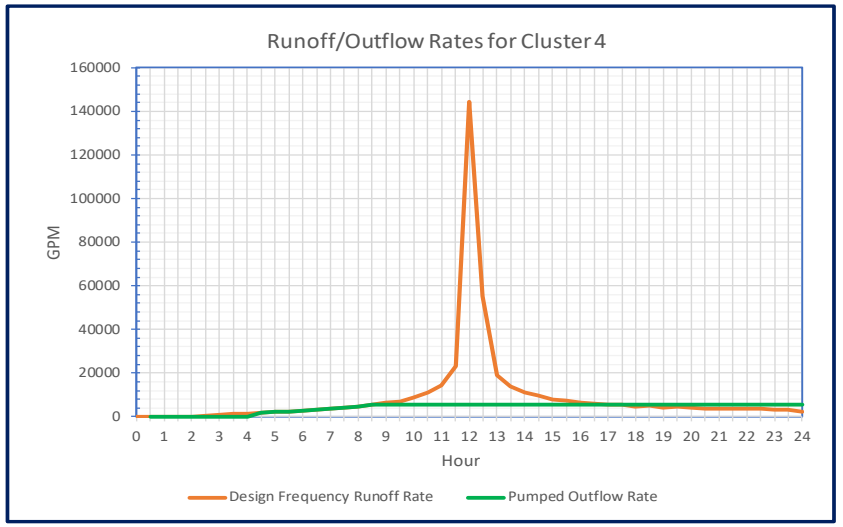
Pumping Capacity	**5,700**	**GPM**	30 ft. tall tank	of 275 ' dia.	13.3 MG
	= 8	MGD			



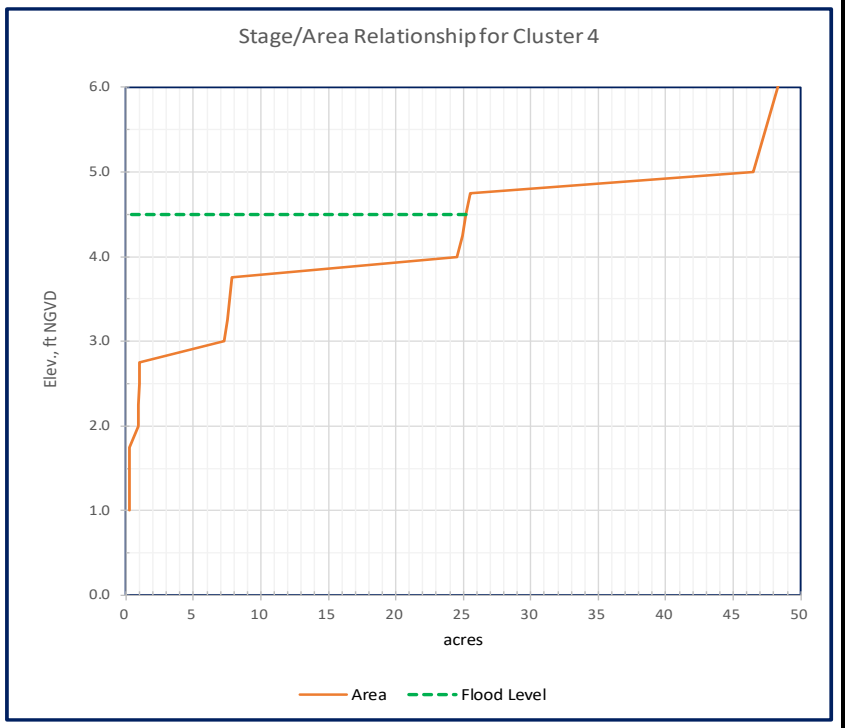
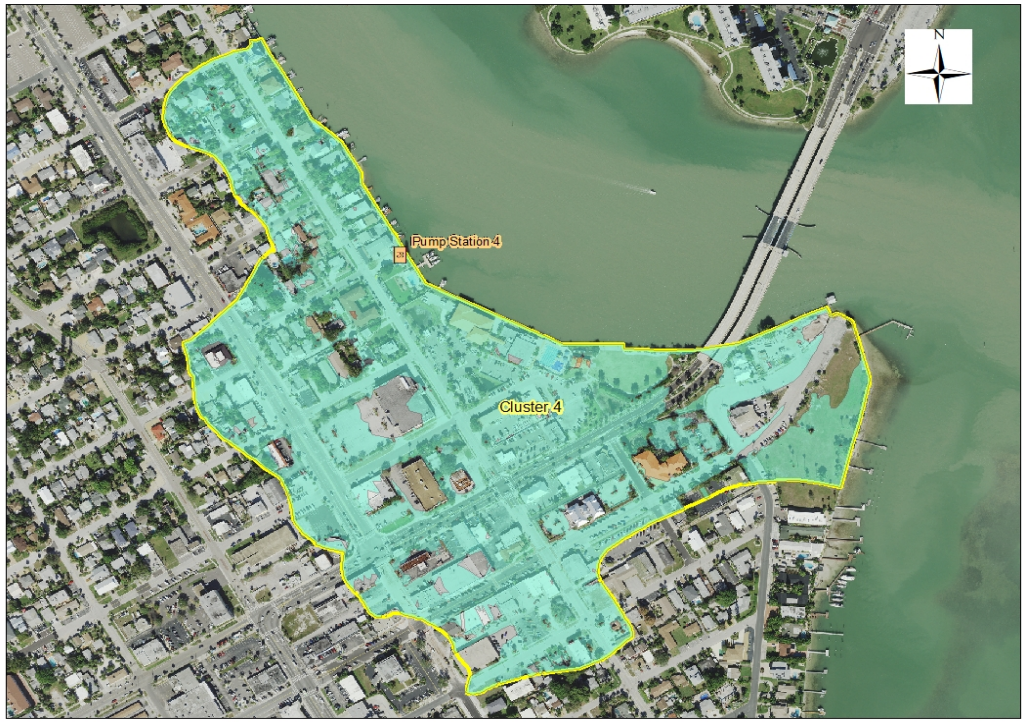
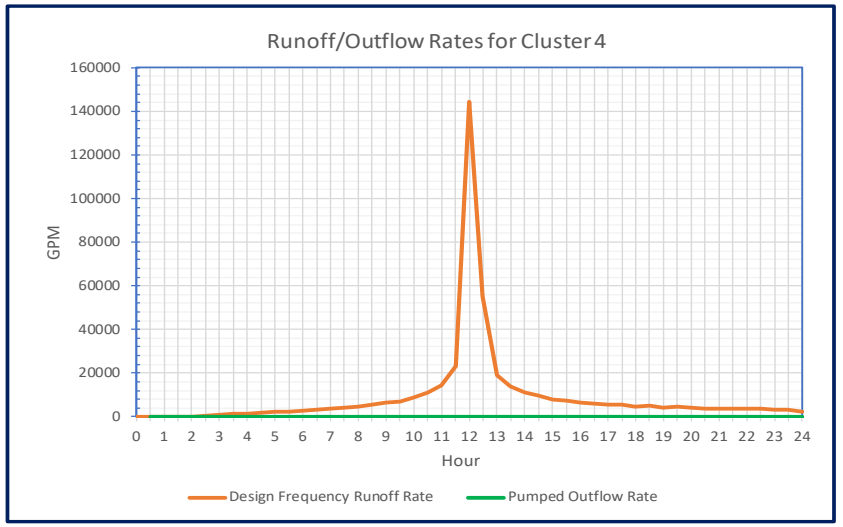
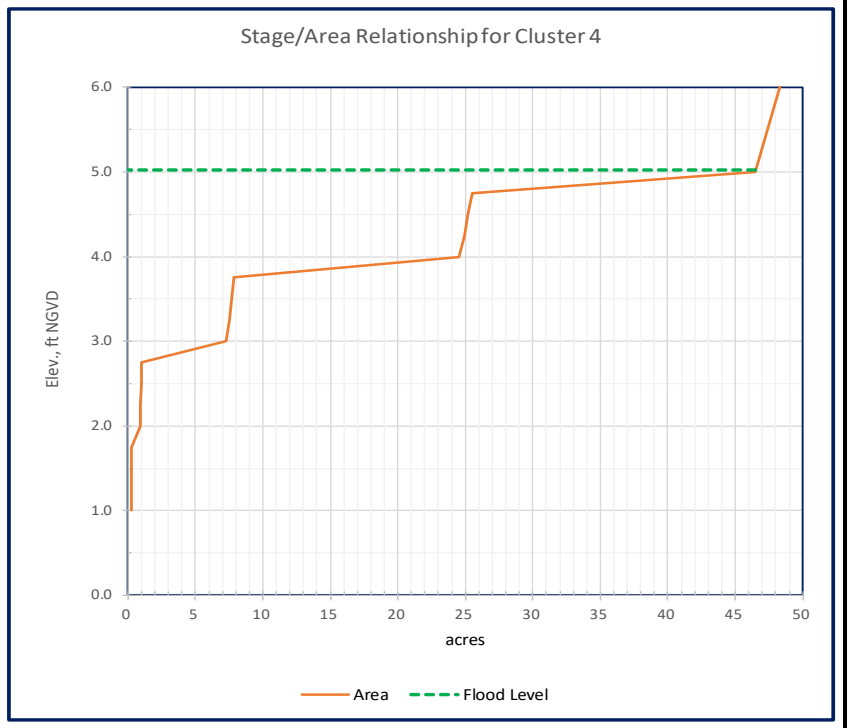


Table 4 -Pump Station Design Table					
Basins Cluster No.	**4**	(6 sub-basins 3C,3D, 3E, 3K,3F, 3P)			
Pump Station Location	In Sub-basin 3K, 78th Ave. & Boca Ciega Dr. (Near east end of 78th Ave.)				
Total Cluster Area	56	Acres			
Flood Level LOS Elevation	2.00	ft.	Flooding & Costs		
Volume/Area Below LOS Elev.	0.32 Ac-ft	/ 1.17 Ac	39.607 ac-ft	5.00 ft	46.445 acres
Flood Protection LOS (Rain Freq.)	50	Year	294.676 ac-ft	10.00 ft	55.583 acres
Total Rainfall Duration	24	Hours	Volume	40.90 ac-ft	13.3 MG
Total 24-Hr. Rainfall	10.0	Inches	Elevation	5.03 ft.	46 acres
Green Infrastructure (Runoff CN)	90.00	Default 96	Depth > LOS	36 Inch.	
Flooding Tolerance, Hrs.	4.00	Default 4	Duration	20.5 Hrs.	
Approx. Peak Pumping Rate Reqd.	32,000	GPM	**P.S. Cost**	**$0.00 M**	
Pumping Capacity	**0**	**GPM**	30 ft. tall tank	of 275 ' dia.	13.3 MG
	= 0	MGD			







There is always a rainbow after every storm…….even if it requires pumping

Table 4 -Pump Station Design Table					
Basins Cluster No.	**4**	(6 sub-basins 3C,3D, 3E, 3K,3F, 3P)			
Pump Station Location	In Sub-basin 3K, 78th Ave. & Boca Ciega Dr. (Near east end of 78th Ave.)				
Total Cluster Area	56	Acres			
Flood Level LOS Elevation	2.00	ft.	Flooding & Costs		
Volume/Area Below LOS Elev.	0.32 Ac / 1.17 Ac		11.814 ac-ft	4.00 ft	24.544 acres
Flood Protection LOS (Rain Freq.)	50	Year	17.996 ac-ft	4.25 ft	24.915 acres
Total Rainfall Duration	24	Hours	Volume	12.72 ac-ft	4.1 MG
Total 24-Hr. Rainfall	10.0	Inches	Elevation	4.04 ft.	25 acres
Green Infrastructure (Runoff CN)	75.00	Default 96	Depth > LOS	24 Inch.	
Flooding Tolerance, Hrs.	8.00	Default 4	Duration	8.0 Hrs.	
Approx. Peak Pumping Rate Reqd.	16,500	GPM	**P.S. Cost**	**$1.27 M**	
Pumping Capacity	**16,500**	**GPM**	30 ft. tall tank	of 243 ' dia.	10.4 MG
	= 24	MGD