



TAYLOR ENGINEERING, INC.



Demonstrating Net Monetary Benefits of Restoration — Quantification of Five Beach and Estuarine Marsh Restoration Projects In Texas

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Presentation outline

- Purpose
- Evaluated projects
- Methods
- Results
- Summary
- Ongoing efforts





Purpose

- 76th Texas Legislature passed the Texas Coastal Erosion Planning and Response Act (CEPRA) in 1999 to address significant coastal erosive threat to Texas coastal assets
- Texas General Land Office (GLO) implemented series of erosion response projects with federal, state, and locals
- Legislature requires the GLO report the economic and natural resource benefits derived from CEPRA funding every biennium
- This presentation focuses on select Cycle 4 (2006 – 2007) projects





Evaluated projects

- **#1189 West Bay Bird Island**
 - Channel relocation and wetland habitat restoration
- **#1191 Goose Island State Park**
 - Breakwater and marsh edge dike protecting seagrass, oyster beds, and submerged habitats
- #1214 Jamaica Beach
- #1233 South Padre Island
- **#1239 Port Aransas Nature Preserve**
 - Revetment protecting 1,200 acres of estuarine wetland and coastal habitat; jetties to reduce channel shoaling





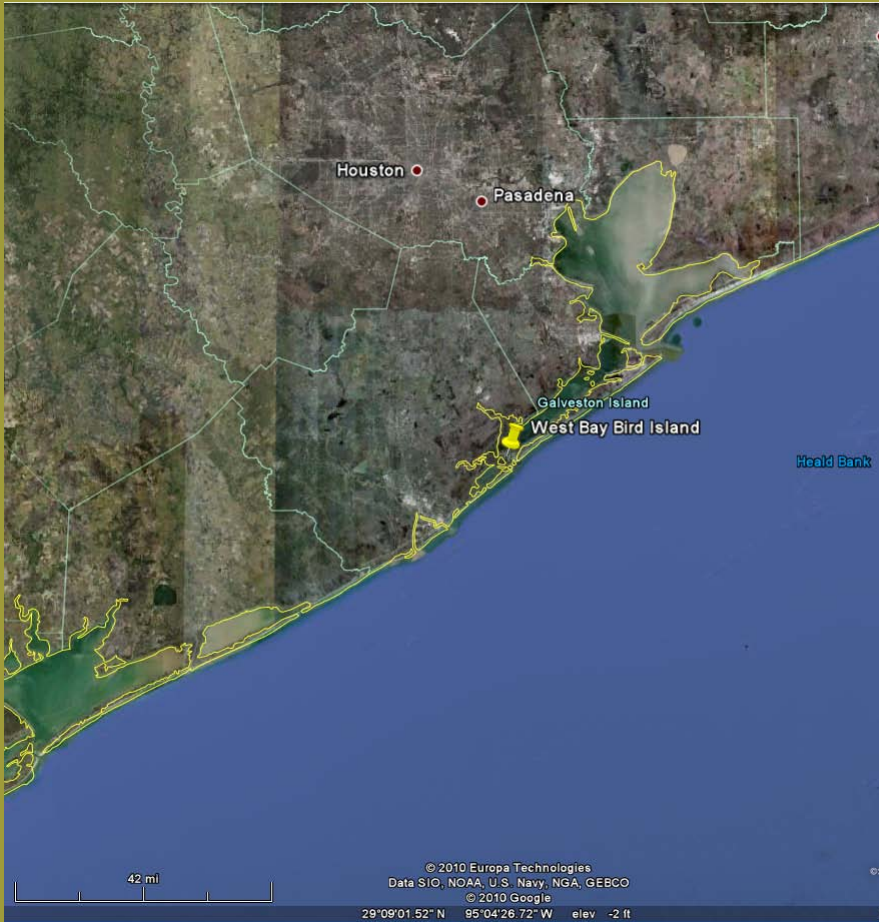
West Bay Bird Island

- Habitat
 - High intertidal marsh for bird rookery
 - Nursery grounds for recreationally and commercially important aquatic species
- Issues
 - Land loss (3.3 ac/yr)
- Project
 - Dredge to move adjacent channel and reduce erosion of island
 - Construct 17.8 acres of new estuarine wetlands
- Project cost
 - \$598,666 (Texas portion only)





West Bay Bird Island





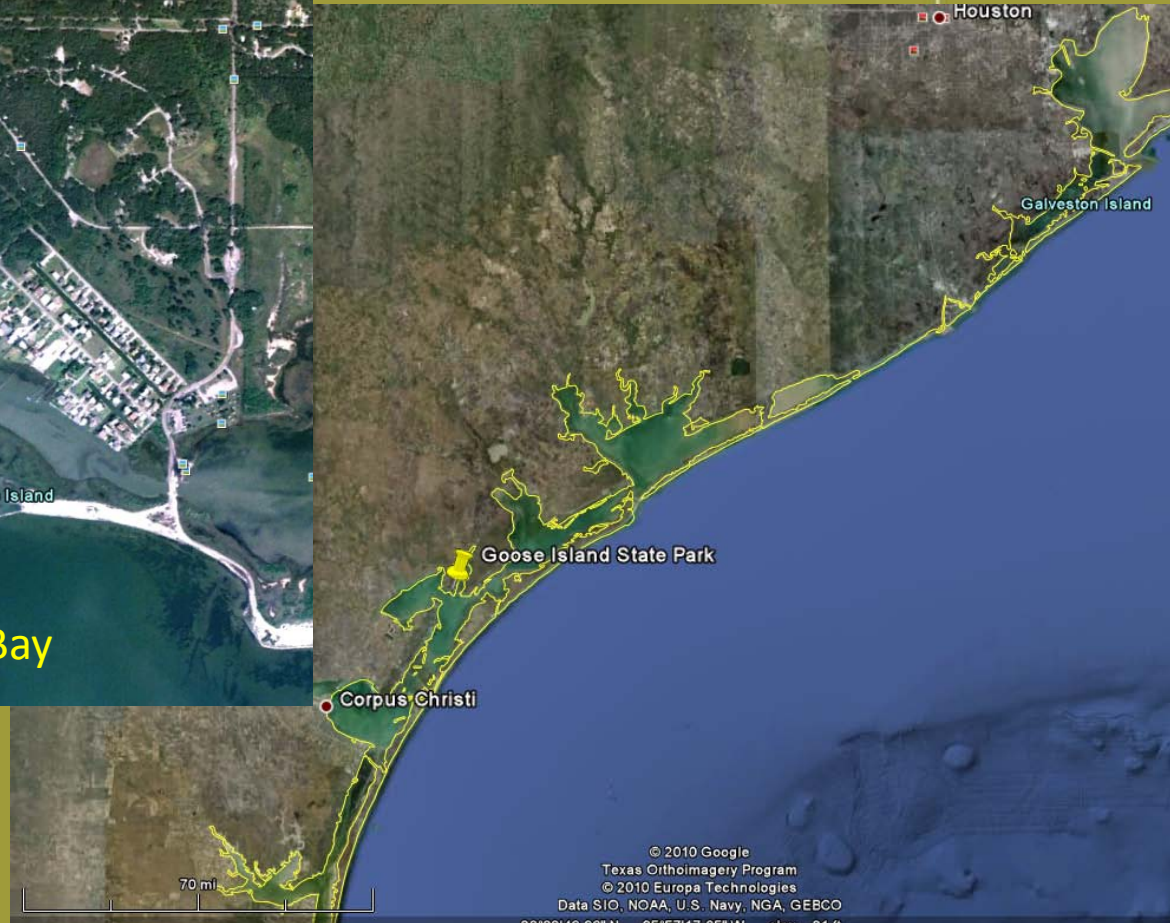
Goose Island State Park

- Marsh, shell ridge, seagrass, and oyster reef habitats
- Function
 - Feeding habitat for waterfowl, shorebirds, and wading birds
 - Nursery for commercially and recreationally important finfish and shellfish
- Issues
 - Land loss (1.2 ac/yr) of wetland, barrier island habitats
 - Impacts to seagrass and oyster reef habitats
- Project
 - Breakwater to reduce wave energy
 - Construction of berms for future salt marsh construction
- Project cost
 - \$1,718,270 (Texas portion only)





Goose Island State Park





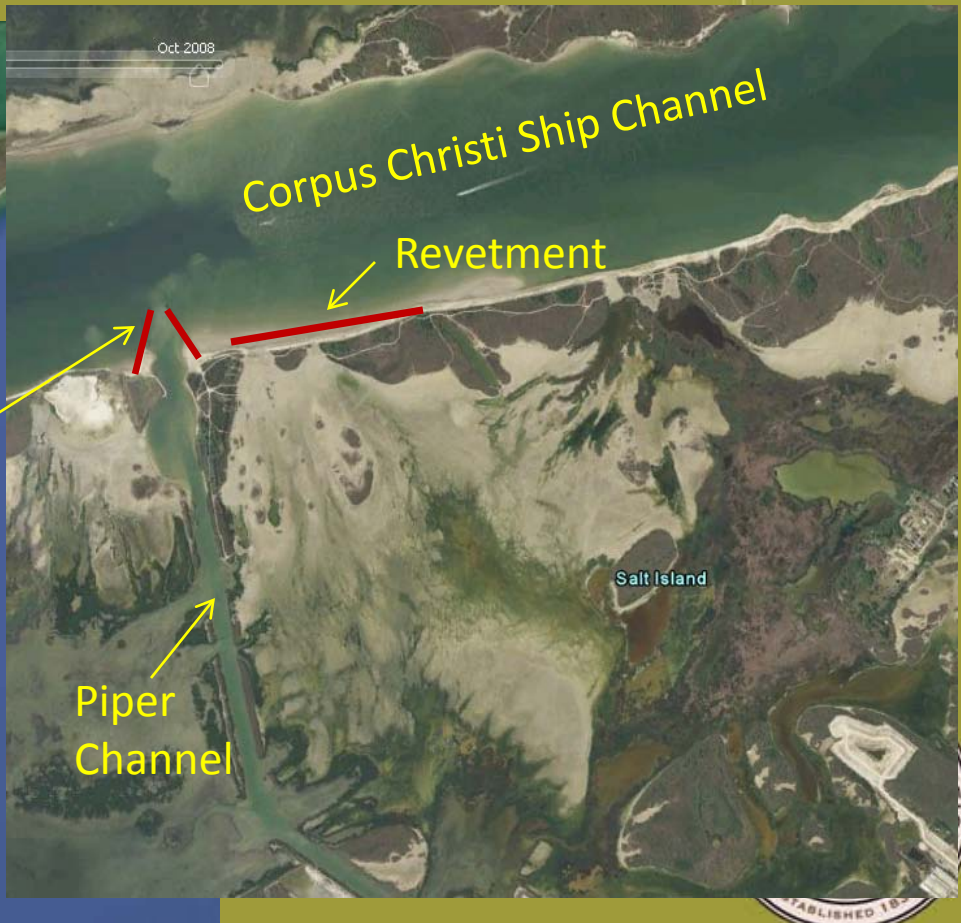
Port Aransas Nature Preserve

- 1,200 ac
 - Wetlands and upland habitat
- Issues
 - Land loss (2.2 ac/yr)
 - Extensive shoaling in Piper Channel
- Project
 - 6,000-ft-long revetment along Preserve shoreline
 - Jetties at mouth of Piper Channel
- Project cost
 - \$3.74 million (Texas portion only)





Port Aransas Nature Preserve





Methods

- Identify the services and functions of each project area
 - For the ecosystem, for human beings
- Visit each site and assess ecological status and conditions
- Find published dollar value estimates of services and functions
 - Natural resource functions, tourism, real estate value benefits of proximity to natural areas
- Identify other possible financial benefits
 - Use of federal dollars in Texas
 - Multiplier effect (secondary effects of spending by visitors)





Methods

- Evaluate published literature for applicability to projects
 - Focus on Texas data if available
- Adjust all dollar values to common year
 - Estimate long-term inflation rate and future dollar value discount rate
- Calculate benefits — defined as the estimated difference between conditions with and without the project over the period of analysis





Benefit analysis – benefit categories

- Recreational fishing
- Commercial fishing
- Ecotourism
- Storm/flood protection (except Port Aransas Nature Preserve)
- Out-of-state visitor spending (except West Bay Bird Island)
- Dredging (Port Aransas Nature Preserve)
- Property valuation (except West bay Bird Island)
- Federal spending





Benefit analysis – available recreational fishing literature values

Value (per acre per year)	Data Year	2006 dollar value	Reference
\$981.00	1984	\$1,903.46	Bell (1997)
\$357.00	1990	\$550.66	Woodward et al. (2000)
\$57.00	1968	\$330.21	Gosselink et al. (1973)
\$1,618.75	2001	\$1,842.69	Xu (2004)
\$948.32	2003	\$1,039.03	Xu (2004)





Benefit analysis – available commercial fishing literature values

Value (per acre per year)	Data Year	2006 dollar value	Reference
\$778.00	1990	\$1,200.04	Woodward et al. (2000)
\$317.00	1983	\$641.64	Barbier et al. (1997)
\$846.00	1983	\$1,712.39	Barbier et al. (1997)
\$45.91	1998	\$56.78	Letson et al. (2002)
\$1,700.00	1998	\$2,102.58	Letson et al. (2002)
\$37.46	1983	\$75.82	Farber and Costanza (1987)
\$462.69	2002	\$518.50	Xu (2004)





Benefit analysis – available ecotourism literature values

Value (per acre per year)	Data Year	2006 dollar value	Reference
\$1,212.00	1990	\$1,869.47	Woodward et al. (2000)
\$1,869.47	2003	\$2,048.29	Xu (2004)





Benefit analysis – available storm/flood protection literature values

Value (per acre per year)	Data Year	2006 dollar value	Reference
\$393.00	1990	\$606.19	Woodward et al. (2000)
\$237.00	1990	\$365.56	Woodward et al. (2000)
\$77.15	1995	\$102.05	Boyer et al. (2004)





Benefit analysis – available adjacent land value literature values

Reference	Location	Type Open Space	Average Increase in House Price
Frech and Lafferty (1984)	CA coast	Protected coastal land	7.6 - 13.4% (< 0.5 miles from coast)
Irwin (2002)	Central MD	Permanently protected open space	0.57 – 1.87% for every acre of developable land converted to permanently open space
Lutzenhiser and Netusil (2001)	Portland, OR	Natural area urban park	16.1% within 1,500 ft of park

This study – one-time (2006) benefit
 Goose Island – 1% for residences
 Port Aransas – 7.6% for residences, 1% for undeveloped lots





Benefit analysis – other parameters

Parameter	Value
Inflation rate	2.5%
Discount rate	7.0%
Period of analysis	10 – 20 yrs
Habitat loss rate	1.2 – 3.3 ac/yr
Out-of-state tourist spending	\$101.71 – \$103.52/day
Tourism growth rate	1.5%
Population growth	2.5%





Benefit analysis – Port Aransas Nature Preserve

Service Function	Existing Habitat Annual Service Values per Acre
Recreational fishing	\$1,039
Commercial fishing	\$642
Ecotourism	\$1,959
Total	\$3,640





Benefit analysis – Port Aransas Nature Preserve Benefits for Existing Acreage



Year	Relevant Acres		Acres With vs. Without	Benefit Value (2006 Prices)	With Inflation	Discounted Present Worth	Cumulative Discounted Present Worth
	With Project	Without Project					
2007	43.2	41.04	2.16	\$7,862	\$8,059	\$7,791	\$7,791
2008	43.2	38.88	4.32	\$15,725	\$16,521	\$14,926	\$22,717
2009	43.2	36.72	6.48	\$23,587	\$25,401	\$21,448	\$44,165
2010	43.2	34.56	8.64	\$31,450	\$34,714	\$27,395	\$71,560
2011	43.2	32.40	10.80	\$39,312	\$44,478	\$32,803	\$104,363
2012	43.2	30.24	12.96	\$47,174	\$54,708	\$37,708	\$142,072
2013	43.2	28.08	15.12	\$55,037	\$65,421	\$42,143	\$184,215
2014	43.2	25.92	17.28	\$62,899	\$76,637	\$46,138	\$230,353
2015	43.2	23.76	19.44	\$70,762	\$88,372	\$49,722	\$280,075
2016	43.2	21.60	21.60	\$78,624	\$100,645	\$52,923	\$332,998
2017	43.2	19.44	23.76	\$86,486	\$113,478	\$55,767	\$388,766
2018	43.2	17.28	25.92	\$94,349	\$126,889	\$58,279	\$447,045
2019	43.2	15.12	28.08	\$102,211	\$140,899	\$60,480	\$507,525
2020	43.2	12.96	30.24	\$110,074	\$155,531	\$62,393	\$569,918
2021	43.2	10.80	32.40	\$117,936	\$170,806	\$64,038	\$633,956
2022	43.2	8.64	34.56	\$125,798	\$186,748	\$65,435	\$699,391
2023	43.2	6.48	36.72	\$133,661	\$203,381	\$66,600	\$765,991
2024	43.2	4.32	38.88	\$141,523	\$220,728	\$67,552	\$833,544
2025	43.2	2.16	41.04	\$149,386	\$238,815	\$68,307	\$901,851
2026	43.2	0.00	43.20	\$157,248	\$257,669	\$68,878	\$970,728





Benefit analysis – Port Aransas Nature Preserve Maintenance Dredging Cost Savings



Year	Annual Benefit (2006 Prices)	With Inflation	Discounted Present Worth	Cumulative Discounted Present Worth
2007	\$168,750	\$172,969	\$167,215	\$167,215
2008	\$168,750	\$177,293	\$160,183	\$327,398
2009	\$168,750	\$181,725	\$153,446	\$480,844
2010	\$168,750	\$186,268	\$146,993	\$627,837
2011	\$168,750	\$190,925	\$140,811	\$768,648
2012	\$168,750	\$195,698	\$134,889	\$903,537
2013	\$168,750	\$200,591	\$129,216	\$1,032,753
2014	\$168,750	\$205,605	\$123,782	\$1,156,534
2015	\$168,750	\$210,746	\$118,576	\$1,275,110
2016	\$168,750	\$216,014	\$113,589	\$1,388,699
2017	\$168,750	\$221,415	\$108,812	\$1,497,511
2018	\$168,750	\$226,950	\$104,236	\$1,601,747
2019	\$168,750	\$232,624	\$99,852	\$1,701,599
2020	\$168,750	\$238,439	\$95,653	\$1,797,252
2021	\$168,750	\$244,400	\$91,630	\$1,888,882
2022	\$168,750	\$250,510	\$87,776	\$1,976,658
2023	\$168,750	\$256,773	\$84,085	\$2,060,743
2024	\$168,750	\$263,192	\$80,548	\$2,141,291
2025	\$168,750	\$269,772	\$77,161	\$2,218,452
2026	\$168,750	\$276,517	\$73,916	\$2,292,368





Benefit analysis – Port Aransas Nature Preserve Out-of-State Visitor Spending



Year	Total Visitor Days		Out-of-State Visitor Days		Visitors With vs. Without	Benefit Value (2006 Prices)	With Inflation	Discounted Present Worth	Cumulative Discounted Present Worth
	With project	Without Project	With Project	Without Project					
2007	159,719	157,416	33,541	33,057	484	\$68,885	\$70,607	\$68,259	\$68,259
2008	166,108	161,351	34,883	33,884	999	\$142,248	\$149,449	\$135,026	\$203,285
2009	172,752	165,385	36,278	34,731	1,547	\$220,311	\$237,250	\$200,331	\$403,616
2010	179,662	169,519	37,729	35,599	2,130	\$303,305	\$334,792	\$264,199	\$667,815
2011	186,849	173,757	39,238	36,489	2,749	\$391,474	\$442,916	\$326,659	\$994,474
2012	194,323	178,101	40,808	37,401	3,407	\$485,070	\$562,532	\$387,736	\$1,382,211
2013	202,096	182,554	42,440	38,336	4,104	\$584,358	\$694,618	\$447,457	\$1,829,668
2014	210,180	187,118	44,138	39,295	4,843	\$689,616	\$840,230	\$505,848	\$2,335,516
2015	218,587	191,796	45,903	40,277	5,626	\$801,130	\$1,000,502	\$562,932	\$2,898,447
2016	227,330	196,591	47,739	41,284	6,455	\$919,204	\$1,176,658	\$618,735	\$3,517,182

Year	Annual Benefit Value With Project (2006 Prices)	With Inflation	Discounted Present Worth	Cumulative Discounted Present Worth
2017	\$919,204	\$1,206,075	\$592,713	\$592,713
2018	\$919,204	\$1,236,227	\$567,786	\$1,160,499
2019	\$919,204	\$1,267,132	\$543,907	\$1,704,406
2020	\$919,204	\$1,298,811	\$521,033	\$2,225,439
2021	\$919,204	\$1,331,281	\$499,120	\$2,724,559
2022	\$919,204	\$1,364,563	\$478,129	\$3,202,688
2023	\$919,204	\$1,398,677	\$458,021	\$3,660,709
2024	\$919,204	\$1,433,644	\$438,758	\$4,099,467
2025	\$919,204	\$1,469,485	\$420,306	\$4,519,773
2026	\$919,204	\$1,506,222	\$402,629	\$4,922,402

\$8,439,584





Benefit analysis – Port Aransas Nature Preserve Summary of Benefits (2007-2026)



Benefit Type	Discounted Present Worth
Existing acreage	\$970,728
Maintenance dredging	\$2,292,368
Residential property values	\$5,599,387
Residential lot values	\$51,682
Out-of-state visitation	\$8,439,584
Federal spending	\$3,654,000
Total	\$21,007,749

Type	Discounted Present Worth
Total benefits	\$21,007,749
Total costs	\$3,740,000
B/C ratio	5.62





Benefit analysis – West Bay Bird Island Summary of Benefits (2007-2016)



Benefit Type	Discounted Present Worth
Existing acreage	\$928,020
New acreage	\$346,214
Federal spending	\$75,600
Total	\$1,349,834

Type	Discounted Present Worth
Total benefits	\$1,349,834
Total costs	\$598,666
B/C ratio	2.25





Benefit analysis – Goose Island State Park Summary of Benefits (2007-2026)

Benefit Type	Discounted Present Worth
Existing acreage	\$1,707,663
Out-of-state visitation	\$8,412,166
Residential property values	\$77,049
Federal spending	\$56,700
Total	\$10,253,578

Type	Discounted Present Worth
Total benefits	\$10,253,578
Total costs	\$1,718,270
B/C ratio	5.97





Evaluated beach/dune projects

- #1214 Jamaica Beach
 - Restored 3,000 ft of dunes with 26,000 cy of sand from Apfel Park
 - Planted dune vegetation
- #1233 South Padre Island
 - Nourish 4,500 ft of beach with 71,000 cy of wind-blown sand removed from Park Road 100





Benefit analysis – Jamaica Beach and South Padre Island Summary of Benefits

Jamaica Beach (2007-2011)

South Padre Island (2007-2008)

Benefit Type	Discounted Present Worth
Storm damage reduction	\$4,643,722
Visitation	
Out-of-state spending	\$43,890
Recreation (WTP)	\$88,870
Subtotal	\$132,760
Total	\$4,776,482
Total cost	\$1,066,667
B/C ratio	4.48

Benefit Type	Discounted Present Worth
Storm damage reduction	\$337,209
Visitation	
Out-of-state spending	\$45,013
Recreation (WTP)	\$88,072
Subtotal	\$133,085
Total	\$470,294
Total cost	\$300,000
B/C ratio	1.57





Summary

- The direct and positive net benefits (B/C ratios greater than 1.0) from the evaluated Cycle 4 CEPRAs projects indicate that these coastal erosion control projects yield good returns on investment for Texans





Ongoing efforts

- Evaluate select CEPRA Cycle 5 and 6 projects
- Projects include
 - #1356 South Padre Island Beach Nourishment with Beneficial Use of Dredged Material / #1355 South Padre Island Beach Nourishment with Truck Haul / #1456 South Padre Island Beach Nourishment with Beneficial Use of Dredged Materials / #1453 Isla Blanca Park Beach Nourishment with Beneficial Use of Dredged Material
 - #1379 Surfside Revetment Project
 - #1391 West Galveston Island Large Scale Beach Nourishment
 - #1404 Sylvan Beach Shoreline Protection and Beach Nourishment
 - #1447 Galveston Seawall Emergency Beach Nourishment
 - **#1483 West Galveston Island Estuarine Restoration**

