A Monte Carlo Simulation Model for Beach Fill Optimization

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Purpose

- An integrated coastal engineering – economics analytical framework for evaluating the life-cycle physical performance and economic costs of beach nourishment projects along sandy shores

San Clemente, CA

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Previous Corps R/U Models

- Storm Damage Model – Jacksonville
- GRANDUC – Wilmington
- “Becky” – Corps R&D

WENDY

- Wave-induced
- Economic
- Net
- Damage
- Yields

WENDY

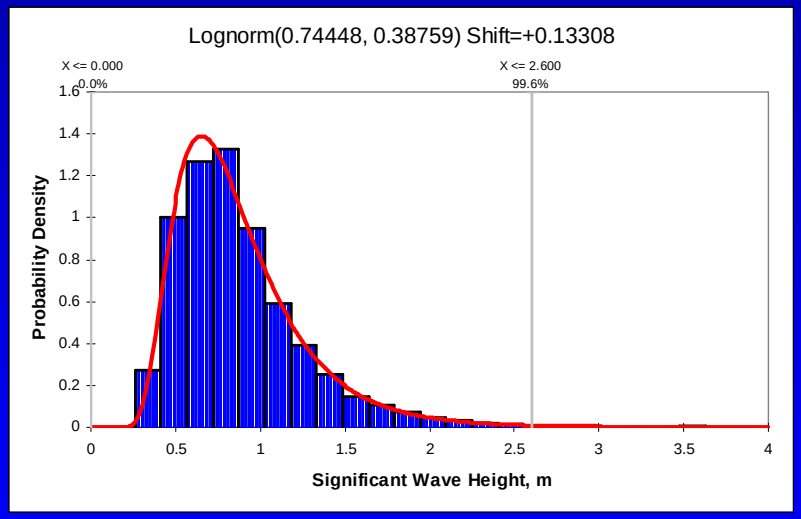
- Excel Spreadsheet
- @Risk – Monte Carlo Simulation Generator
- Inputs: Engineering & Economic
- Outputs: Economic

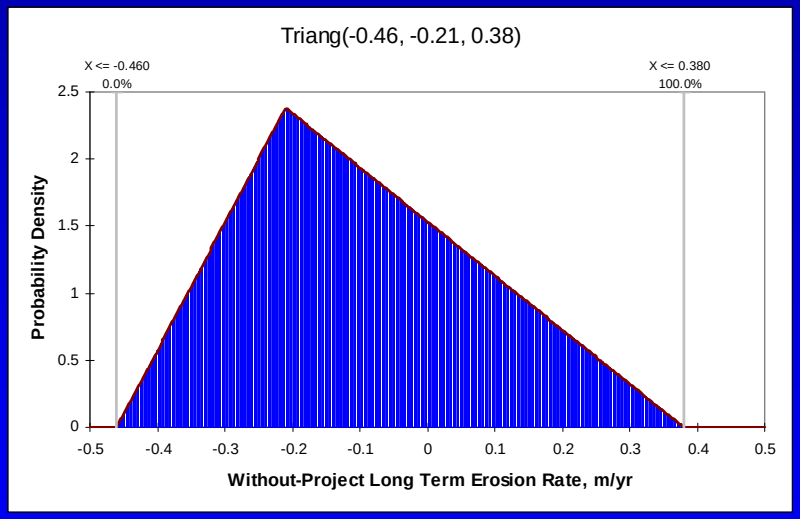
Engineering Inputs

- Beach Morphology
- Structure Information

- Water Level (tide+surge+SLC)
- Wave Info (height, period)
- Shoreline Erosion Rates

Engineering Inputs





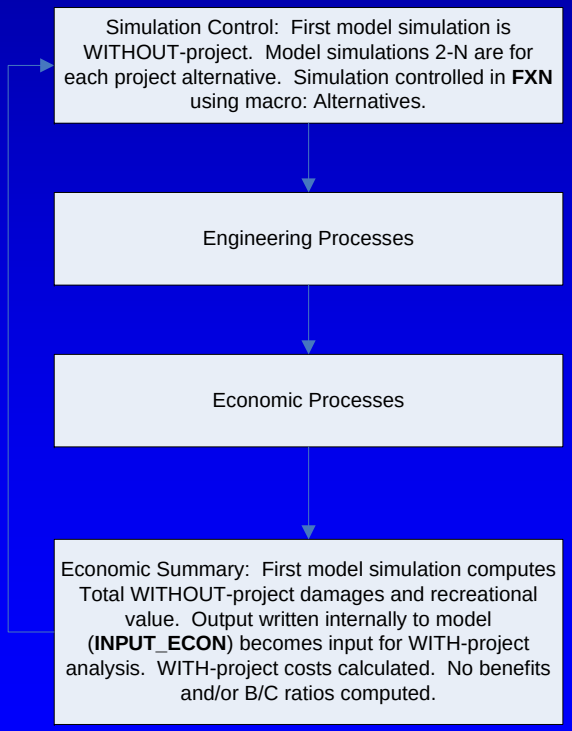
Economic Inputs

- Real Estate Valuations
- Costs
- Recreation
- Interest Rates

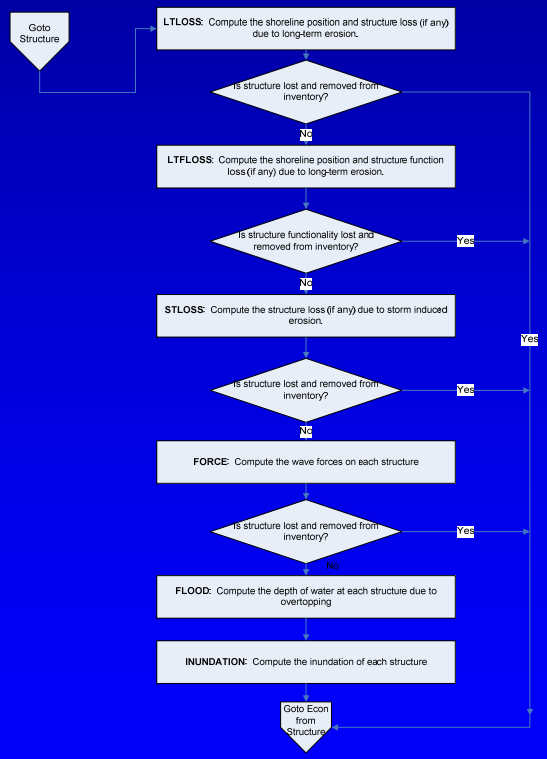
- Unit Prices

Model Logic

GENERAL MODEL FLOW

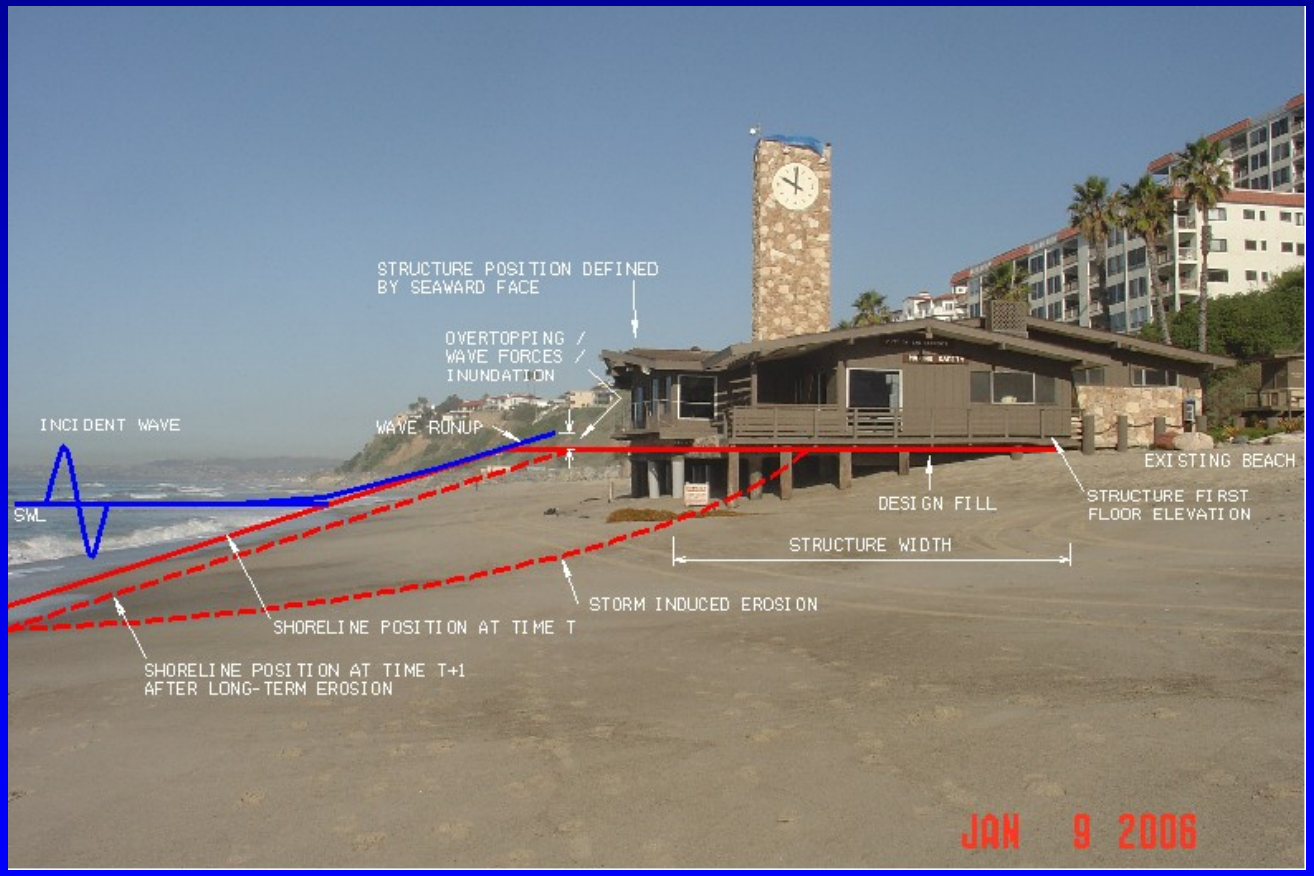


STRUCTURE



Note: BOLD corresponds to model worksheet name.

Structure Damages



Railroad Damages

Model

	A	B	C	D	E	F	G	H	I	J	K	L	M
6			Coastal Engineering Input and Parameter Calculations										
7			Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
8			2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
9			1	2	3	4	5	6	7	8	9	10	11
10	Long Term Erosion		-0.1	-1.1	0.8	0.1	-0.6	-1.1	-0.1	-0.2	0.2	-1.0	0.4
11	Storm Erosion		3									2	0
12	Period		13									4	10
13	Water Level		6.3									5	4.7
14	Beach Slope		7									9	11
15	Lo		866									4	512
16	Hs		9.0									0	10.1
17	SurfSimBeach		1.40									2	0.65
18	Runup 2% Beach		16.9									5	11.6
19	L @ Revet		185									8	123
20	H @ Revet		3.8									7	2.8
21	SurfSimRevet		4.67									8	4.39
22	Runup1/3 Revet		11.1									6	8.5
23	MF		1.00									2	0.95
24	H/L		0.020									6	0.023
25	Runup Revet 2% Hughes		17.8									1	13.2
35	Sea Level Rise (cum)												0.3
36													
37													
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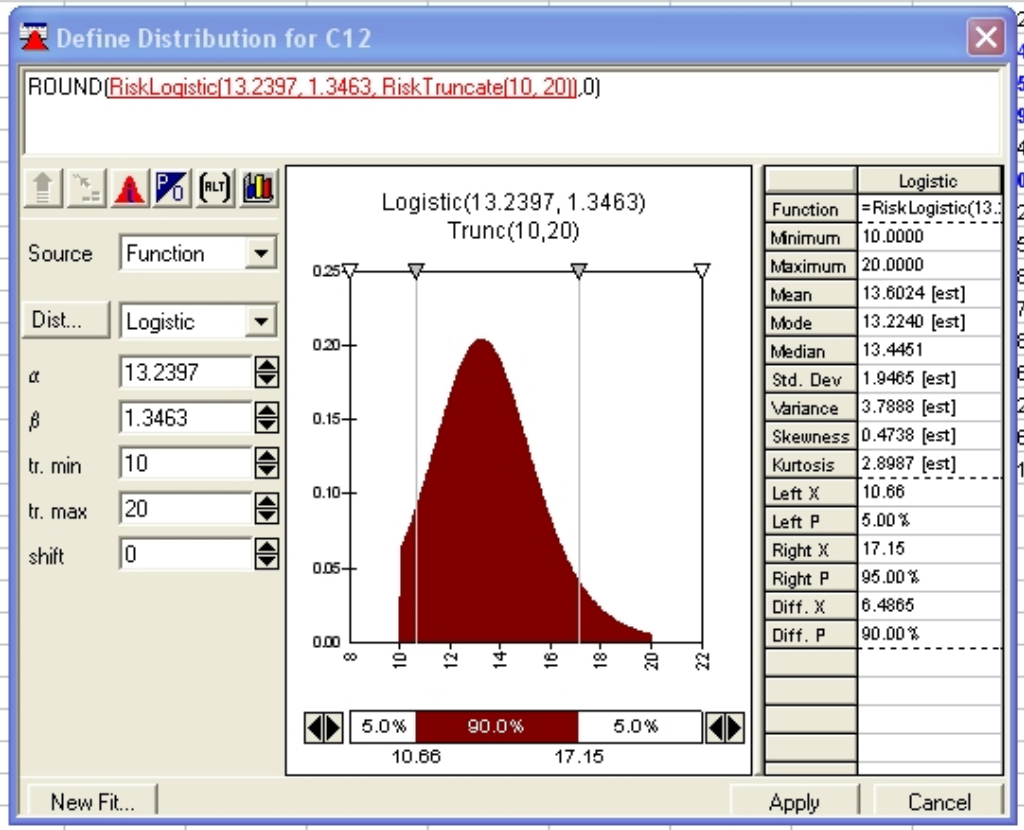
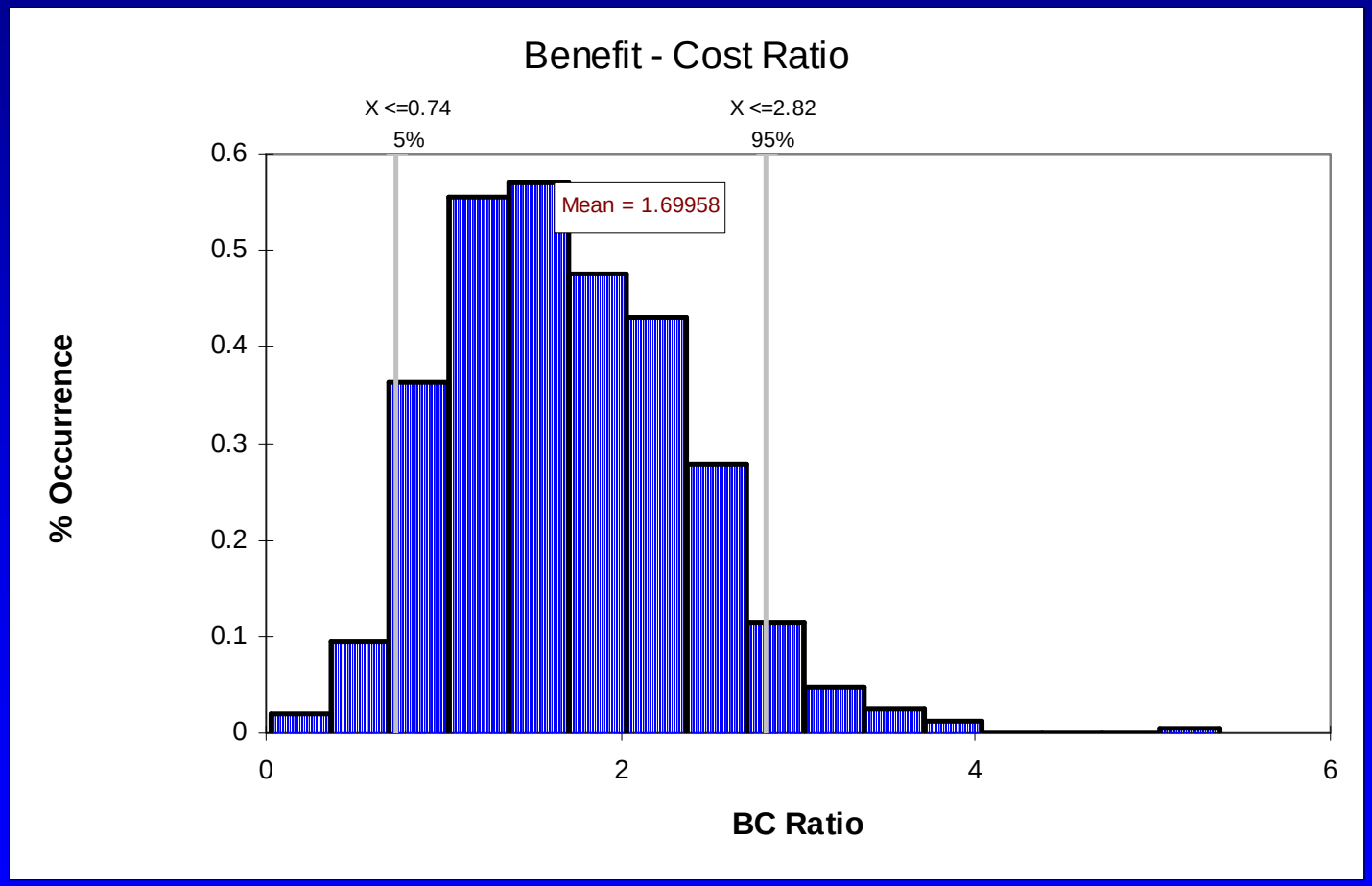


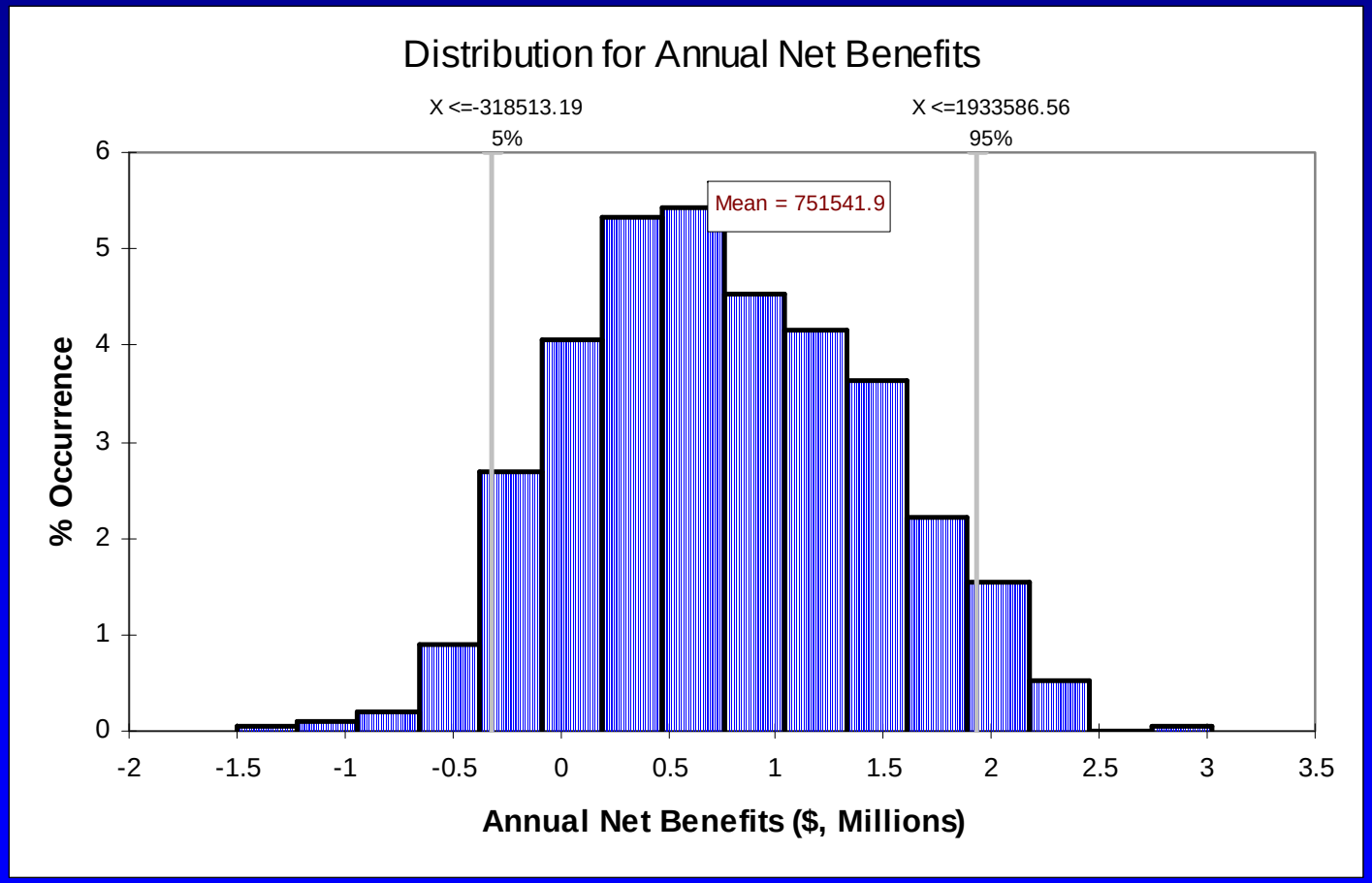
Project

- 56 Alternatives
  - 4 base beach widths
  - 14 sacrificial beach widths
- < 1 sec per simulation
- <1000 simulations to achieve numerical stability

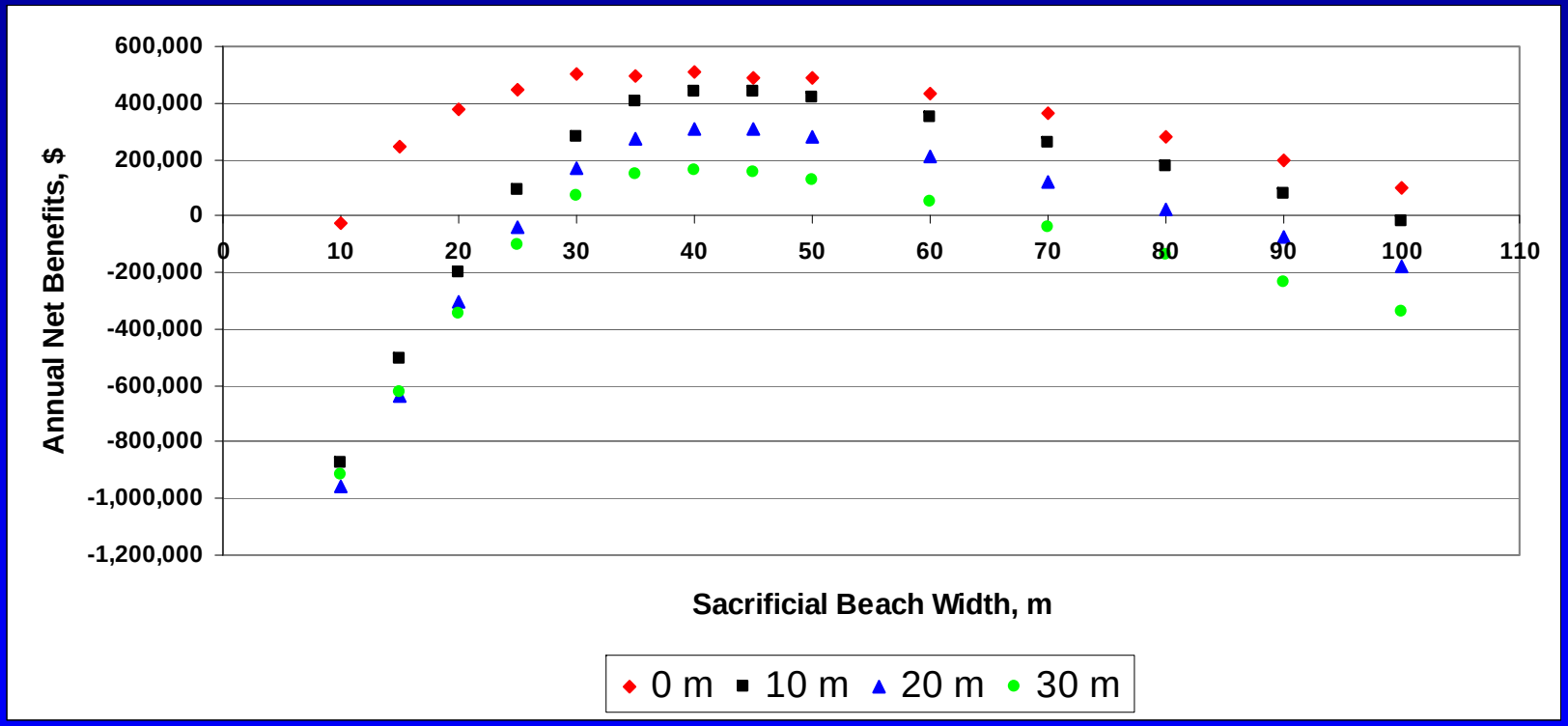
Economic Outputs



Economic Outputs



Project Results



Conclusion

- Monte Carlo Simulation Model
- Engineering – Economics
- Simple or Complex
- Customizable
- Fear not - you can do this too

Post Script

- Beach-fx, 2007