



US Army Corps
of Engineers

Navigation Risk and Consequences

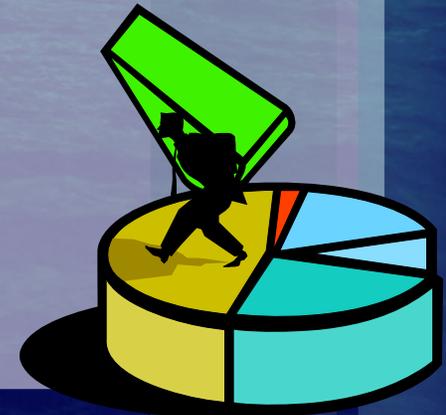
Budget EC-2-193; Appendix V

https://corpsinfo.usace.army.mil/cw/ec/fy10ec/final/fy10ec_final.pdf

POC: George Domurat, SPD

Risk-Informed and Performance-Based Budget

- Competition for federal funds getting tighter each year
- Goal to consistently prioritize nation's critical coastal infrastructure
- Risk-based matrices being developed in all major areas of Navigation business line
- Inland Navigation has jump on the process
- Final goal – to produce risk & uncertainty matrix to replace old condition index system
- Being used for FY10 budget process



Critical Columns in Navigation Budget Sheet

- Probability/Condition Rating
- Consequence/Economic Impact Rating
- Relative Risk Ranking
- Secondary Qualifiers:
 - Caretaker Activities
 - Critical Harbors of Refuge
 - Subsistence Harbor

- Consequence

- Remarks

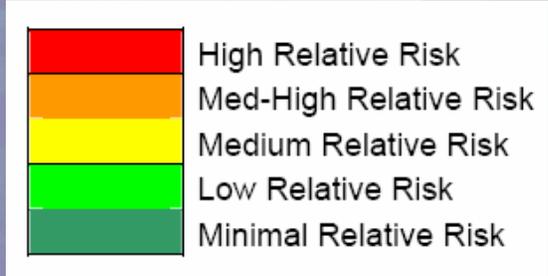


Secondary Qualifier Definitions

- Sufficient to meet minimum legal responsibilities for operation, safety, and environmental compliance.
 - **Caretaker Activities:** Minimum level of funding required to place these unfunded projects in a caretaker mode, including public safety and environmental impacts.
 - **Critical Harbors of Refuge:** Harbors that offer safe haven to boaters that represent the sole site for protection based on a public safety based regional distance criteria. Authorization as a Harbor of Refuge does not automatically make that harbor critical.
 - **Subsistence Harbor:** Those harbors that are dependent on the navigation project as their principal means of receiving goods and services, and for which alternative means of delivery are not practical.

TABLE V-3 NAVIGATION RELATIVE RISK RANKING MATRIX

		Probability/Condition Classification				
		F	D	C	B	A
Consequence	Condition	Failed	Inadequate	Probably Inadequate	Probably Adequate	Adequate
	Consequence/Economic Impact	I	25	24	22	19
II		23	21	18	14	10
III		20	17	13	9	6
IV		16	12	8	5	3
V		11	7	4	2	1



**Table V-9
Navigation Structures
Probability/Condition**

Condition Level	Probability / Condition	
GOOD	A	Failure to the point navigation will be measurably impacted is unlikely within budget cycle Project fully accomplishing its intended purpose
MODERATE	B	Low risk of failure to the point navigation will be measurably impacted within budget cycle
POOR	C	Medium risk of failure to the point navigation will be measurably impacted within budget cycle
FAILING	D	High risk of failure to the point navigation will be measurably impacted within budget cycle
FAILED	F	Condition severely restricts or halts navigation within budget cycle

Economics
Safety
Critical Use

Table V-10
Navigation Structures
Consequence/Economic Impact

Consequence Level	Consequence Description
1	Demonstrated highest economic impact ¹ Imminent life safety impact Critical to safe navigation by commercial vessels at High Use Navigation Project (>10M tons) Critical to safe navigation at DoD Strategic Ports
2	Demonstrated High economic impact ¹ Probable life safety impact. Probable impacts to subsistence harbors/harbors of refuge. High economic loss (5 - 10 M Tons) Probable life safety impact Alternate modes of transportation exist for Energy Distribution Facilities, but at a higher cost than water borne transportation
3	Demonstrated Moderate economic impact ¹ Possible life safety impact. Possible impacts to subsistence harbors/harbors of refuge. Moderate economic loss (1 - 5 M Tons) Possible life safety impact
4	Low economic impact¹ and no life safety impact. Little impacts to subsistence harbors/harbors of refuge. Low economic impact (<1M Tons) No life safety impact
5	Negligible economic and no life safety impact. No impacts to subsistence harbors/harbors of refuge. Negligible economics (Recreation Harbors, No commercial Activity) No life safety impact.

TABLE V-3 NAVIGATION RELATIVE RISK RANKING MATRIX

		Condition	Probability/Condition Classification				
			F	D	C	B	A
	Consequence		Failed	Inadequate	Probably Inadequate	Probably Adequate	Adequate
		Consequence/Economic Impact	I		25	24	22
II			23	21	18	14	10
III			20	17	13	9	6
IV			16	12	8	5	3
V			11	7	4	2	1

Table V-9 defines abscissa.

Table V-3 value input to Column BJ in Navigation Budget Sheet table.

	High Relative Risk
	Med-High Relative Risk
	Medium Relative Risk
	Low Relative Risk
	Minimal Relative Risk

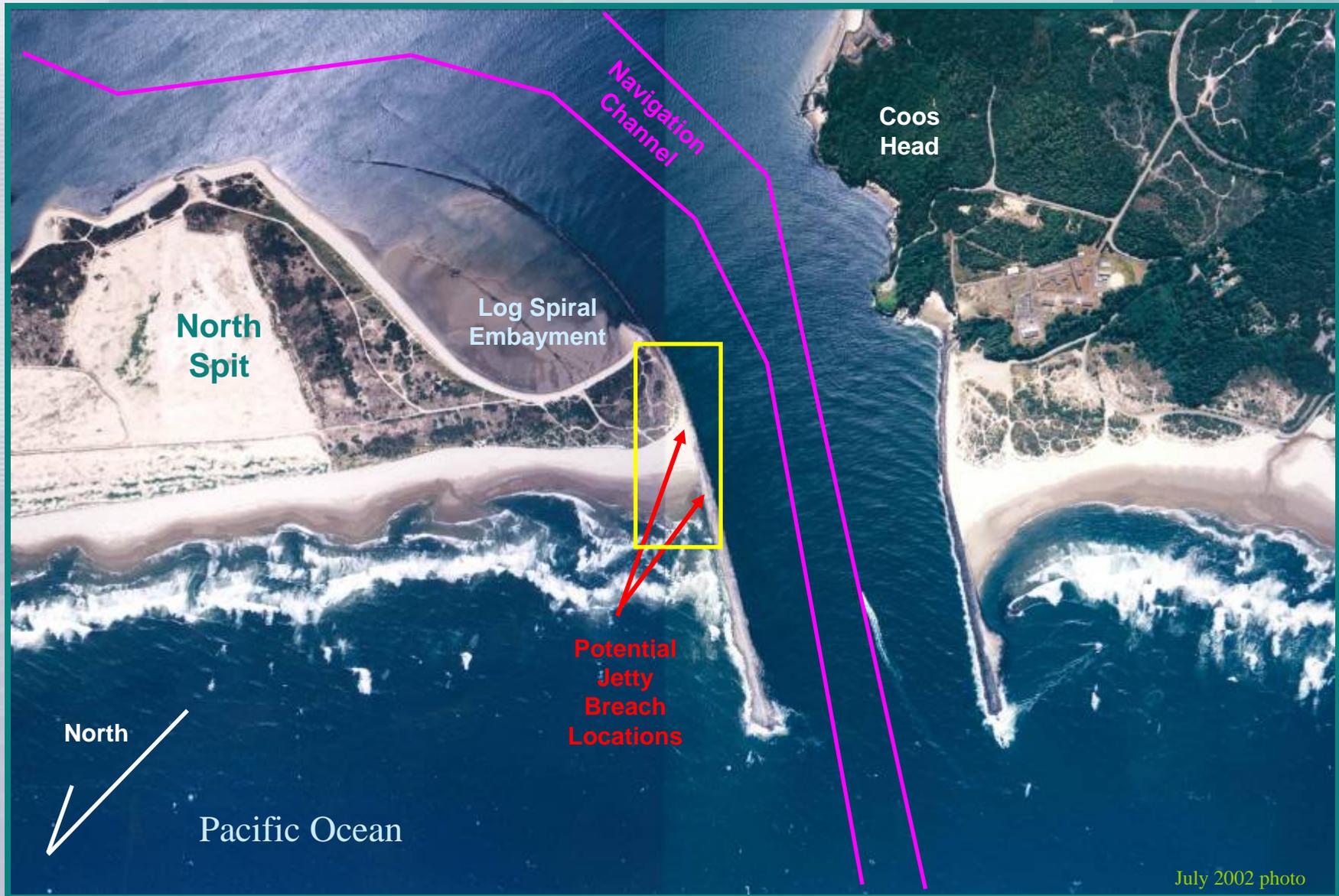
Table V-10 defines ordinate.

COASTAL NAVIGATION PROJECT STATUS - PORTLAND DISTRICT (USACE)

Coastal Navigation Project	Project History					Structural Condition/Damage Area				Navigation Use of Project				Level of Concern			Degree of Urgency Ranking
	Construction Date	Constructed Length	Last Maintenance Date	Location of Maintenance	Current Studies	Length Lost (using GPS)	Jetty head	Jetty Trunk	Jetty Root	Commercial	Recreational	Charter	Coast Guard Presence	Chance of Structural Failure	Consequences of Failure	Navigation Concerns	
High Navigation Use Projects (ordered by vessel volume within high use category)																	
Columbia River Entrance																	
North Jetty (06/06) ⁹	1913-1917	12,200'	2005	trunk	MR/CO	2061' ¹	Poor	Poor	Poor	High	High	High	All Year	High		High	1
South Jetty (06/06)	1885-1895	34,850'	2006-2007	trunk	MR/CO	6247' ²	Poor	Poor	Fair	11299	100530	4642		High			
Jetty A (06/06)	1939	10,000'	1961	trunk/head	MR	886' ³	Poor	Fair	Good					High			
Chetco Entrance																	
North Jetty (06/06)	1957-1958	1,300'	1969	450' ext.	-	0'	Fair	Good	Good	Med	High	Low	All Year	Low		Low	10
South Jetty (06/06)	1957-1959	1,570'	1996	root/trunk	-	10'	Fair	Good	Good	6743	39139	845		Low			
Harbor Breakwater (06/06)		1781'	2006	head	CO	-	Fair	Good	Good								
Yaquina Entrance																	
North Jetty (06/05)	1889-1896	7,000'	2001	head	MT	352' ⁴	Good	Good	Good	High	Med	High	All Year	Med		High	6
South Jetty (06/05)	1881-1896	8,600'	1972	1800' ext.	-	16'	Good	Good	Good	14394	8741	5282		Low			
Coos Bay Entrance																	
North Jetty (06/05)	1891-1898	9,600'	2002	root	EV/MT	1117' ⁵	Poor	Fair	Poor	High	Med	Low	All Year	Med		High	3
South Jetty (06/05)	1924-1929	4,580'	1963-1964	all	-	328' ⁶	Fair	Good	Good	11012	5739	1029		Med			
Tillamook Entrance																	
North Jetty (04/05)	1914-1918	5,700'	2004	root	MT	480'	Poor	Fair	Poor	Med	Med	Med	All Year	High		High	2
South Jetty (04/05)	1969-1979	8,000'	-	-	-	816'	Poor	Poor	Fair	5161	10141	2482		High			
Medium/Low Navigation Use Projects (ordered by vessel volume within medium/low use category)																	
Port Orford																	
Breakwater (06/06)	1968	550'	-	-	-	0'	Fair	Poor	Good	Med	Low	Low	N/A	High		High	4
Rogue River Entrance																	
North Jetty (06/06)	1960-1961	3,300'	1966	trunk	-	9'	Fair	Good	Fair	Low	Low	Med	Seasonal	Med		Low	8
South Jetty (06/06)	1959-1960	3,400'	-	-	-	0'	Poor	Poor	Fair	1843	476	3349		High			
Umpqua Entrance																	
North Jetty (06/05)	1917-1919	8,000'	1977	trunk/head	-	0'	Fair	Good	Good	Low	Low	Low	All Year	Med		Med	7
South Jetty (06/05)	1933-1934	4,200'	1963	all	-	176' ⁸	Poor	Fair	Good	2978	4266	164		High			
Training Jetty (06/05)	1950-1951	6,100'	1978-1980	3144' ext.	-	-	-	Good	Fair					Med			
Siuslaw Entrance																	
North Jetty (06/05)	1892-1901	9,740'	1984-1985	1900' ext.	EV	464'	Poor	Fair	Good	Low	Low	Low	All Year	High		Med	5
South Jetty (06/05)	1910-1913	6,245'	1984-1985	2300' ext.	EV	419'	Poor	Good	Good	2199	639	466		High			
North Jetty Spur (06/05)	1984-1985	400'	1984-1985	-	EV	10'	Fair	Good	Good								
South Jetty Spur (06/05)	1984-1986	400'	1984-1985	-	EV	130'	Poor	Good	Good								
Coquille Entrance																	
North Jetty (06/06)	1892-1909	4,200'	1957	trunk	-	0	Good	Good	Good	Low	Low	Low	Seasonal	Low		Low	9
South Jetty (06/06)	1881-1901	2,700'	1954-1955	head	-	0'	Poor	Fair	Good	506	319	669		High			
Nehalem Entrance																	
North Jetty (93/05)	1916-1919	3,500'	1981-1982	all	-	<25'	Fair	Good	Good	Low	Low	N/A	N/A	Low		Low	11
South Jetty (93/05)	1910-1916	4,950'	1981-1982	all	-	<25'	Fair	Good	Good	66	930	0		Low			

FY 2007 Regional Navigation Program		SOUTH PACIFIC DIVISION (SPD): San Francisco District (SPN) ---											Structure Condition Status Report					
Status Definition: "Green" funding greater than 95% obligated .. "Amber" funding between 85% & 95% obligated .. "Red" funding less than 85% obligated.															April 13, 2007			
Matrix Data Elements															Condition Index: "Green" for Structure Index Rating between 75 to 100.. "Amber" Rating between 50 to 75.. "Red" Rating falls below 50			
															Design Structure Location Last Next Current Chance of consequence			
															FY 06 FY 07 FY 08			
DEEP-DRAFT / HIGH USAGE															REMARKS / ISSUES			
Type of	Constructe	Design ed	Length	Last	of	Inspection	Inspection	Structure	Structural	of	Navigation	Cargove	Work Plan	President's				
Structure	Date	(ft) MLLW	(ft)	Repaired	Repair	Date	Date	Condition	Failure	Failure	Concerns	Funds	Amount	Budget	Structure funding includes all structures at Project, unless noted.			
Richmond Harbor																		
Training Wall	rubble-mound	1922 to 1931	+10	10,000	1984 - 85	Stations 31 thru 37 and 41 to 70	Jun-05	Summer 2007	Red (45)	High	Shipping	Low	0	25	0	Existing breach in wall since 1991 between stations 23 to 26.		
Oakland Harbor																		
South Jetty	rubble-mound	1876	+13	8,520	1893	extension of jetty	Jun-05	Summer 2007	Green (81)			Low	0	25	0			
Humboldt Harbor																		
North Jetty	rubble-mound	1927 to 1927	+12 to +25.5	7,400	2000	Stations 31 thru 34	10-Aug-06	Summer 2007	Red (49)	High	Shipping	Low	0	50	0	Jetty was breached at Stations 18 to 19 in January 2006.		
South Jetty	rubble-mound	1927 to 1927	+12 to +26	8,000	1992	Stations 33 to 84	11-Aug-06	Summer 2007	Amber (70)	Low	Shipping	Low						
DEEP-DRAFT / LOW USAGE																		
(none)																		
SHALLOW-DRAFT																		
Moss Landing Harbor																		
North Jetty	rubble-mound	1946 to 1949	+8 to +12	1,550	1997	various spots along entire length	Jul-06	Summer 2007	Amber (60)	Medium	Safety	Low	0	25(PCS)	0	PCS denotes funding by Project Condition Surveys		
South Jetty	rubble-mound	1946 to 1949	+8 to +12	1,323	1997	various spots along entire length	Jul-06	Summer 2007	Red (55)	High	Safety	Medium				Failure of side slope between stations 22 and 20 in February 2005 and further damage in December 2006.		
Crescent City Harbor																		
Outer Breakwater	rubble-mound	1920 to 1931	+20 to +22	4,670	1992	various spots along entire length	8-Aug-06	Summer 2007	Green (79)	Low	Safety	Low			25(PCS)	25(PCS)		
Inner Breakwater	rubble-mound	1945	+18	1,500	unknown	unknown	3-Aug-06	Summer 2007	Green (80)	Medium	Safety	Low						
Sand Barrier	rubble-mound	1939	+10	2,420	unknown	unknown	3-Aug-06	Summer 2007	Green (87)	Low	Safety	Low						
Noyo Harbor																		
North Jetty	concrete	1924	+13	345	1990	head and channel side	25-May-05	Summer 2007	Amber (67)	Low	Safety	Low						
South Jetty	concrete	1924	+12.8	240	1990	filled voids in wall	25-May-05	Summer 2007	Amber (67)	Low	Safety	Low						
Pillar Point Harbor																		
West Breakwater	rubble-mound	1959 to 1961	+11 to +15	3,670	1978 to 1978	various spots along entire length	14-Jun-06	Summer 2007	Amber (66)	Medium	Safety	Low			25(PCS)	0		
East breakwater	rubble-mound	1959 to 1961	+11 to +13	4,420	1978	various spots along entire length	15-Jun-06	Summer 2007	Amber (58)	Medium	Safety	Low	223			Plans and Specs are currently in review to repair a "200' section of the trunk and add stone on top of revetment area.		
Monterey Harbor																		
West Breakwater	concrete	1932 to 1934	+10 to +13	1,700	1993	near Coast Guard gate	Jul-06	Summer 2008	Amber (61)	Medium	Safety	Low	0	0	25(PCS)			
Santa Cruz Harbor																		
West Jetty	rubble-mound	1963	+12 to +16	1,125	none?	none?	Jul-06	Summer 2008	Amber (58)	Low	Safety	Low	0	0	25(PCS)			
East Jetty	rubble-mound	1963	+12 to +16	850	none?	none?	Jul-06	Summer 2008	Green (79)	Low	Safety	Low						
Bodega Bay Harbor																		
North Jetty	rubble-mound	1942	+12	2,170	none	none	27-May-05	Summer 2007	Amber (68)	Medium	Safety	Low	0	25(PCS)	0			
South Jetty	rubble-mound	1942	+12	1,650	1961	Stations 42 to 44	26-May-05	Summer 2007	Amber (66)	Medium	Safety	Low						
Spud Point Marina Breakwater	concrete	1984	+8	1,306	none	none	26-May-05	Summer 2007	Green (81)	Medium	Safety	Low						
San Francisco Waterfront																		
Fisherman's Wharf Outer Sheetpile Breakwater	concrete	1986	+12	1,509	none?	none?	23-May-06	Summer 2008	Green (90)	Low	Safety	Low			0	0	25(PCS)	
Fisherman's Wharf West Segmented Breakwater	concrete	1986	+12	258	none?	none?	23-May-06	Summer 2008	Green (81)	Low	Safety	Low						
Fisherman's Wharf East Segmented Breakwater	concrete	1986	+12	150	none?	none?	23-May-06	Summer 2008	Green (81)	Low	Safety	Low						
Gas House Cove Breakwater	concrete	1975	+12.7	117	none?	none?	23-May-06	Summer 2008	Green (85)	Low	Safety	Low						
Jack Maltster Channel/San Leandro Marina																		
Breakwater	sediment fill	1966	+12	700	1977	Corps takes over project and does a major rehab	16-May-06	Summer 2008	Green (81)	Low	Safety	Low			0	0	25(PCS)	
Berkeley Marina																		
Rubble-mound Breakwater	rubble-mound	1965	+13	725	none	none	27-Jun-05	Summer 2007	Green (95)	Low	Safety	Low			0	25(PCS)	0	
Sheetpile Breakwater	concrete	1980	+15	440	none	none	27-Jun-05	Summer 2007	Green (ar)	Low	Safety	Low						

Coos Bay Project Area





**Table V-9
Navigation Structures
Probability/Condition**

Condition Level		Probability / Condition
GOOD	A	Failure to the point navigation will be measurably impacted is unlikely within budget cycle Project fully accomplishing its intended purpose
MODERATE	B	Low risk of failure to the point navigation will be measurably impacted within budget cycle
POOR	C	Medium risk of failure to the point navigation will be measurably impacted within budget cycle
FAILING	D	High risk of failure to the point navigation will be measurably impacted within budget cycle
FAILED	F	Condition severely restricts or halts navigation within budget cycle

**Table V-10
Navigation Structures
Consequence/Economic Impact**

Consequence Level	Consequence Description
1	<p>Demonstrated highest economic impact¹ Imminent life safety impact Critical to safe navigation by commercial vessels at High Use Navigation Project (>10M tons) Critical to safe navigation at DoD Strategic Ports</p>
2	<p>Demonstrated High economic impact¹ Probable life safety impact. Probable impacts to subsistence harbors/harbors of refuge. High economic loss (5 - 10 M Tons) Probable life safety impact Alternate modes of transportation exist for Energy Distribution Facilities, but at a higher cost than water borne transportation</p>
3	<p>Demonstrated Moderate economic impact¹ Possible life safety impact. Possible impacts to subsistence harbors/harbors of refuge. Moderate economic loss (1 - 5 M Tons) Possible life safety impact</p>
4	<p>Low economic impact¹ and no life safety impact. Little impacts to subsistence harbors/harbors of refuge. Low economic impact (<1M Tons) No life safety impact</p>
5	<p>Negligible economic and no life safety impact. No impacts to subsistence harbors/harbors of refuge. Negligible economics (Recreation Harbors, No commercial Activity) No life safety impact.</p>

Coos Bay Jetty Breach Example

		Condition	Probability/Condition Classification				
			F	D	C	B	A
Consequence			Failed	Inadequate	Probably Inadequate	Probably Adequate	Adequate
	Consequence/Economic Impact	I	25	24	22	19	15
II		23	21	18	14	10	
III		20	17	13	9	6	
IV		16	12	8	5	3	
V		11	7	4	2	1	

Where Do We Go from Here?

- National Board of Directors/PDT proposed
 - Participation by MSC, District, HQ, IWR, ERDC, CERB, etc.
- Process needs to be developed - Portfolio Risk Assessment for Dams
- Coastal engineering element should contribute to budget request spreadsheet
- Economics and other input to spreadsheet
- Filling in matrix needs to be a team effort
- Ranking/prioritizing of nation's critical coastal infrastructure

Discussion

