

# RISING TIDE-ADAPTIVE MANAGEMENT

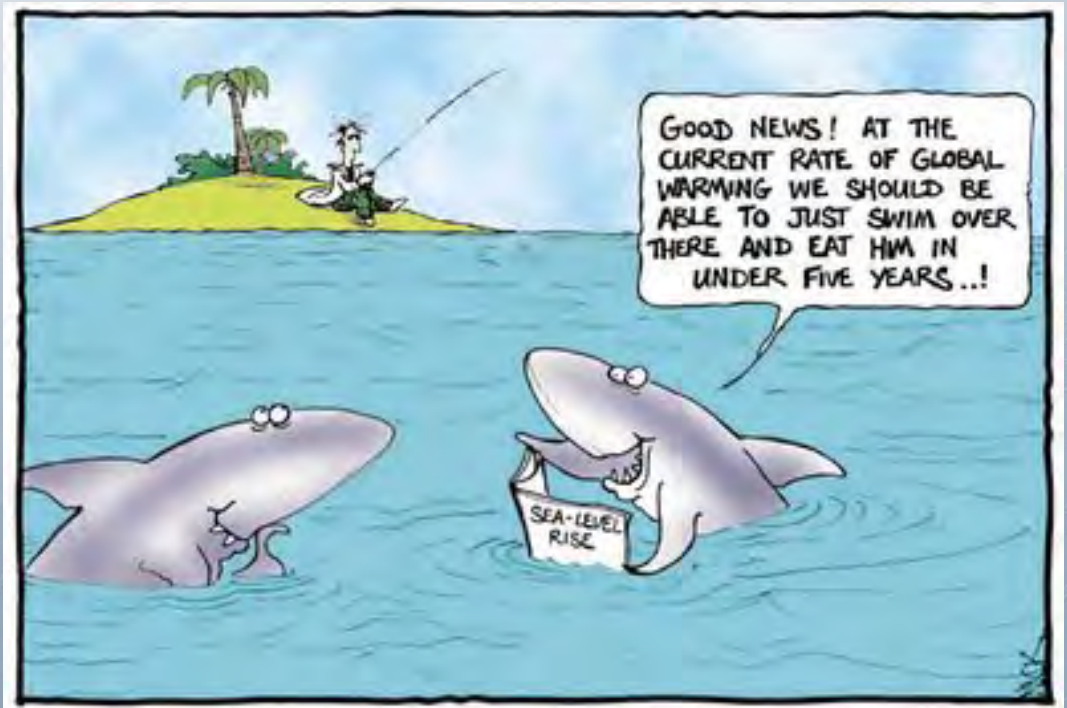


PCC of Harbormasters and  
Port Managers, Inc.

*Spring 2013 Conference  
Des Moines / Seattle, WA*

# Overview

- SLR projections
- Existing guidance from USACE
- Incorporating SLR in design

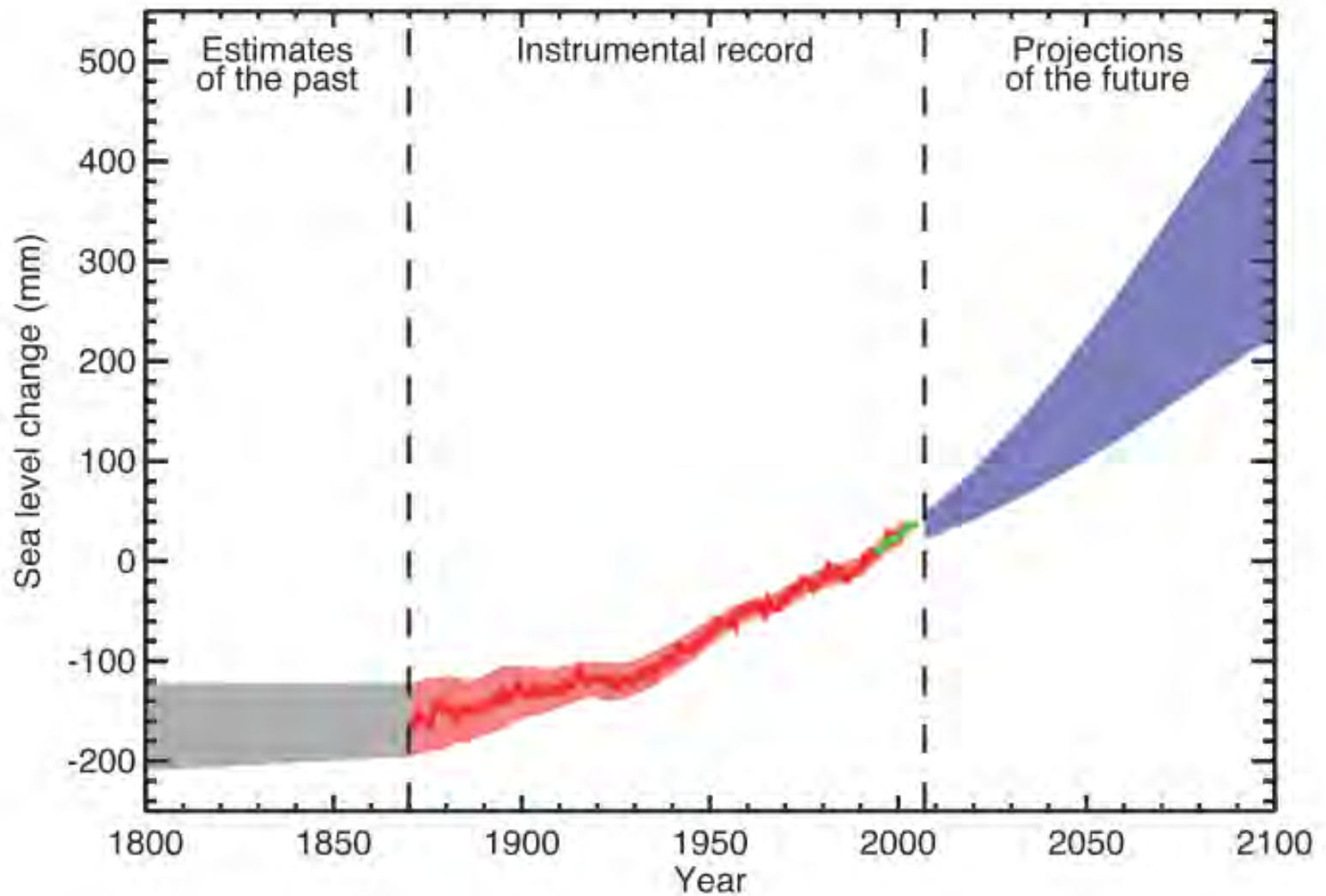


# Approach To Climate Change - CERB

- **Science should be objective, transparent and accurate**
- **Emphasize Inter-Agency cooperation including science and management approaches**
- **We must react, but we should not overreact**
- **Focus on physics/economics of SLR and associated plan formulation**



# Global Sea Level Rise



Source: IPCC 2007

# Why So Much Uncertainty?

- Feedback loops still being researched [temp-ice melt, temp-sea levels, CO2-temp, others]
- Semi-Empirical Models predict greater SLR (Rahmstorf 2007, Vermeer 2009)
- Significant uncertainty / skepticism /debate

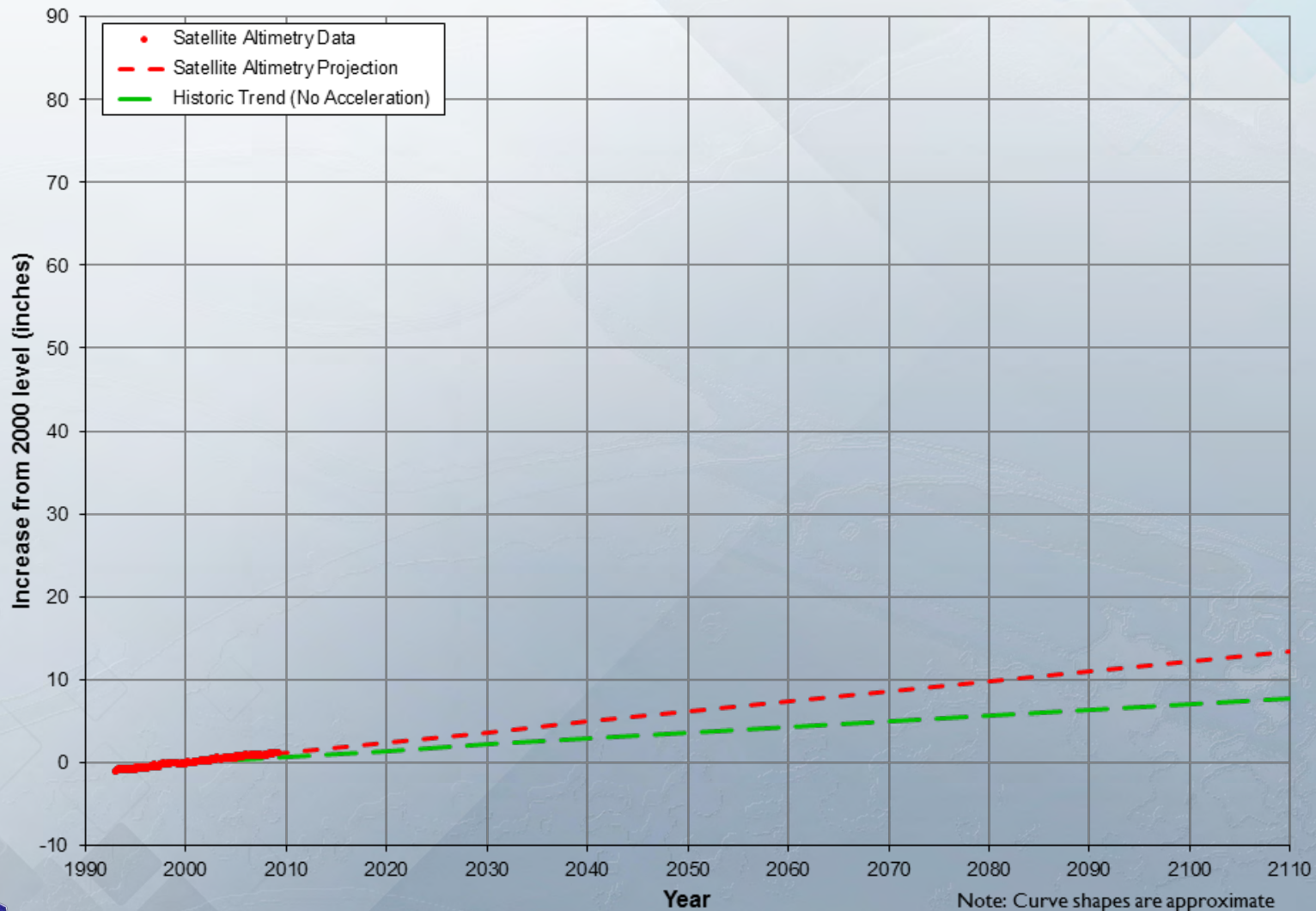
# CONCLUSIVE PROOF OF STABLE SEA LEVELS

STILL ONLY COMES  
HALF-WAY UP A DUCK

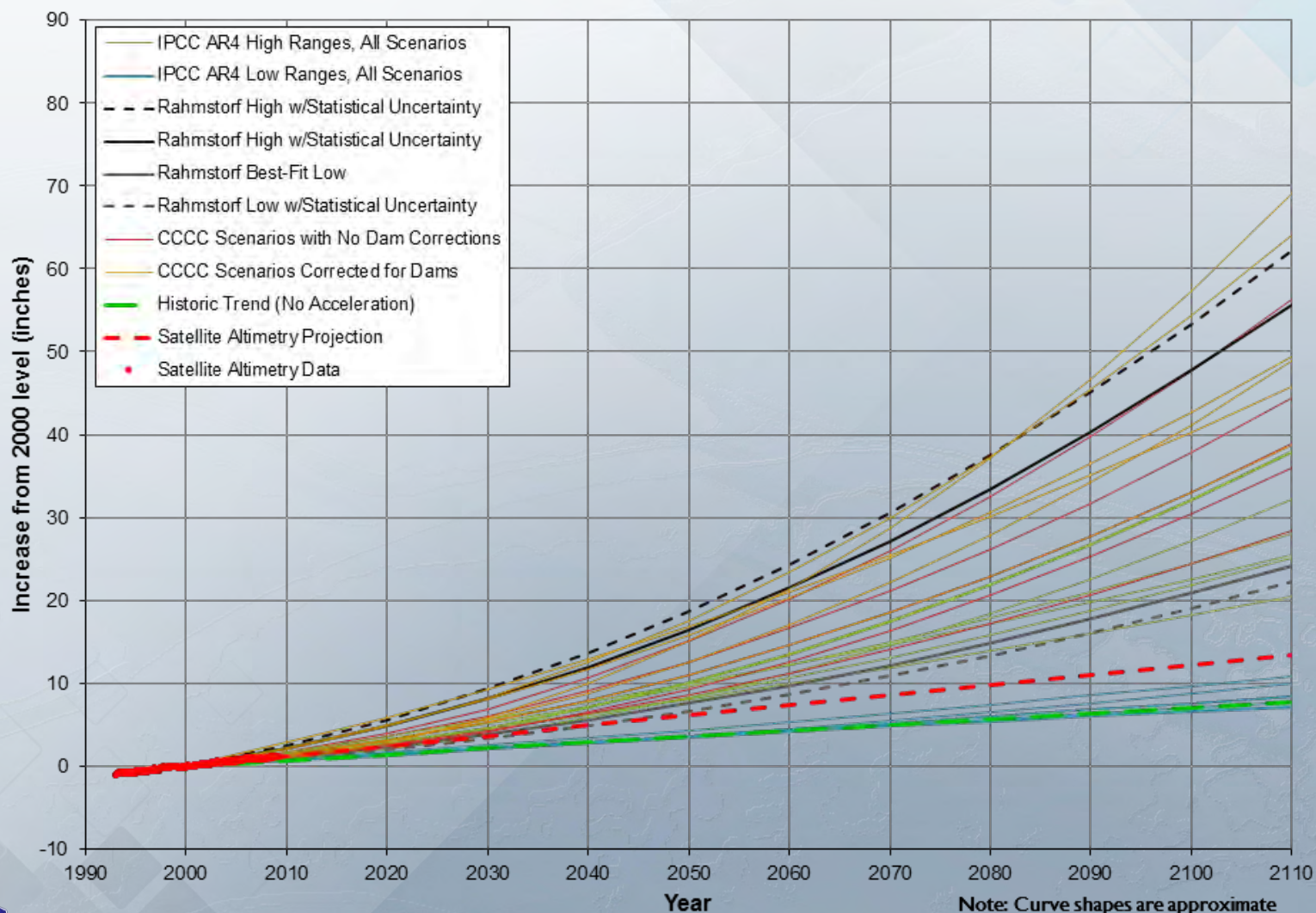




# Global Sea Level Rise Projections



# Sea Level Rise Projections





# Federal Guidance

- **Federal (Army Corps)**
  - <http://corpsclimate.us/ccaceslcurves.cfm>
  - *Eng. Circular (EC) 1165-2-212, Sea Level Change for Civil Works Program*
- **Environmental Protection Agency**
  - <http://www.epa.gov/climatechange/impacts-adaptation/>

# Local Agency Guidance

## CA

- “State of California Sea-Level Rise Interim Guidance Document”, Oct 2010, Sea-Level Rise Task Force of the Coastal and Ocean Working Group of the California Climate Action Team (CO-CAT)

## OR

- “The Oregon Climate Change Adaptation Framework”, Dec 2010, State of Oregon

## WA

- “Preparing for a Changing Climate: Washington State's Integrated Climate Response Strategy”, Apr 2012, Washington Department of Ecology

## AK

- “Alaska’s Climate Change Strategy: Addressing Impacts in Alaska”, Jan 2010, Adaptation Advisory Group to the Alaska Climate Change Sub-Cabinet

## Other Agency Guidance

- **Global Sea Level Rise Scenarios for the United States National Climate Assessment, USGS, 2013**
- **Sea Level Rise for the Coasts of CA, OR, & WA Past, Present and Future, NRC, 2012**
- **Adapting to Climate Change: A Planning Guide for State Coastal Managers, NOAA, 2010**
- **An Examination of the Factors Affecting Relative & Absolute Sea Level in Coastal B.C., Canadian Terminal Report 260, 2008**
- **Over 10,000 Agency Reports & Peer Reviews on SLR**



## Some of the Potential Impacts of SLR

- Greater flood elevations
- Beach erosion
- Marsh erosion
- Greater design wave heights
- Salinity intrusion and greater salt wedge penetration
- Increased tidal prisms

# Increase Wall Height

- **Ripple Effects**





# Change Use

- Was a public sling launch
- Accommodates Design





# Results of Early December (2012) Storm



- High Tides
- High Winds

Only Going to Get Worse!



# Management of Climate Change & SLR

- **Uncertainties and economic analyses lead to an adaptive management approach**
- **In the event of severe SLR:**
- **Will we protect/elevate or retreat?**
  - *Do developed areas have an option other than protect/elevate?*
  - *Can we pursue either option in an environmentally responsible way?*
  - *How do we address land rights in a retreat scenario?*



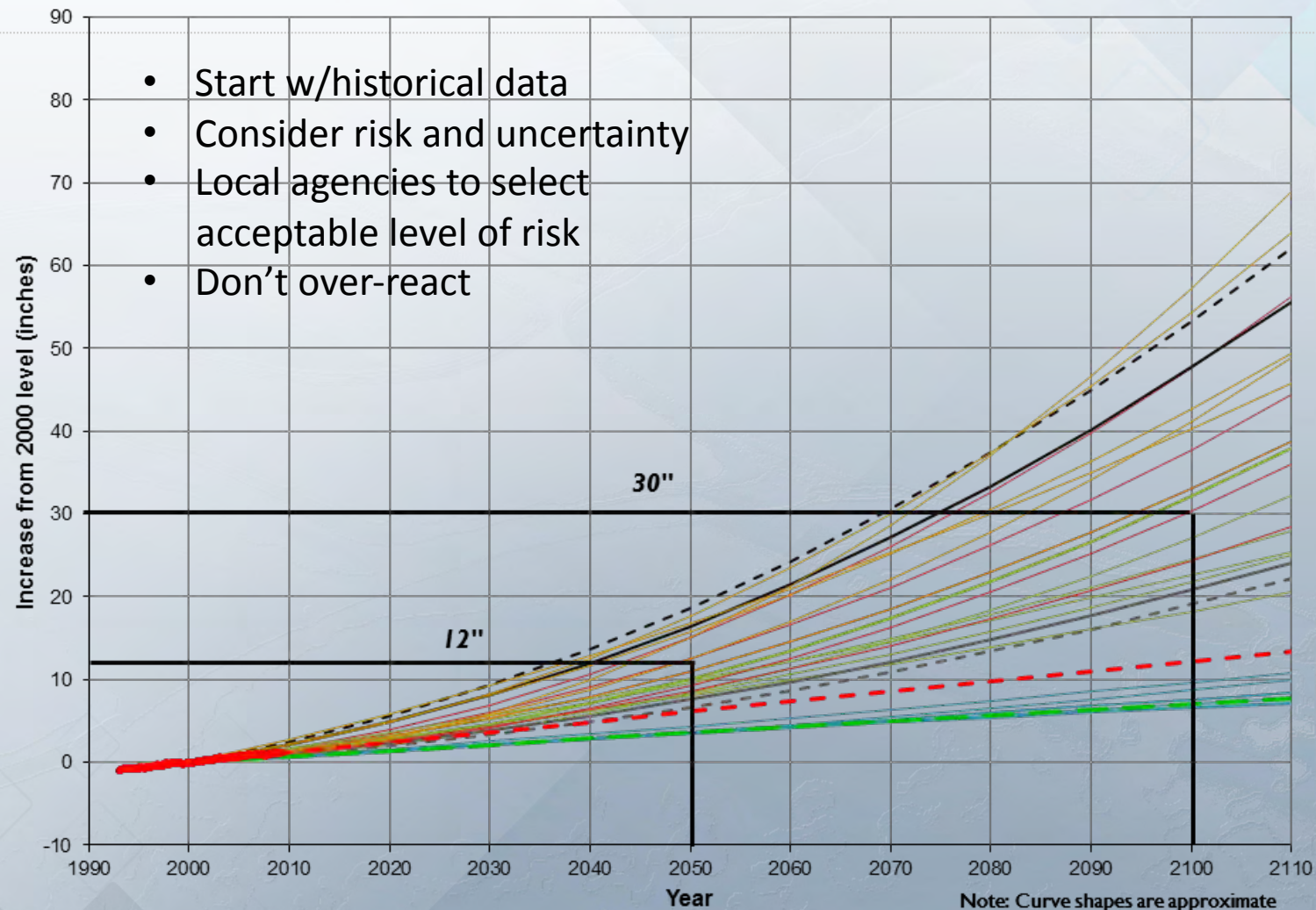
# Adaptive Management – Financial Strategy

- **Special Assessment District to be formed**
- **Property taxes accumulated to fund improvements**
- **Tax rates, plans reassessed every 10 to 20 years**
  - *Monitor ongoing sea level rise*
  - *Specific thresholds for action*
- **300-foot setback lets plans change over time**
  - *Perimeter berm and levee protection*
  - *Terraces and setbacks*
  - *Raise buildings on stilts*
  - *Purchase waterfront properties*





# Adaptive Management – Grades



# Existing Dry Shed Launch Deck

Existing Use vs. Change of Use





# What Did You Expect?





CURRENT  
SEA LEVEL



Source: Digital Coast NOAA Coastal Services Center



2 FEET



Source: Digital Coast NOAA Coastal Services Center



4 FEET



Source: Digital Coast NOAA Coastal Services Center



6 FEET



Source: Digital Coast NOAA Coastal Services Center



# Des Moines Marina, December 17, 2012!





# Final Observations

- **SLR can be addressed with Optimal Adaptive Management**
- **Adaptive management is generally more economical than building for full SLR now**
- **Relatively small cost differences and SLR scenario uncertainties support Adaptive Management**
- **Need regulatory agency buy-in on mitigation measures**

# Collapse of Antarctic Ice Sheet Would Likely Put Washington, D.C. Largely Underwater

February 6, 2009

