# A Rational Economic Basis for Hurricane Protection:

## Why 100-year protection is inadequate and What We Should be Doing About it

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# The Product Development Process:

## Deficient Products have their Basis in a Deficient Process

- Requirement
  - What you want
    - New requirement is more sophisticated than previous
    - Also more complicated methodology
      - will benefit from vigorous technical debate
- Specification
  - What you choose to get
  - In this case, the choice is the most important part
- Design
  - Certain design methodology required by limitations of circumstance
- Implement/Build
- Test & Evaluate (QA)
- Operate
- Maintain
- Improve, or look for ways to improve

# Specifying the Level of Protection

- Current & Historical Basis
  - Post-Betsy plans reduced due to funding cuts
  - Current & potential defined in terms of a selected level of risk
    - 100 year protection (1% annual risk) required by FEMA for federal flood insurance
    - USACE study is considering different levels of protection: 100, 400, 1000 year
    - Dutch chose 10,000 year protection (0.01% annual risk) with great redundancy
- We want more funding and greater protection
  - But who doesn't?
  - Not a compelling argument…
- Political nature of decision process
  - Level & location of protection are political decisions made by others elsewhere
  - What level of protection do they think we need? How much are they willing to spend on us?
  - Competition for funds
    - Risk of anything more than 100-year protection being perceived as a pork-barrel water project?

# Congressional Perspective

- 100 years is a long time
  - Compared to what?
  - Not really! The risk of a house burning down is much less than 1%/year and you wouldn't dream of not having further protection/insurance
  - Losing your individual house is a much less severe disaster than also losing the surrounding community (jobs, businesses, schools, property values)
- ~$10B is a lot
  - Compared to what?
  - Compared to the $100B exposure?!
  - Are we being penny-wise?
- If the government does not give us more than 100-year protection, or postpones improvements, they have "saved money" in the current budget
  - It is highly unlikely that a catastrophe will occur prior to re-election

# Historical Perspective on the Process

- In the past, we trusted Congress, the Corps, and the Levee Boards to make rational choices on our behalf
  - But the Corps acts under the direction of Congress (a political body)
  - Unfortunately, the level of protection has been decided by negotiation instead of by analysis
- Congressional Track Record
  - Poor risk management for engineering projects
    - Challenger: design by budget cut
    - Columbia: design by treaty exacerbated by design by budgeting
    - Katrina: design by budget cuts
  - Poor actuarial integrity too
    - Social Security Trust Fund, Medicaid, …
- "It will take a major disaster for everyone to wake up before we can do it right"
  - But the process of design by budget cut is still our biggest source of risk
- Why was the Netherlands more successful than post-Betsy Louisiana?
  - A reasonable outcome from a political body for a major project requires:
    - A compelling basis for consensus
    - A broadly shared purpose
      - All communities with levees (missed post-K opportunity?)

# A Rational Economic Basis: Risk Management

- 1st Eliminate the risk
  - Up to the point where further investment is no longer economic
- 2nd Insure the risk
  - Up to the point where further premiums are no longer economic
  - There will be substantial uninsured risks
    - Uninsured direct losses
      - E.g., property values (not structures), business values
    - Uninsured consequential damages
      - E.g. damage to the rest of the economy as a result of loss of energy production, loss of suppliers, and interruption in shipping
- 3rd Accept the rest of the risk
  - But prudence requires that risks are not simply accepted
  - Risks must be managed with diversification, reserves, and/or other safeguards

# Existing Risk Management

- While redundancy and reserves do exist in the economy, they are not adequate
- Katrina revealed structural flaws in the way in which we manage risk
  - 1st: Funding sources have powerful incentives to inadequately eliminate the risks
    - Inadequate level of protection costs less
    - Inadequate level of robustness costs less
    - Bureaucrats have powerful incentives to obey the will of Congress
  - 2nd: Many risks are not insured, some for good reasons
    - So significant risk ends up being implicitly accepted by stakeholders
  - 3rd: Residual risks are often not well managed nor even well understood by those affected
    - Many are not big enough to be diversified outside the flood plain
    - Not empowered by tax policy to affordably maintain appropriate reserve accounts
    - Nor even sufficiently informed to quantify the risk

# The Fix

- We need to reform the way the government manages risk & robustness

# #1: A Change of Language

- 100-year protection
  - People think that means that we will be safe for 100 years
  - Actually means that there are short odds (39.5%) of being flooded in the next 50 years
- 10,000-year protection, or Category 5 protection
  - People think we are worrying unnecessarily about the remote distant future
- Define the level of protection as the percent probability of a catastrophic event in the next 50 years
  - The underlying math is all the same
  - State the risk in language that is relevant to the decisions we need to make
    - What is the risk an investment will be destroyed?
      - Build or buy a house or other infrastructure
      - Build or buy a business
    - By comparison, what is the probability of a building or bridge collapsing?
    - Grade AAA bonds have a default rate of 0.01% in one year, higher than 0.30% is junk
  - Precedent
    - In California, for earthquake protection, the required risk is <10% over 50 years
    - In the Netherlands, for flooding, this is equivalent to 0.5% for over years

# Analysis instead of Negotiation

- Multi-Criteria Decision Analysis
  - Commonly used in engineering
  - Useful for making a decision process explicit
  - But equally, can formalize a deficient decision process
  - Build a table of selection criteria, fill in scores, assign weights, get ordinal priorities
- Biggest shortcoming: In the end, we get an ordinal ranking that the political process will then negotiate
- We need a clear justification for how much funding should be available to protect the assets in a flood plain
  - Lives: use the judicial wrongful death valuations including loss of future earnings
  - Economic assets, including consequential damages
  - Cultural & Historic assets, e.g. identify a $ premium for the protection of historic structures
- The analysis should present a ranked portfolio of investment opportunities
  - We can not allow >100-year protection to be treated like just another “pork barrel” water project
  - It is in our vital interest to dramatically reduce the scope of any potential “negotiation”
  - Every safeguard that can pay for itself would be more likely to be implemented
    - Conversely, converting $ benefits to “scores” in a ranking makes it harder to justify funds
  - Congress mandated economic valuation based on property values
    - but book value<< equity << consequential damages

# A Change in Design Methodology (Robustness)

- Flood protection has similarities to rocketry
  - Rockets cannot be fully tested except in operation
  - If a manned rocket fails in operation, someone dies
  - Therefore a higher level of engineering is required
- Require methodology that explicitly values robustness in the design
  - I.E., FMEA/CIL
  - Would result in primary and secondary levees, possibly emergency levees as well
  - Would have caught backflow problem with Jefferson drainage system
  - Probably many other design impacts
- This process would give us an outcome that is robust to:
  - A poorly defined requirement
  - Defects in design or workmanship
  - Out-of-spec weather events
  - Single-point terrorist attack

# A Change in Tax Policy

- Currently, the expense of setting aside reserves is treated as an after-tax profit
- It doesn't do much good to be able to carry forward a loss as a deduction for your future taxes if your means of making a living has been wiped out
  - Need to have the means to restore operations and income
  - Need to have reserves so as to not get wiped out
- Reserves need pre-tax treatment
  - E.g., 529 Plan, deductible IRA
  - Reserves would be set aside in proportion to the risk and the value of the asset
    - Insurance companies can set aside reserves pre-tax
    - What is needed would therefore be an extension to the current tax law
  - If the reserves are withdrawn for their intended purpose, it is a tax free event
    - Otherwise, withdrawals are taxable events
  - This would avoid the abuse of the previous off-shore self-insurance premiums

# A Change in Incentives

- If a spending cut results in a corresponding increase in the affected public's right to set aside reserves pre-tax, then the spending cut may be offset by an even bigger reduction in tax revenues
  - If Congress cuts or delays $Billions for our flood protection, then we would get to set aside additional $Billions/year each year in reserves
  - The converse incentive for Congress is that once the protection is completed, there is a decrease in reserve requirements which may decrease allowable pre-tax reserves and would return tax revenues to normal
- The private right to pre-tax reserves will create a tangible incentive for the government to make rational decisions regarding risk management
  - Possibly the most important consequence of the change in tax policy
  - Risk would no longer be the phantom account that balances the budget at a hidden, and eventually, catastrophic expense

# Recommendations

- We must build a broad constituency around a compelling rational economic basis in order for the political process to have a reasonable outcome
  - Explicit risk management at all levels (public, commercial, personal)
- We should be seeking (in partnership with many other communities):
  - Requirement be based on high-quality modeling of threats with extensive peer review
  - Specification be based on risk management resulting in rational economic decisions
    - Risks be stated in terms of risk of failure within 50 years
    - Level of protection be based on analysis instead of negotiation
    - Funding bodies be incentivized to not treat risk as a phantom account
  - Design be required to be robust against catastrophic failure
    - Explicitly employ FMEA & CIL methodology
  - Individual stakeholders be well apprised of the residual risks and better-equipped to manage them
    - Understand risks and options for their properties
    - Reasonable tax treatment for before-the-loss self-insurance