Building Resilience to a Changing Climate:

A Technical Workshop in Water Utility Decision Support and Adaptation

WUCA
Water Utility Climate Alliance

Water Utility Climate Adaptation and Resilience Planning: Some Guiding Principles

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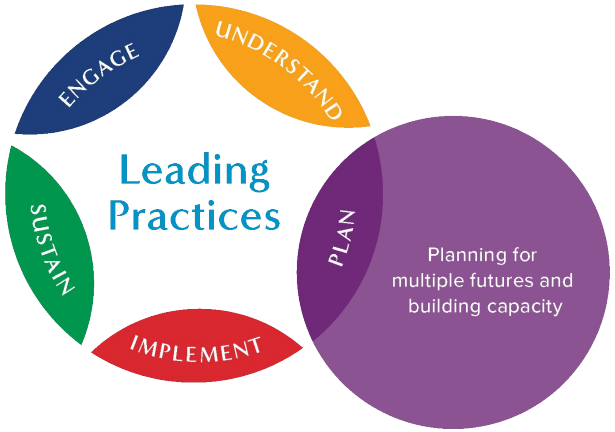


The Challenge of Adaptation to Climate Change

- We cannot adapt to a specific forecast of future climate
  - At best we know the direction of change of key variables
  - Some key aspects are uncertain
- Challenge is how to make decisions about investments and other decisions with long lifetimes in light of the uncertainties?
- This situation is not unique to climate change adaptation
- There is a path forward!

Some Desirable Attributes of Adaptation

- Flexibility
  - The adaptation can accommodate different conditions by adjusting
- Robustness
  - The adaptation can withstand widely varying conditions
- Resilience
  - Classic definition concerns capacity to recover from shocks
  - In context of climate change has been used to also include withstanding shocks
- The terms are often used interchangeably in the climate change context

Two Guiding Principles for Adaptation

- Make decisions that work or function over a wide range of possible conditions; what is desired is:
  - Flexibility
  - Robustness
  - Resilience
- Consider Economics
  - Basically, benefits should exceed costs
  - Complicated when benefits (avoided impacts) may not happen or be much larger decades into the future
    - Discounting – do not spend **a lot** now to avoid risks many years from now

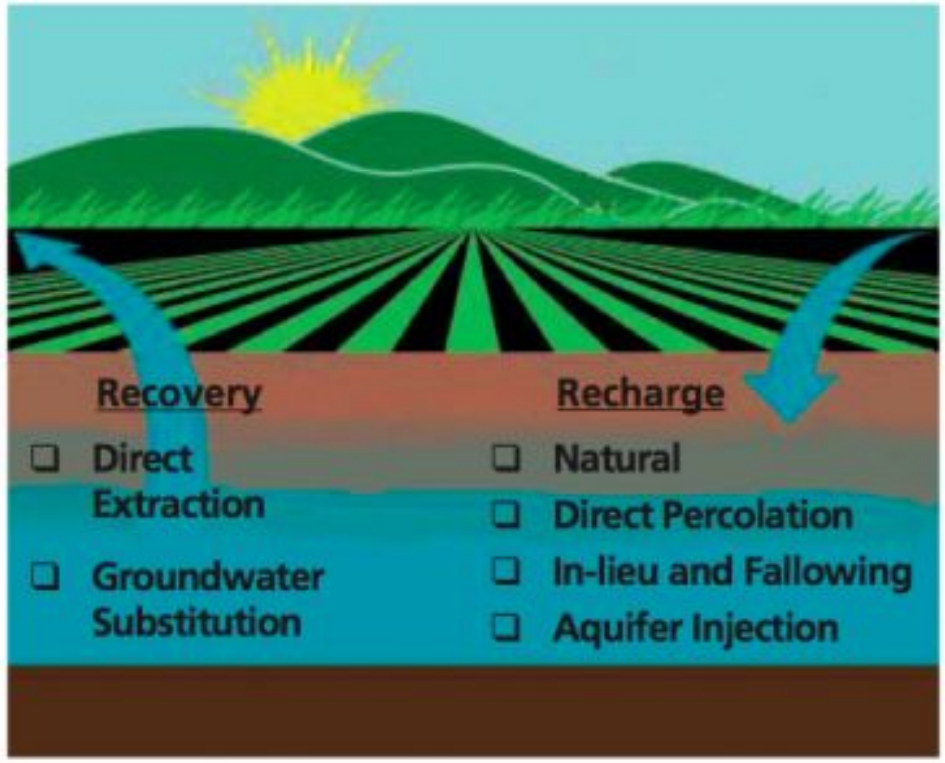
Other Approaches to Adaptation

- Win win
  - Aka “No Regrets.”
  - Look for adaptations that can be justified without consideration of climate change but help adapt to changing climate

- “Low Regrets”
  - Relatively small investments that provide some degree of adaptation

Adaptation Examples that Satisfy These Principles

- Incremental investments
  - Low cost adjustments to infrastructure
    - Can buy additional protection now and into the future
- Maintain options
  - Buy land on which can build infrastructure in the future
- Diverse portfolio of options (for example, supply)
- Use resilient or flexible management systems
  - Water markets are responsive to changing conditions



Transformative Adaptation

- Previous types of adaptation try to keep systems functioning as they are
- May not work over long run
- In many cases more “transformative” changes are needed
  - Relocation
  - Change in livelihood
  - Change in behavior
- Transformation can be politically more challenging

Isle de Jean Charles, Louisiana

How Do We Assess Adaptation Options?

Two basic approaches:

1. Traditional assessment approaches
   - Often used to help identify an optimal solution

2. Deep Uncertainty approaches
   - Recognize “deep uncertainty” is part of problem and try to identify adaptations that can work across an array of possible outcomes

Traditional Assessment Approaches

Optimization Approaches

1. Benefit-Cost Analysis (BCA) - King of traditional approaches
    - Express all benefits and costs in common unit, typically money
    - Seek to maximize
        - Net Benefits
        - Benefit cost ratio
2. Cost-effectiveness
    - Seek the least costly way to achieve a common outcome
3. Multi-criteria assessment
    - It is typically applied where different metrics are used
4. Triple Bottom Line (TBL) splits out financial, social, and environmental benefits
    - TBL can be used in the above approaches

Traditional approaches work best when uncertainties are well-characterized

- Can also be applied when they are not; for example, for individual scenarios

Challenge of Applying BCA to Climate Change

- Probabilities of outcomes are not known
  - There are no reliable probabilities on GHG emissions
  - Challenging with regional climate change
- Timing of impacts
  - How to assess risks to life and limb over generations
  - Property is more straightforward but even that has challenges

Cost to adapt		Adaptation Benefits	
$$	<	$$$$$	
$$$$$	>	$$$	
$$$	=	$$$	

Deep Uncertainty

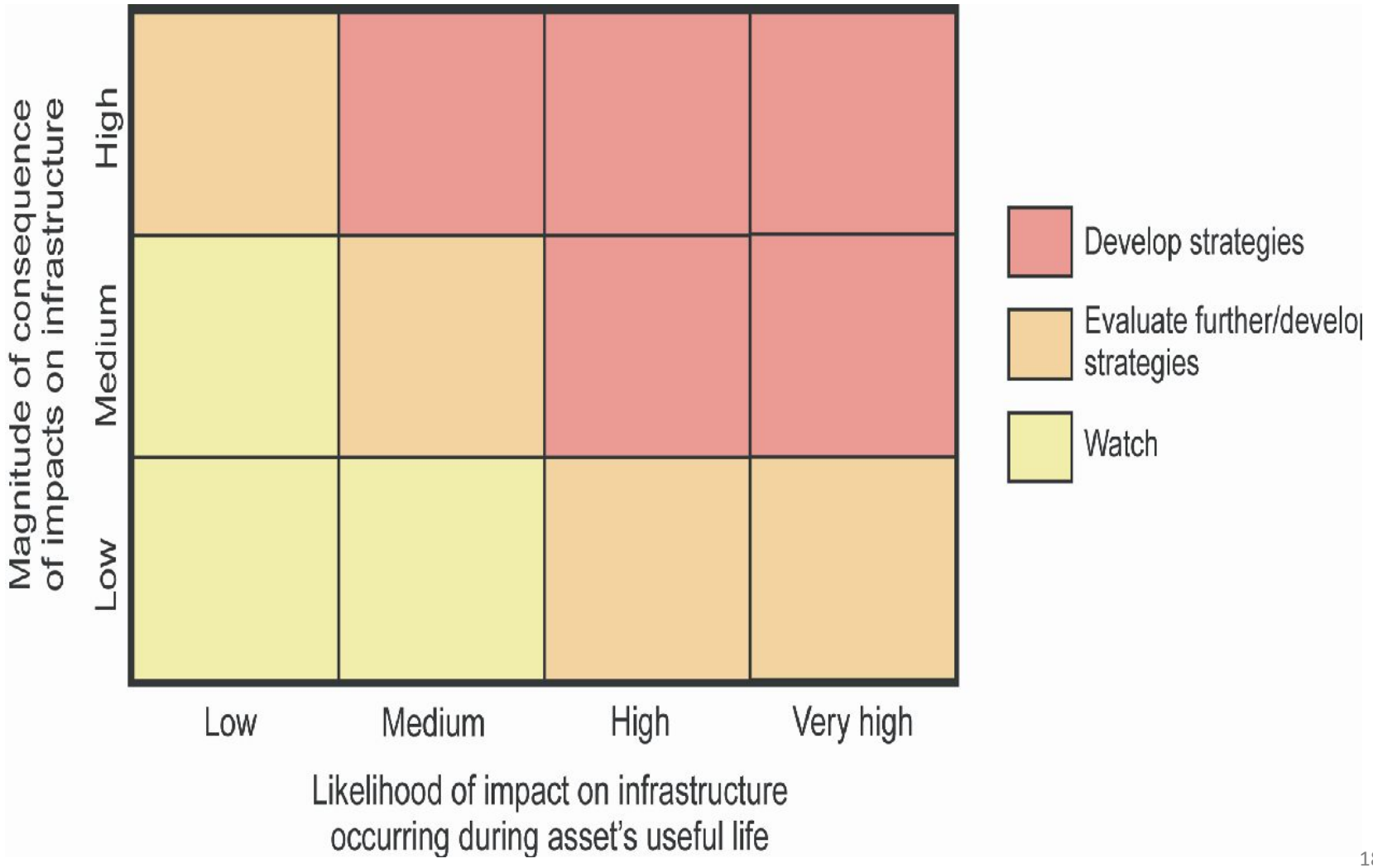
- Recognize climate change cannot be predicted – some uncertainties remain

- Philosophies
  - Risk Management
  - Adaptive Management

- Types of Adaptation
  - No Regrets
  - Low Regrets
  - Incremental Adaptation

Philosophy: Risk Management

Consider likelihood and consequence of outcomes



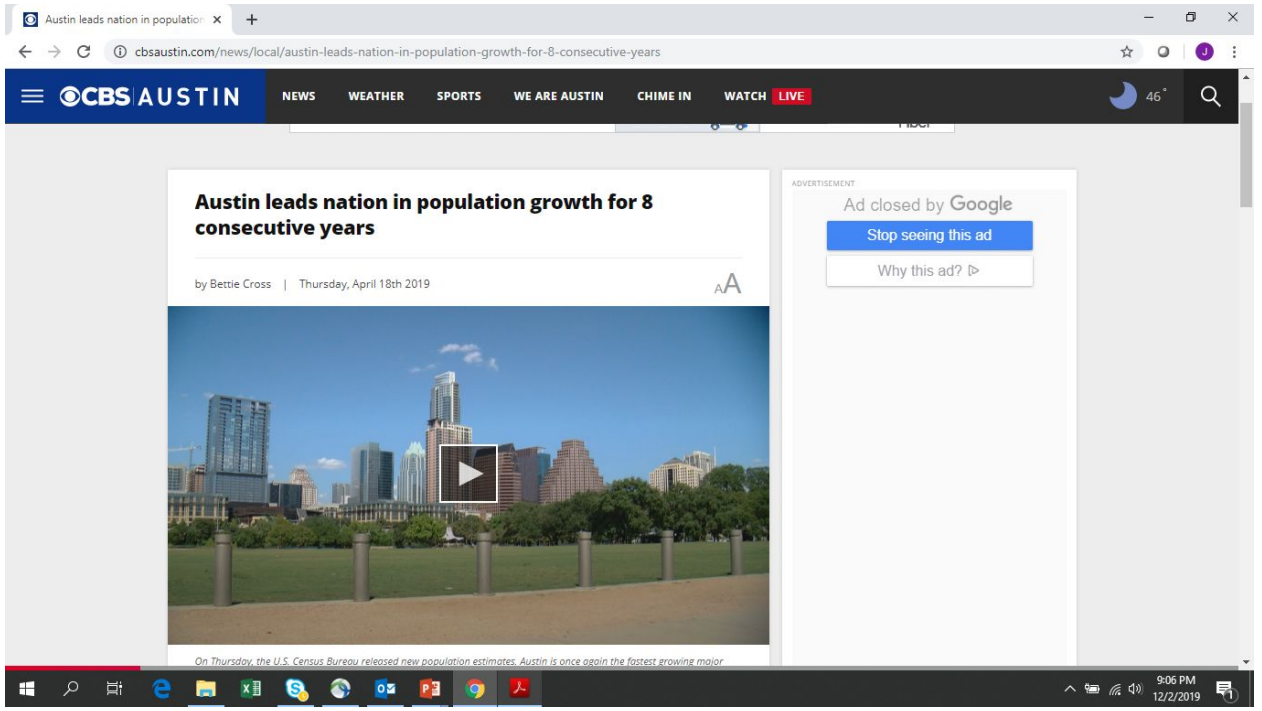
Source: Major and O'Grady, 2010

Philosophy: Adaptive Management

- Recognizes that we can make adjustments as conditions change
- Design systems/decisions so future conditions can be incorporated
  - Option to use land for investment in future such as a reservoir
- Examples:
  - Thames River barrier to protect London from storm surges over rest of century
  - MWD organized near-term investments in local supplies expecting some will need to expand and some be contracted as demand, regulations, climate, another factors change
- ASCE recommends adaptive management approach be applied

Other Key Factors Will Change And Should be Considered

- Population
- Income
- Technology
- Preferences/Culture



Key point is not to project these but understand how change in these and other factors can change vulnerability of a system to climate

How Precise Do We Need to Be in Our Projections?

Adaptations Often Incorporate Ranges or are Incremental

- Culverts can accommodate a wide range of flow and come in incremental diameters from 6” to 1’
- Decisions on sea level rise and flooding such as freeboard are often made in 1’ increments

Before You Jump In – Clearly Articulate…

- What is your endgame? What question(s) do you want to answer
  e.g., what variables, levels of confidence
- How will you get there?
  - Method – simple, sophisticated
  - Data – type, scale, magnitude of change, level of uncertainty
  - Tools – current, new?
- Will it be useful?
- New science?
- Messaging – internal, external

Source: L. Kaatz, Denver Water

Key Takeaways

- The challenge of anticipating climate change is making decisions in light of uncertainty
  - Note: that is the challenge of anticipating any future change
- Uncertainty approaches are better suited to identify and assess options for anticipation of climate change
  - Adaptive management, risk management
  - No regrets, low regrets
  - Incremental, modular (scalable), diversification
  - May need to transform systems.
- Other factors besides climate are also changing and can be relevant
- You need to take an active role in decision making process
  - Tell the scientists what information you need