Building Urban Flood Risk Resilience under deep uncertainty

A CRIDA Case Study in Udon Thani, Thailand
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Management

Udon Thani, Thailand

2000

2001

2011

RID canal

Railway canal

Huay Mak Khaeng

Huay Rin

Huay Mang

Ring Road Canal

Huay Bong

RID canal

UDON THANI PROVINCE

THAILAND

UDON THANI MUNICIPALITY

Mekong River

Water Basin
Flood Extent 2008
Flood Extent 2011
Flood Extent 2012
Recurrent Flood
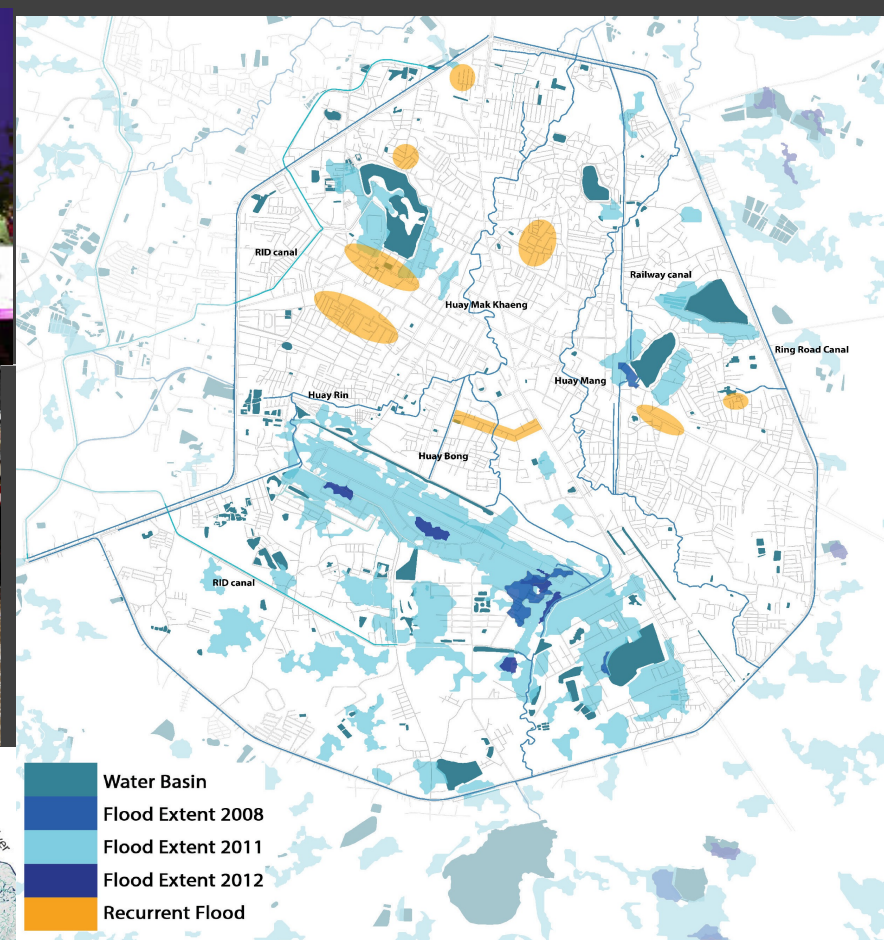
Population (2019): ~150,000 registered // City area: ~50km^2 (475% growth in designated boundaries since 1953)

Bottom-up Principles used in Udon Thani

(1) generate plans that mitigate against future unknown scenarios in a way that doesn't require us to predict the future; and

(2) identify vulnerabilities to potential future scenarios;

(3) provide a collaborative framework for risk informed decision making under deep uncertainty.

Principles

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Need to make a decision: "What, When, Where, How Much" in timely & cost effective manner.

1. Choice of future climate projection is deeply uncertain
   • **Standard cash-flow procedures are biased to least robust solution**
2. Pragmatic / decision scaled approach
3. 'Business-as-usual', robust, adaptable, or both ?

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Plans must be Complete and Effective:

1. **Bottom-Up Approaches** = avoid chronic unacceptable performance (not plan to mitigate a specific future climate)
2. **Stress test** : Discover the combinations of stressors that lead to failure (e.g. Δ urbanization + Δ demographics + Δ rainfall intensity)
   - **Decision scaling**: Align the technical analysis to the decision needs
3. Uses **science to assess the plausibility** of those states

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**Plans must be Efficient and Acceptable:**

1. Acceptability has cultural, legal and social aspects.
2. Risk communication is important for planning under deep uncertainty
3. Standard economic approaches **+ incremental costs for 'robustness' or 'flexibility'**
4. Added costs may require ancillary benefits (think: **multi-purpose projects**)
5. Decision makers like to evaluate options and **not 'black-box'** solution

CRIDA FRAMEWORK

A planning framework that is coupled with a 'Level of Concern' analysis about the uncertain future
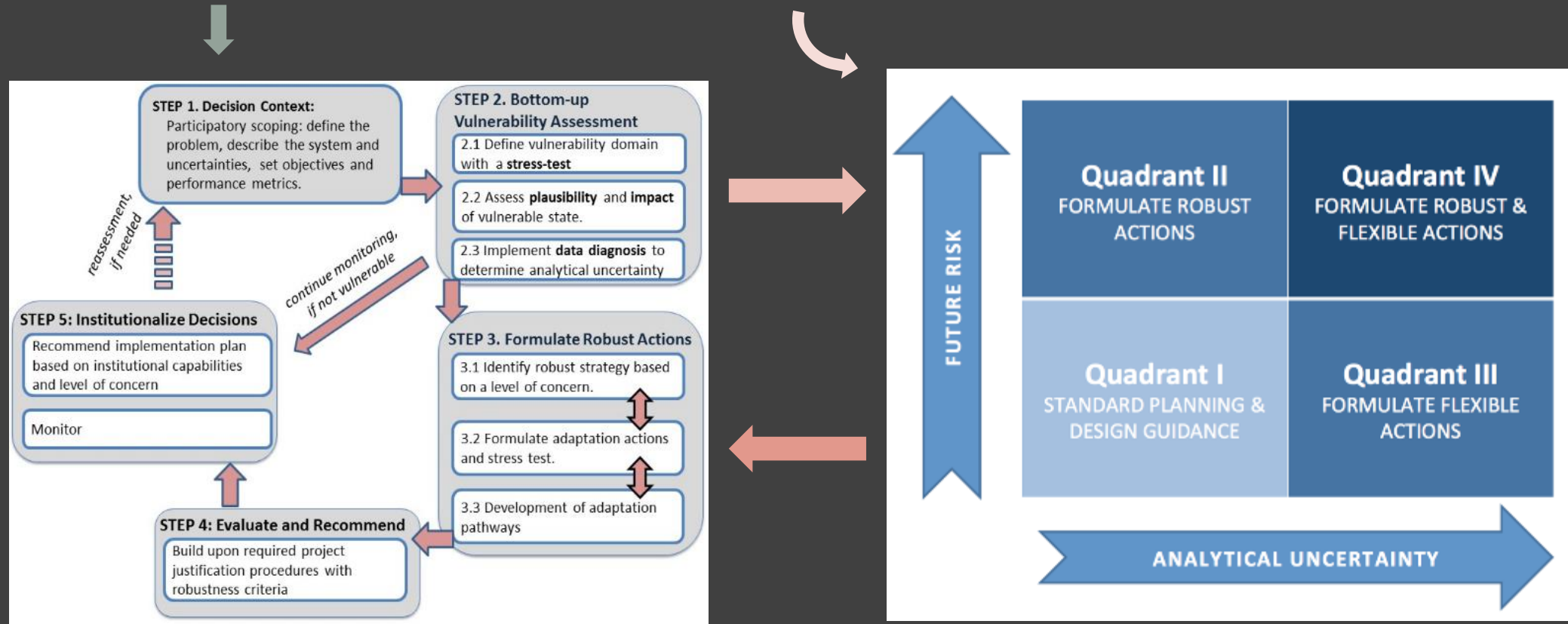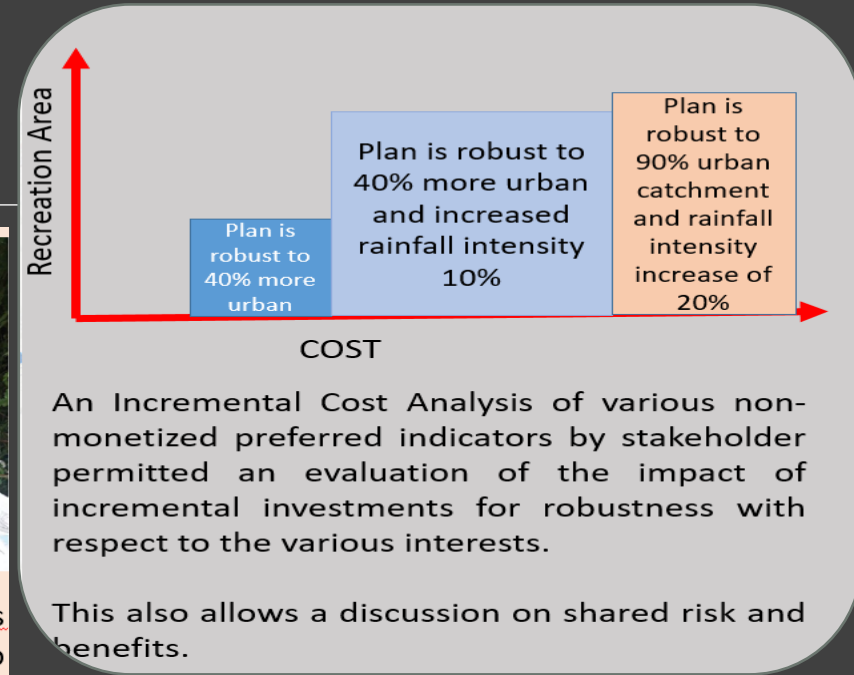
Stress tests: Uncover vulnerability domain & test effectiveness of plans
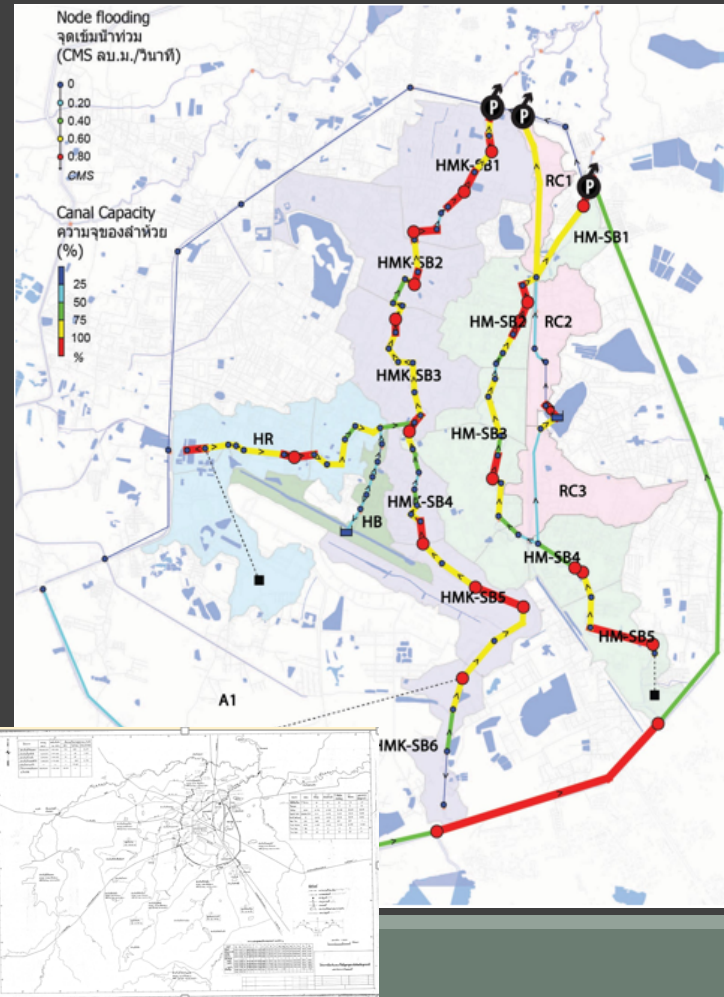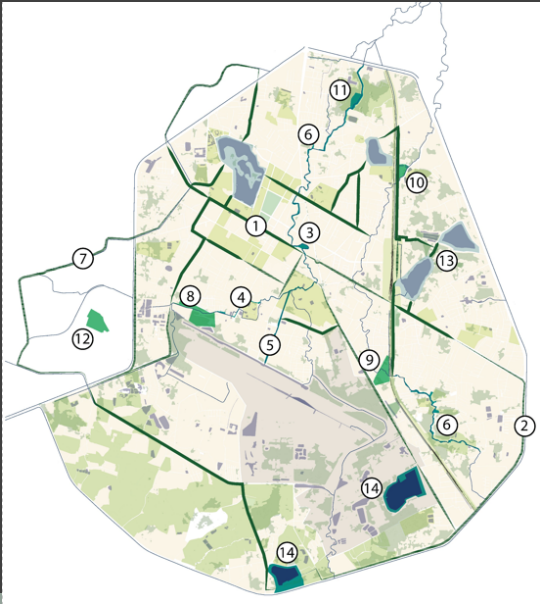
Stress Test: **Run many iterations** of hydraulic model simulations to discover when/how it "breaks".

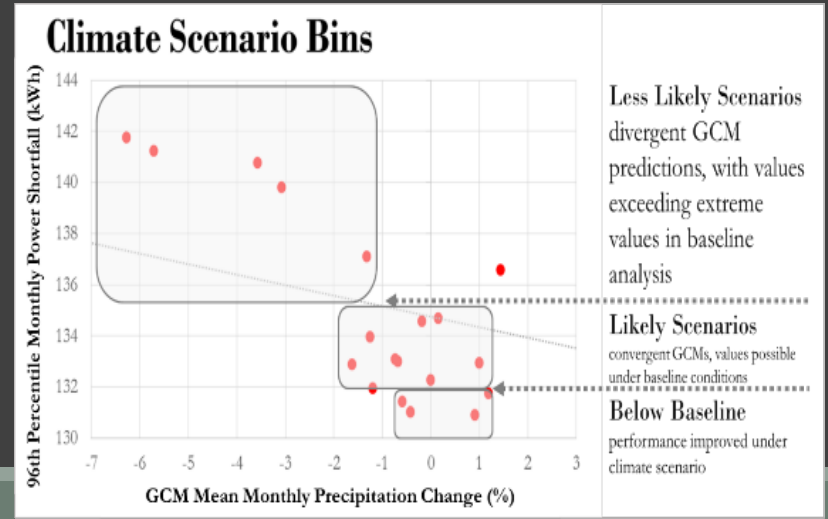# A collaborative process informed by risk assessment and management

Periodic briefings for direction held with decision makers. The mayor and director of Public Works SVP results.

Source: estudioOCA

At various stages of the process, decision makers validated a planning milestone, requested additional information, and provide next steps.

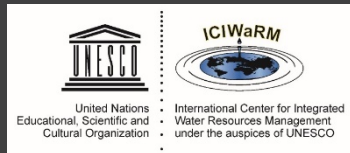USACE style planning charrettes with stakeholders were held to discuss alternatives / concepts at the sites. The city provided logistics and staff.

Recreation Area

Plan is robust to 40% more urban

Plan is robust to 40% more urban and increased rainfall intensity 10%

Plan is robust to 90% urban catchment and rainfall intensity increase of 20%

COST

An Incremental Cost Analysis of various non-monetized preferred indicators by stakeholder permitted an evaluation of the impact of incremental investments for robustness with respect to the various interests.

This also allows a discussion on shared risk and benefits.

Climate Scenario Bins

Less Likely Scenarios divergent GCM predictions, with values exceeding extreme values in baseline analysis

Likely Scenarios convergent GCMs, values possible under baseline conditions

Below Baseline performance improved under climate scenario

96th Percentile Monthly Power Shortfall (kWh)

GCM Mean Monthly Precipitation Change (%)

Thank you

Udon Thani Mayor, Itthipol Treewatanasuwan, opening remarks at a workshop to share lessons with Lao PDR city officials

estudioOCA