Overview:
CLIMATE/ DISASTER RISK AND VULNERABILITY ASSESSMENT (C/DRA-VA)

Communities for Resilience: Convergence Forum for Tagum-Libugananon River Basin

10 – 11 March 2016
Ateneo de Davao, Davao City
C/DRA-VA

• Provide methodology (process) for Climate/Disaster Risk and Vulnerability Assessment

• Using results of C/DRA & VA for mainstreaming CCA/DRR in local development planning process
Scope

Climate/Disaster Risk Assessment

- Applicable for *extreme events* (e.g., *flood*, landslide, severe wind)
- Availability of exposure database (ClimEx.DB)
- Availability of fine-scale (base/hazard) maps
Climate/Disaster Vulnerability Assessment

- Applicable for *climate change* effects or impacts (e.g., sea-level rise, change in rainfall/temperature trends)
- Applicable even if exposure database (ClimEx.DB) is not available
- Sectoral approach (e.g., agriculture, water)
Administrative Order No. 1
(17 September 2010)

Directing the local government units, particularly provinces, to adopt and use in their planning activities the guidelines on mainstreaming disaster risk reduction (DRR) in subnational development and land use/physical planning
DRA model as described under Administrative Order No. 1 (17 September 2010) of President Aquino
C/DRA-VA

Risk Estimation
Risk Evaluation
Hazard Characterization/
Frequency Analysis
Consequence Analysis
Risk Estimation
Risk Evaluation

Climate Projections
Rainfall pattern, temperature changes

Sectoral Impacts
Agricultural, forestry, water, health and coastal sectors

Vulnerability Analysis

Physical Impacts
Flooding, landslide, etc.

C/DRA-VA Project
## Comparison of Models

<table>
<thead>
<tr>
<th>Parameter</th>
<th>NEDA DRR Guidelines</th>
<th>Other models</th>
<th>C/DRA-VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disaster risk assessment</td>
<td>• Quantitative approach <em>(using proxy variables)</em></td>
<td>RAP Project:</td>
<td>• Quantitative approach</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Quantitative approach</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>HLURB Supplemental Guidelines:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Quantitative approach <em>(with the use of index/score)</em></td>
<td></td>
</tr>
</tbody>
</table>
## Comparison of Models

<table>
<thead>
<tr>
<th>Parameter</th>
<th>NEDA DRR Guidelines</th>
<th>Other models</th>
<th>C/DRA-VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicability</td>
<td>• Natural hazards</td>
<td>RAP Project: • Natural hazards</td>
<td>• Natural hazards (case study limited to flood only)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HLURB Supplemental Guidelines: • Natural hazards</td>
<td>• Climate change</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Comparison of Models

<table>
<thead>
<tr>
<th>Parameter</th>
<th>NEDA DRR Guidelines</th>
<th>Other models</th>
<th>C/DRA-VA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System Requirement</strong></td>
<td>• Hazard susceptibility maps</td>
<td>RAP Project:</td>
<td>• Hazard maps (probabilistic)</td>
</tr>
<tr>
<td></td>
<td>• Demographic/other data at the barangay levels</td>
<td>• Hazard maps (probabilistic)</td>
<td>• Demographic/other data at element level</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Demographic/other data at block/cluster level</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>HLURB Supplemental Guidelines:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Hazard maps (susceptibility or probabilistic)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Demographic/other data</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Hazard Characterization and Frequency Analysis
2. Consequence Analysis
3. Risk Estimation/Evaluation
4. Risk Management
Hazard Characterization and Frequency Analysis
Hazard Characterization & Frequency Analysis

- Preparatory steps – collecting and organizing historical climate/disaster data
- Data requirements
  - Hazard maps
  - Historical data
  - Other thematic maps
### Hazard Characterization & Frequency Analysis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>NEDA DRR Guidelines</th>
<th>Other models</th>
<th>C/DRA-VA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hazard characterization</strong></td>
<td>• Hazard susceptibility maps</td>
<td>RAP Project:</td>
<td>• Hazard maps (probabilistic)</td>
</tr>
<tr>
<td><em>(hazard map)</em></td>
<td>Hazard maps (e.g., flood, RIL, EIL) from mandated agencies were used.</td>
<td>• Hazard maps (probabilistic)</td>
<td>Flood inundation maps were produced using flood modeling software (maps with 5, 10, 25, 100 years RRP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hazard maps (e.g., flood inundation) were produced using modeling software (e.g., flood model).</td>
<td>Climate change projections were used to produce additional sets of flood inundation maps (2050 and 2100).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note that other hazard maps (e.g., severe wind) were produced by the project.</td>
<td>The process is applicable to other hazards provided the maps are probabilistic (i.e., map/s is associated to a specific return period).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HLURB Supplemental Guidelines:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Hazard maps (susceptibility or probabilistic)</td>
<td></td>
</tr>
</tbody>
</table>

Note: Other hazard maps (e.g., severe wind) were produced by the project.
### Hazard Characterization & Frequency Analysis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>NEDA DRR Guidelines</th>
<th>Other models</th>
<th>C/DRA-VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Analysis</td>
<td>• Return period or probability of occurrence was associated with susceptibility levels.</td>
<td>RAP Project: Use of probabilistic return period (e.g., RRP for flood)</td>
<td>Use of probabilistic return period (i.e., RRP for flood)</td>
</tr>
<tr>
<td>Hazard (under the H-E-V model)</td>
<td>Frequent event for HSA, likely event for HSA and MSA, and rare event for HSA, MSA and LSA.</td>
<td>HLURB Supplemental Guidelines: Use of index/score for measuring likelihood of occurrence</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Frequent
- Likely
- Rare
Flood Inundation Map of Dumangas, Iloilo

1 in 5-yr Rainfall Return Period Simulation
Baseline Scenario

Flood Depth
- below 0.20m
- 0.20m to 0.50m
- 0.51m to 1.0m
- 1.01m to 2.0m
- more than 5.0m

Emergency Facilities
- Evacuation Facility
- Alternative Evacuation
- Health Facility

Technical Notes:
Flood inundation levels are generated from a particular scenario of rain amount falling within a 24-hour period. The frequency of this event is estimated from historical rainfall records from PAGASA stations found within or nearest the catchment.

0.20 to 0.50m – Areas likely to experience 0.2 to 0.5m inundation (foot to knee-high) within 24 hours. These occur intermittently in areas that are poorly drained such as low hills and gentle slopes that have moderate drainage.

0.51 to 1.0m – Areas likely to experience 0.51 to 1.0m (knee to waist-high) within 24 hours. These occur for prolonged periods in areas which are relatively flat with inundation widespread.

1.01 to 2.0m – Areas likely to experience 1.01 to 2.0m (waist to person’s height) within 24 hours. These include areas adjacent to rivers and bodies of water such as fluvial terraces, alluvial fans and rippled walkways.

2.01 to 5.0m – Areas likely to experience 2.01-5.0m (person’s height to 2-storey high) and durations of less than 24 hours. Likely to occur in topographic lows and along banks of major active river channels and meanders.

More than 5.0m – Areas likely to experience more than 2-storey-high water level. This will almost immediately occur along major active river channels and meanders.

Satellite Imagery: Worldview-3
Date of Acquisition: March 2014

Flood Map generated by:
Modeling and DEM by:
Flood Inundation Map of Dumangas, Iloilo
1 in 25-yr Rainfall Return Period Simulation
Baseline Scenario

Flood Depth
- below 0.20m
- 0.20m to 0.50m
- 0.51m to 1.0m
- 1.01m to 2.0m
- more than 2.0m

Emergency Facilities
- Evacuation Facility
- Health Facility
- Alternative Evacuation

Technical Notes:
Flood inundation levels are generated from a particular scenario of rain amount falling within a 24-hour period. The frequency of this event is estimated from historical rainfall records from PAGASA stations found within or nearest the catchment.

0.20 to 0.50m — Areas likely to experience 0.2 to 0.5m inundation (foot-to-knee high) within 24 hours. These occur intermittently in areas that are poorly drained such as low hills and gentle slopes that have moderate drainage.

0.51 to 1.0m — Areas likely to experience 0.51 to 1.0m (knee-to-waist high) within 24 hours. These occur for prolonged periods in areas which are relatively flat with inundation widespread.

1.01 to 2.0m — Areas likely to experience 1.01 to 2.0m (waist-to-person’s height) within 24 hours. These include areas adjacent to rivers and bodies of water such as fluvial terraces, alluvial fans and infilled wetlands.

2.01 to 5.0m — Areas likely to experience 2.01-5.0m (person’s height to 2-story high) and durations of less than 24 hours. Likely to occur in topographic lows and along banks of major active river channels and meanders.

More than 5.0m — Areas likely to experience more than 2-story high water level. This will almost immediately occur along major active river channels and meanders.

Satellite Imagery: Worldview-2
Date of Acquisition: March 2014

Flood Map generated by: [List of generating entities]
Modeling and DEM by: [List of modeling and DEM entities]
Flood inundation maps (mid-century)
Flood inundation maps (late-century)
Consequence Analysis
Consequence Analysis

• Requires the use of GIS
• Two major groups/sections:
  ✓ Extreme events *(C/DRA)* – flood (but can be used for other hazards)
  ✓ Climate change impacts *(VA)* – sectoral approach
• *C/DRA* – covers the exposure and damage assessment (including fatality estimation)
• *VA* – covers the *priority* sectors of agriculture, water and health
Consequence Analysis

a. Exposure Database
b. Exposure Assessment
   – Population
   – Property and Production Area
c. Damage Assessment
   – Vulnerability Curves
   – Damage Estimation for Structures
   – Damage Estimation for Industrial Establishment
   – Damage Estimation for Other Production Area
d. Fatality estimation
# Consequence Analysis

## Exposure Database

<table>
<thead>
<tr>
<th>Parameter</th>
<th>NEDA DRR Guidelines</th>
<th>Other models</th>
<th>C/DRA-VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>• Population density (at the municipal or barangay level)</td>
<td>RAP Project: • Population density (at the barangay level)</td>
<td>• Actual occupancy (based on ClimEx.DB survey)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HLURB Supplemental Guidelines: • Population density (at the barangay level)</td>
<td></td>
</tr>
</tbody>
</table>
## Consequence Analysis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>NEDA DRR Guidelines</th>
<th>Other models</th>
<th>C/DRA-VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property/Structure</td>
<td>• Land use category&lt;br&gt;Valuation table/s prepared for each land use category (e.g., built-up area, agricultural)</td>
<td>RAP Project:&lt;br&gt;• Structure/bldg profile – profiles (e.g., estimated floor area, types of structures) defined for each block/cluster based on sampling data.</td>
<td>• Actual inventory (based on ClimEx.DB survey) to generate structure/building profile</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HLURB Supplemental Guidelines:&lt;br&gt;• Structure/bldg profile – Minimum requirement is the generation of structure/building profile at the barangay level.</td>
<td></td>
</tr>
</tbody>
</table>
### Consequence Analysis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>NEDA DRR Guidelines</th>
<th>Other models</th>
<th>C/DRA-VA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Estimation of fatality</strong></td>
<td>Use of Factor for Fatality:&lt;br&gt;Factor for Fatality tables provided for each hazard corresponding to <em>frequent, likely</em> and <em>rare</em> hazard events.</td>
<td>RAP Project:&lt;br&gt;• <em>none</em>&lt;br&gt;&lt;br&gt;HLURB Supplemental Guidelines:&lt;br&gt;• Use of index/score to assess population vulnerability</td>
<td>Use of fatality ratio&lt;br&gt;Fatality ratio computed based on historical data of the municipality (or province, if municipal data are not available).</td>
</tr>
</tbody>
</table>
## Consequence Analysis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>NEDA DRR Guidelines</th>
<th>Other models</th>
<th>C/DRA-VA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Loss and Damages</strong></td>
<td>• Use of Factor for Property Damage Factor for Property Damage tables provided for each hazard corresponding to <em>frequent, likely</em> and <em>rare</em> hazard events.</td>
<td>RAP Project: • Replacement cost using vulnerability or damage curves Damage to structures estimated using vulnerability or damage curves for each structure type. HLURB Supplemental Guidelines: • Use of index/score to assess vulnerability</td>
<td>• Actual inventory (based on ClimEx.DB) to generate structure/building profile</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Replacement cost using vulnerability or damage curves (developed by RAP Project)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RAP Project: • Replacement cost using vulnerability or damage curves Damage to structures estimated using vulnerability or damage curves for each structure type.</td>
<td>• Agricultural L&amp;D based on PSA-BAS <em>Manual on Damage Assessment and Reporting System (2014)</em></td>
</tr>
</tbody>
</table>

---

**Note:** The table outlines various models and guidelines for assessing consequences, specifically focusing on loss and damages. It highlights the use of different factors and methodologies for assessing vulnerability, damage, and replacement costs, with specific references to the NEDA DRR Guidelines, RAP Project, and HLURB Supplemental Guidelines.
Exposure Database

(ClimEx.DB)

Developed under the
Climate Twin Phoenix Project

(CCC-UNDP-Aus Govt)
Consequence Analysis

Exposure Database
(ClimEx.DB)

a. Household data (location, household size)
b. Demographic data (age profile, gender profile, education profile)
c. Economic activity data (sources of income, business/livelihood, access to financing, ownership)
d. Structure data (size, elevation, construction materials)
e. Disaster and climate perceptions
Consequence Analysis
Consequence Analysis
Consequence Analysis
Consequence Analysis

Vulnerability Curves for Damage Assessment

Developed under the Greater Metro-Manila Area – Risk Analysis Project (GMMA-RAP) (OCD/CSCAND-Aus Govt)
Damage Assessment

Available vulnerability curves (flood events) from GMMA-RAP

- Wood, Light Frame (W1*)
- Bamboo (W3)
- Makeshift (N)
- Concrete Hollow Blocks (CHB)
- CHB with Wood or Light Metal (MWS)
- Reinforced Concrete Moment Frames with Wood or Light Metal (CWS)
- Reinforced Concrete Moment Frames (C1)
- Steel Moment Frame (S1*)
Damage Assessment

Damage estimation for structure

- For each of the structure, determine the inundation level using the hazard map.
- Using the inundation level, determine the damage using the appropriate vulnerability curve.
- Total damage can be aggregated from the estimated damage for each type of structures (see working table-template). This shall be repeated for all the flood hazard maps.
### Consequence Analysis

#### Damage Assessment

**Damage estimation for structure**

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Structural Type or Description</th>
<th>Bldg. Type or Sub-Type Code for FL</th>
<th>Range of No. of Floors (Floor-Sensitive Attribute)</th>
<th>Inundation Depth (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>0.1</td>
<td>0.5</td>
</tr>
<tr>
<td>Wifi</td>
<td>Wood, Light Frame</td>
<td>WI-L-1</td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Bamboo</td>
<td>WS-L</td>
<td>2</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Malas Hf</td>
<td>N-L-1</td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N-L-2</td>
<td>2</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Concrete Hollow Blocks with Wood or Light Metal</td>
<td>MWS-L</td>
<td>2</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Concrete Hollow Blocks</td>
<td>CHB-L-1</td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CHB-L-2</td>
<td>2</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Reinforced Concrete Moment Frames with Wood or Light Metal</td>
<td>CWS-L</td>
<td>2</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Reinforced Concrete Moment Frames</td>
<td>C1-L-1</td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C1-L-2</td>
<td>2</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C1-M</td>
<td>3-7</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Steel Moment Frames</td>
<td>S1-L-1</td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S1-L-2</td>
<td>2</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S1-M</td>
<td>3-7</td>
<td>0.00</td>
</tr>
</tbody>
</table>

1. Flood inundation level at each HH bldg was extracted from the Flood Map (raster)
2. Elevation of the Bldg from ground was subtracted from the inundation depth i.e., negative value means the bldg is not affected by the inundation level in the area
3. Number of structures damaged was summarized based on the GMMA-RAP vulnerability curves

**Note:** Tables provided by AusAID-funded project, Greater Metro-Manila Area – Risk Analysis Project (GMMA-RAP) – selected methods are heuristic or computational.
Consequence Analysis

Damage Assessment
Damage estimation for roads and bridges (pure inundation)

• Damage Estimation for roads

<table>
<thead>
<tr>
<th>Inundation level (meters)</th>
<th>Gravel</th>
<th>Asphalt</th>
<th>Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.2 meter</td>
<td>30%</td>
<td>20%</td>
<td>5%</td>
</tr>
<tr>
<td>0.2 – 0.5 meters</td>
<td>50%</td>
<td>30%</td>
<td>10%</td>
</tr>
<tr>
<td>&gt; 0.5 meters</td>
<td>50%</td>
<td>40%</td>
<td>20%</td>
</tr>
</tbody>
</table>

• Damage Estimation for bridges – total damage for overtopped bridges
Consequence Analysis

Damage Assessment
Damage estimation for agriculture


- Use crop damage matrices (CDM)

<table>
<thead>
<tr>
<th>Crops</th>
<th>CDM Reference</th>
<th>Damage Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palay (rainfed) Palay (irri.)</td>
<td>Flowering/Maturity Stage (CDM-7a) Muddy Water/3 – 4 days submerged</td>
<td>40 – 70%</td>
</tr>
<tr>
<td>Corn yellow</td>
<td>Reproductive/3 – 4 days submerged/Maturity Stage (CDM-7b) 90%</td>
<td></td>
</tr>
<tr>
<td>Potato</td>
<td>Reproductive/continuous heavy rain</td>
<td>40 – 50%</td>
</tr>
<tr>
<td>Cabbage/Carrot/Sayote/Ampalaya/habitchuelas</td>
<td>Vegetative/continuous heavy rain with SW</td>
<td>60 – 80%</td>
</tr>
</tbody>
</table>

Cost estimation based on farm gate price
# Consequence Analysis

## Damage Assessment

Damage estimation for agriculture

<table>
<thead>
<tr>
<th>Crops</th>
<th>CDM Reference</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squash/Sitaw/string beans</td>
<td>Vegetative /continuous heavy rain with SW</td>
<td>60 – 80%</td>
</tr>
<tr>
<td>Tomato</td>
<td>Continuous heavy rain with SW</td>
<td>90 – 100%</td>
</tr>
<tr>
<td>Eggplant</td>
<td>Continuous heavy rain with SW</td>
<td>20 – 25%</td>
</tr>
<tr>
<td>Pechay</td>
<td>Vegetative /continuous heavy rain with SW</td>
<td>80 – 90%</td>
</tr>
<tr>
<td>Mango/ Banana</td>
<td>Flowering/continuous heavy rain</td>
<td>80 – 100%</td>
</tr>
<tr>
<td></td>
<td>Fruiting/continuous heavy rain</td>
<td>10 – 20%</td>
</tr>
<tr>
<td>Coffee</td>
<td>Flowering/continuous heavy rain</td>
<td>40 – 50%</td>
</tr>
</tbody>
</table>

Source: Manual on Damage Assessment and Reporting System *(Loss estimation index)*
Consequence Analysis

Fatality Estimation

- Use of *fatality ratio* (use historical data collected)

<table>
<thead>
<tr>
<th>Events</th>
<th>Population Affected</th>
<th>Casualty</th>
<th>Fatality Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event 1</td>
<td>X</td>
<td>Y</td>
<td>Y / X</td>
</tr>
<tr>
<td>Event 2</td>
<td>A</td>
<td>B</td>
<td>B / A</td>
</tr>
<tr>
<td>Event 3</td>
<td>L</td>
<td>M</td>
<td>M / L</td>
</tr>
<tr>
<td>....</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Event n</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Preferably, at least 10 – 15 records

(default value)

<table>
<thead>
<tr>
<th>5/10 year RP</th>
<th>25 year RP</th>
<th>100 year RP</th>
</tr>
</thead>
<tbody>
<tr>
<td>$6.60 \times 10^{-5}$</td>
<td>$1.33 \times 10^{-4}$</td>
<td>$2.00 \times 10^{-4}$</td>
</tr>
</tbody>
</table>

Adapted from: Mainstreaming DRR in Sub-national Development and Land Use/Physical Planning in the Philippines (NEDA 2008)
Risk estimation and evaluation/prioritization
Risk Estimation

Risk estimation involves estimating the risk expressed as the expected annual number of lives lost, and annual damage to property (in monetary value).

• **Scope:**

  ✓ Risk of *Fatality* (/year)
  ✓ Risk of *Loss & Damages* (PhP/year)
Risk Estimation

**Risk** = probability of occurrence × consequence

\[ R = P \times C \]

where

- **R** = risk (in fatalities/year or PhP L&D/year)
- **P** = probability of occurrence (or the *frequency* expressed as hazard event/year)
- **C** = consequence in terms of estimated fatality or PhP L&D per hazard event
Risk evaluation involves making judgment about the significance and acceptability of the estimated risks.

Under the C/DRA-VA process, risk prioritization will be used in lieu of the determination of risk acceptability.

- Scope:
  - Risk Acceptability/Prioritization
  - Vulnerability and Adaptation (VA) Assessment
Risk Prioritization Scheme

✓ Low priority – at this level, risks are deemed acceptable. The values are pegged at the internationally-accepted of acceptable or tolerable risks of $10^{-6}$. No actions are required in terms of risk management or adaptation measures.

✓ Moderate priority – at this level, risks are deemed moderately acceptable or tolerable. Risk management or adaptation measures may be necessary. However, a plan to maintain or further reduce the risks (or vulnerability) to a more acceptable level is necessary.

✓ High priority – this is the level where risks are deemed as intolerable. At this range of risk values, further investigation is necessary to plan and implement risk management and/or adaptation measures to reduce risk (or vulnerability) to acceptable level.

✓ Urgent – this is the level of risk considered as highly intolerable. At the range, extensive investigation is mandatory to plan and implement risk management and/or adaptation measures in order to reduce risks (or vulnerability) to tolerable levels.
## Risk Evaluation

### Risk Prioritization Scheme

<table>
<thead>
<tr>
<th>Estimated risk of Loss and Damages, R&lt;sub&gt;LD&lt;/sub&gt;</th>
<th>Estimated risk of fatality, R&lt;sub&gt;F&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very high risk</td>
</tr>
<tr>
<td></td>
<td>High risk</td>
</tr>
<tr>
<td></td>
<td>Moderate risk</td>
</tr>
<tr>
<td></td>
<td>Low risk</td>
</tr>
<tr>
<td></td>
<td>Very low risk</td>
</tr>
<tr>
<td>&gt; 10&lt;sup&gt;-2&lt;/sup&gt;</td>
<td>10&lt;sup&gt;-4&lt;/sup&gt; – 10&lt;sup&gt;-2&lt;/sup&gt;</td>
</tr>
<tr>
<td>10&lt;sup&gt;-4&lt;/sup&gt; – 10&lt;sup&gt;-2&lt;/sup&gt;</td>
<td>10&lt;sup&gt;-5&lt;/sup&gt; – 10&lt;sup&gt;-4&lt;/sup&gt;</td>
</tr>
<tr>
<td>10&lt;sup&gt;-6&lt;/sup&gt; – 10&lt;sup&gt;-5&lt;/sup&gt;</td>
<td>&lt; 10&lt;sup&gt;-6&lt;/sup&gt;</td>
</tr>
<tr>
<td>Very high risk</td>
<td><strong>URGENT</strong></td>
</tr>
<tr>
<td>&gt; 20%</td>
<td></td>
</tr>
<tr>
<td>High risk</td>
<td><strong>HIGH PRIORITY</strong></td>
</tr>
<tr>
<td>15% – 20%</td>
<td></td>
</tr>
<tr>
<td>Moderate risk</td>
<td><strong>MODERATE PRIORITY</strong></td>
</tr>
<tr>
<td>10% – 15%</td>
<td></td>
</tr>
<tr>
<td>Low risk</td>
<td><strong>LOW PRIORITY</strong></td>
</tr>
<tr>
<td>5% – 10%</td>
<td></td>
</tr>
<tr>
<td>Very low risk</td>
<td><strong>LOW PRIORITY</strong></td>
</tr>
<tr>
<td>&lt; 5%</td>
<td></td>
</tr>
</tbody>
</table>

No action needed
Risk Evaluation
Risk Evaluation

Risk of Fatality in the Municipality of Zarraga, Iloilo
Baseline Scenario

Risk of Fatality
- Very Low (< 10^-6)
- Low (10^-6 – 10^-5)
- Moderate (10^-5 – 10^-4)
- High (10^-4 – 10^-3)
- Very High (> 10^-3)

Risk Prioritization Scheme
- Low priority – at this level, risks are deemed acceptable. No actions are required in terms of risk management or adaptation measures.
- Moderate priority – at this level, risks are deemed moderately acceptable or tolerable. Risk management or adaptation measures may be necessary. However, a plan to maintain or further reduce the risk (or vulnerability) to a more acceptable level is necessary.
- High priority – this is the level where risks are deemed as intolerable. At this range of risk values, further investigation is necessary to plan and implement risk management and/or adaptation measures to reduce risk (or vulnerability) to acceptable level.
- Urgent – this is the level of risk considered as highly intolerable. At the range, extensive investigation is mandatory to plan and implement risk management and/or adaptation measures in order to reduce risks (or vulnerability) to tolerable levels.

Map generated from:
Risk Evaluation

**Risk of Loss & Damages in the Municipality of Zarraga, Iloilo**

*Baseline Scenario*

- **Kilometers**
  - Scale: 0 - 3.6 km

- **Risk of Loss and Damages**
  - Very Low: (< 1%)
  - Low: (1% - 5%)
  - Moderate: (5% - 10%)
  - High: (10% - 20%)
  - Very High: (> 20%)

**Risk Prioritization Scheme**

- **Low** priority – at this level, risks are deemed acceptable. No actions are required in terms of risk management or adaptation measures.
- **Moderate** priority – at this level, risks are deemed moderately acceptable or tolerable. Risk management or adaptation measures may be necessary. However, a plan to maintain or further reduce the risk (or vulnerability) to a more acceptable level is necessary.
- **High** priority – this is the level where risks are deemed as intolerable. At this range of risk values, further investigation is necessary to plan and implement risk management and/or adaptation measures to reduce risk (or vulnerability) to acceptable levels.
- **Urgent** – this is the level of risk considered as highly intolerable. At the range, extensive investigation is mandatory to plan and implement risk management and/or adaptation measures in order to reduce risks (or vulnerability) to tolerable levels.

---

Map generated from [UNDP's Geospatial Data](https://www.undp.org/dems)
Risk Evaluation

Risk of Loss & Damages in the Municipality of Zarraga, Iloilo
Baseline Scenario

Risk of Loss and Damages

- **Very Low** (< 1%)
- **Low** (1% - 5%)
- **Moderate** (5% - 10%)
- **High** (10% - 20%)
- **Very High** (> 20%)

Risk Prioritization Scheme

Low priority – at this level, risks are deemed acceptable. No actions are required in terms of risk management or adaptation measures.

Moderate priority – at this level, risks are deemed moderately acceptable or tolerable. Risk management or adaptation measures may be necessary. However, a plan to maintain or further reduce the risks (or vulnerability) to a more acceptable level is necessary.

High priority – this is the level where risks are deemed as intolerable. At this range of risk values, further investigation is necessary to plan and implement risk management and/or adaptation measures to reduce risk (or vulnerability) to tolerable level.

Urgent – this is the level of risk considered as highly intolerable. At the range, extensive investigation is mandatory to plan and implement risk management and/or adaptation measures in order to reduce risks (or vulnerability) to tolerable levels.

Map provided from:
Risk Evaluation

Risk Prioritization Scheme in Zarraga, Iloilo
Baseline Scenario

Risk Priority
- **Urgent**
- High Priority
- **Moderate Priority**
- Low Priority
- **No Action Needed**

Risk Prioritization Scheme

Low priority – at this level, risks are deemed acceptable. No actions are required in terms of risk management or adaptation measures.

Moderate priority – at this level, risks are deemed moderately acceptable or tolerable. Risk management or adaptation measures may be necessary. However, a plan to maintain or further reduce the risks (or vulnerability) to a more acceptable level is necessary.

High priority – this is the level where risks are deemed as intolerable. At this range of risk values, further investigation is necessary to plan and implement risk management and/or adaptation measures to reduce risk (or vulnerability) to acceptable levels.

Urgent – this is the level of risk considered as highly intolerable. At the range, extensive investigation is mandatory to plan and implement risk management and/or adaptation measures in order to reduce risks (or vulnerability) to tolerable levels.

Map generated from:

[Logos and icons]
Vulnerability and adaptation assessment
VA assessment

Priority Sectors:

- Agriculture
- Health
- Water
- Forestry
- Coastal
VA assessment

Agriculture

- Vulnerability assessment:
  - Productivity losses – economic losses based on farm gate price
  - Water demands vs water availability
Agriculture

- **Vulnerability assessment (productivity loss):**
  - Use of model (e.g., ORYZA for rice) to estimate yield of various scenarios (e.g., baseline, 2050)
  - Default value – IPCC/FAO reports

<table>
<thead>
<tr>
<th>Crop</th>
<th>% change in yield</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CSIRO estimates</td>
</tr>
<tr>
<td>Rice, irrigated</td>
<td>– 14.4%</td>
</tr>
<tr>
<td>Rice, rain-fed</td>
<td>– 1.3%</td>
</tr>
<tr>
<td>Corn, irrigated</td>
<td>– 2.0%</td>
</tr>
<tr>
<td>Corn, rain-fed</td>
<td>0.2%</td>
</tr>
<tr>
<td>Wheat, irrigated</td>
<td>– 28.3%</td>
</tr>
<tr>
<td>Wheat, rain-fed</td>
<td>– 1.4%</td>
</tr>
</tbody>
</table>
Health

• Vulnerability assessment:
  ✓ Data analysis (health data vs temp and rainfall)
    o Derive/estimate current/2050/2100 incidents
    o Derive health cost (using “burden of disease” or treatment cost)
    o Determine sufficiency (deficit) of health budget

✓ Other analysis
  o Current personnel complement vs DOH standards – plot health units/stations with above/adequate/inadequate personnel
  o Capacity/capability vs DOH standards
Health

- Adaptation assessment:
  - Increase/decrease in incidents
  - Sufficiency of resources
  - Capacity/capability of health infra

- Physical vulnerability of health facilities
  - Estimated damages from 5, 10, 25, 100 RRP
  - Scenario building/analysis from disruptions of health services due to *damaged* facilities
  - Health facility vs evacuation centers during extreme events
VA assessment

Water

<table>
<thead>
<tr>
<th>Period</th>
<th>Computation table (per watershed) MCM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P</td>
</tr>
<tr>
<td>Jan</td>
<td></td>
</tr>
<tr>
<td>Feb</td>
<td></td>
</tr>
<tr>
<td>Mar</td>
<td></td>
</tr>
<tr>
<td>Apr</td>
<td></td>
</tr>
<tr>
<td>May</td>
<td></td>
</tr>
<tr>
<td>Jun</td>
<td></td>
</tr>
<tr>
<td>Jul</td>
<td></td>
</tr>
<tr>
<td>Aug</td>
<td></td>
</tr>
<tr>
<td>Sep</td>
<td></td>
</tr>
<tr>
<td>Oct</td>
<td></td>
</tr>
<tr>
<td>Nov</td>
<td></td>
</tr>
<tr>
<td>Dec</td>
<td></td>
</tr>
<tr>
<td>Annual</td>
<td></td>
</tr>
</tbody>
</table>

\[ P = AET - Q - GR \]

where
- \( P \) = rainfall
- \( AET \) = actual evapotranspiration
- \( Q \) = stream discharge
- \( GR \) = groundwater recharge.
Maraming salamat po

Climate Change Office
LPLP Building, Malacañang Complex
JP Laurel Street, San Miguel, Manila
www.climate.gov.ph
info@climate.gov.ph