HCMC CLIMATE CHANGE IMPACT AND ADAPTATION STUDY
ADB/HCMC PPC

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HCMC study scenarios

3

- **One time horizon** for assessing climate extent and impact: 2050
- **Two IPCC scenarios:**
  1. A2: High emission - Minimal innovation to current practice (SLR 26cm)
  2. B2: Medium emission – Mitigation measures applied (SLR 24cm)
- **Regular and extreme** climate situations – flood, drought and saline intrusion
- **With and without planned comprehensive dyke system** – designed for current climate (USD650 million)

The steps to adaptation planning

4

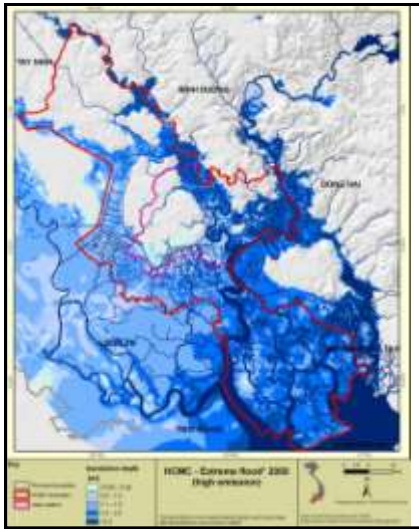
1. **Assessing the threat:** Estimating the kinds of (i) climate and (ii) hydrodynamic changes and their nature, scale and location
2. **Making socio-economic projections:** Modeling socio-economic conditions in future climate situations
3. **Assessing the impact:** Linking estimates of climate threat to potential socio-economic and environmental impacts
4. **Assessing vulnerability:** Identifying areas, sectors and communities sensitive to climate change impacts
5. **Identifying adaptation options and priorities:** Defining what needs to be done, by whom and when
6. **Integrating with development planning:** policies, procedures, design standards, budgets, projects
7. **Implementing adaptation measures:** including monitoring, learning and adjustment

Threat - from 2050 climate

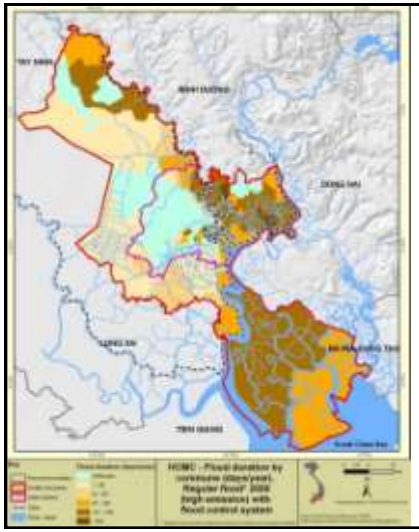
5

- **Regular events** (ie daily or seasonal)
  - Temperature - seasonal and rising
  - Monsoon rainfall - annual and more intense
  - Tides - twice daily and increasing in amplitude
  - Wind - annual and more intense
  - Drought - annual and more intense
  - Saline intrusion - regular and with greater inland reach
  - Sea level rise - incremental increase (26cm/25cm)
- **Extreme events** (eg 10 or 30 year return period)
  - Tropical storms – more frequent, more intense wind and rain
  - Storm surge - more intense

2050 extreme flood event for high emission scenario with planned dyke system



2050 extreme flood event for high emission scenario without planned dyke system



2050 regular flood duration by commune (days/year) with dyke system

Impact - from 2050 climate

9

Assessing the potential impacts on:

1. **Economic assets:** Industrial assets, water, transport, agriculture and energy, public health infrastructure
2. **Social variables and assets:** population affected, livelihood/income types most affected, poor communities affected
3. **Environmental assets:** aquatic systems, forest resources, fish resources affected, biodiversity lost
4. **Environmental quality:** (i) Areas affected by salinity, and (ii) areas affected by wastewater/pollution

2050 existing and planned **transport** network - roads without dyke system

2050 - Populations effected by flood – top ten districts

10

			Extreme A2		Extreme A2 with dyke	
District	Area (Ha)	Population 2050	People affected	Percent area affected	People affected	Percent area affected
2	5236.54	1,492,000	1,410,089	94.51	1,160,179	77.76
4	407.65	125,000	124,988	99.99	80,550	64.44
6	712.97	216,000	193,363	89.52	25,553	11.83
7	3146.06	1,071,000	1,070,572	99.96	691,009	64.52
8	1968.57	575,000	573,735	99.78	170,718	29.69
9	11979.2	3,420,000	2,321,838	67.89	2,310,894	67.57
Binh Thanh	2094.44	623,000	510,922	82.01	502,263	80.62
Nha Be	10413.5	437,000	436,956	99.99	368,915	84.42
Can Gio	61284.5	393,000	393,000	100	393,000	100
Binh Chanh	25433.3	1,483,000	1,342,560	90.53	1,232,521	83.11
Total/ average		**9,835,000**	**8,378,023**	**92.42**	**6,935,602**	**66.40**
Total/ average HCMC		**19,345,000**	**11,914,687**	**57.99**	**10,178,751**	**43.33**

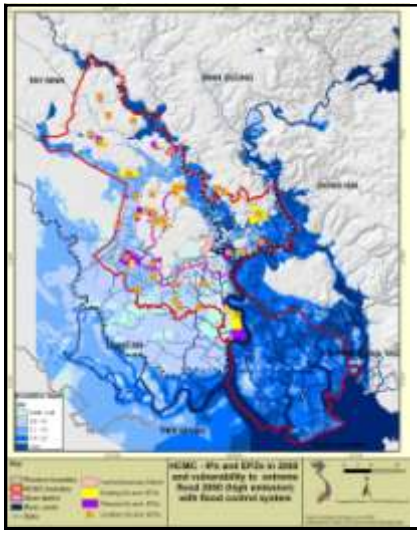
2050 Existing and planned **transport** network – roads with dyke system

Risk indicator
0 km: Inundated
<1 km: Very high risk
<5 km: High risk
<10km: Medium risk
>10km: Low risk

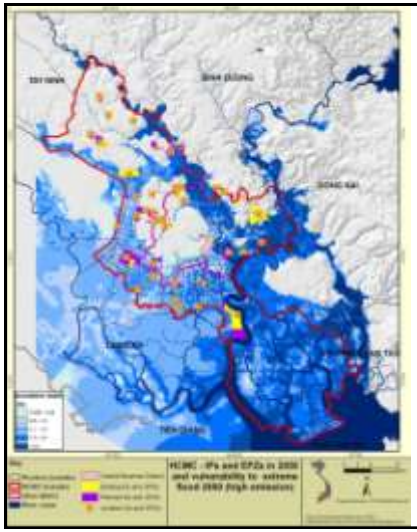
2050 planned major road intersections at risk with and without the planned dyke system

Main intersections	Distance from flooded area (km)	
	Extreme A2	Extreme A2 with dyke
National road no. 13 (Binh Phuoc intersection)	0.00	0.00
Provincial road no. 12 - Nga Tu Ga	0.00	0.00
Provincial road no. 16	0.00	0.00
Provincial road no. 15 (Quang Trung inersection)	0.48	0.48
National road no. 22 (An Suong intersection)	1.27	1.27
South-Western new road	1.28	1.28
Tan Tao - Cho Dem highway	0.79	1.06
Provincial road no. 10	0.00	0.37
Hung Vuong (An Lac intersection)	0.00	0.83
Nguyen Van Linh	0.00	0.00
National road no. 50	0.00	0.00
Chanh Hung	0.00	0.00
Nguyen Van Cu	0.00	0.00
North-South Axis	0.00	0.26
Intersection of A Area	0.00	0.11
Inter-Provincial road no. 15	0.00	0.00
Inter-Provincial road no. 25	0.17	0.17
Hanoi highway (Binh Thai intersection)	0.10	0.10
Saigon-Long Thanh-Dau Giay highway	0.00	0.00
Saigon-Long Thanh-Dau Giay highway	2.41	2.41
Tan Van intersection	0.08	0.08
National road no. 1K	0.32	0.32
National road no. 13 (Thu Dau Mot)	2.77	2.17
Provincial road no. 15	0.00	0.00
National road no. 22	0.00	0.00
Provincial road no. 14	0.00	0.00
Provincial road no. 10	0.00	0.00
Saigon-Trung Luong highway	0.00	0.00
National road no. 50	0.00	0.00
National road no. 1A (Ben Luc town, Long An)	0.00	0.00
Saigon-Trung Luong highway	0.00	0.00
New road (Provincial road no. 14 near Duc Hoa town	0.01	0.01
National road no. 22	0.76	0.56
HCMC-Moc Bai highway	5.87	3.38
National road no13	3.30	3.30
National road no. 1A (Trang Bom), km 1845	3.04	3.04
National road no. 50	0.00	0.00
Ring road no. 3 (Nhon Trach)	0.00	0.34
North-South Axis	0.00	0.00
Ring road no. 3 (Nhon Trach)	0.00	0.00
Provincial road no. 16	0.00	0.00

13



2050 existing and planned **industrial zones** in extreme flood with dyke system



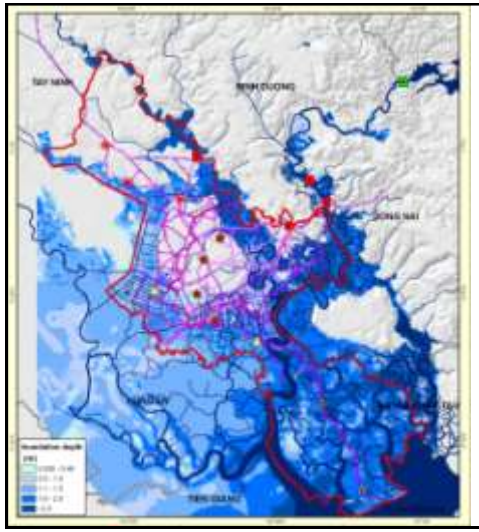
2050 existing and planned **industrial zones** in extreme flood without dyke system

Risk indicator
0 km: Inundated
<1 km: Very high risk
<5 km: High risk
<10km: Medium risk
>10km: Low risk

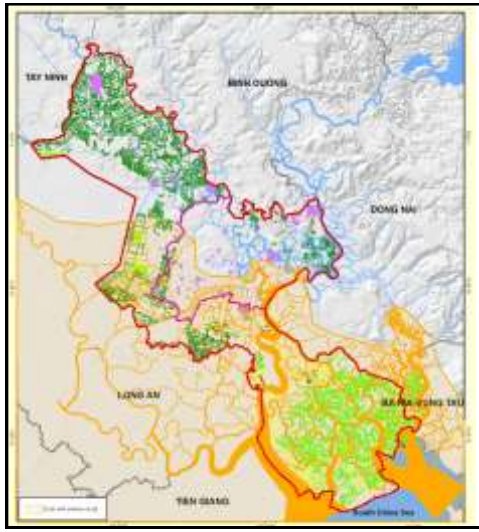
2050 existing and planned industrial zones in extreme flood (i) without and (ii) with dyke system

16

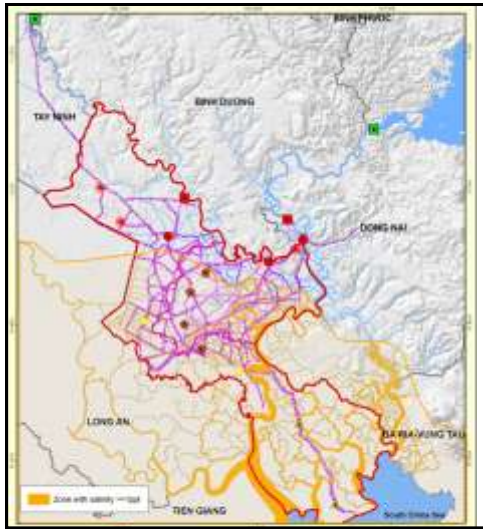
Name Izs and IPZs	Type	Distance from flooded area	
		Extreme A2	Extreme A2 with dyke
Hoc Mon	Group	2.45	2.45
Hiep Thanh IZ	IZ	0.00	0.00
Tan Thoi Nhat	Group	0.35	0.35
Tan Binh IZ	IZ	1.88	1.88
Vinh Loc I IZ	IZ	0.15	0.15
Tan Tao IZ	IZ	0.00	0.00
De Bo Metro	Group	0.00	0.00
Le Minh Xuan IZ	IZ	0.00	0.00
Xuan Thoi Son	Group	0.00	0.00
Xuan Thoi Thuong IZ	IZ	1.95	1.95
Vinh Loc II IZ	IZ	0.40	0.40
Nhat Thanh	Group	0.00	0.65
Thoi An	Group	0.55	0.55
Ba Diem	Group	0.46	0.46
Dong Thanh IZ	IZ	1.07	1.07
Bau Dung IZ	IZ	4.70	4.70
West-North Cu Chi IZ	IZ	2.00	0.78
Tan Phu Trung IZ	IZ	0.00	0.00
Bau Tran IZ	Group	4.34	4.34
Phan Van Coi IZ	Group	1.81	1.81
Phuoc Hiep IZ	Group	2.99	0.00
Tan Quy IZ	Group	0.00	0.00
Tan Tuc	Group	0.00	0.00
Phong Phu IZ	IZ	0.00	0.00
Tan Thuan IPZ	IPZ	0.00	0.00
Hiep Phuoc IZ	IZ	0.00	0.00
Quy Duc	Group	0.00	0.00
Hung Long	Group	0.00	0.00
Small enterprisez	Group	0.00	0.16
Cat Lai IZ	IZ	0.00	0.00
SaiGon Hi-Tech Park	IZ	0.00	0.00
Phu Huu	IZ	0.00	0.00
Linh Trung II	IPZ	0.48	0.48
Binh Chieu IZ	IZ	1.18	1.18
Da Phuoc	Group	0.00	0.00
Tan Thoi Hiep IZ`	IZ	1.60	1.60



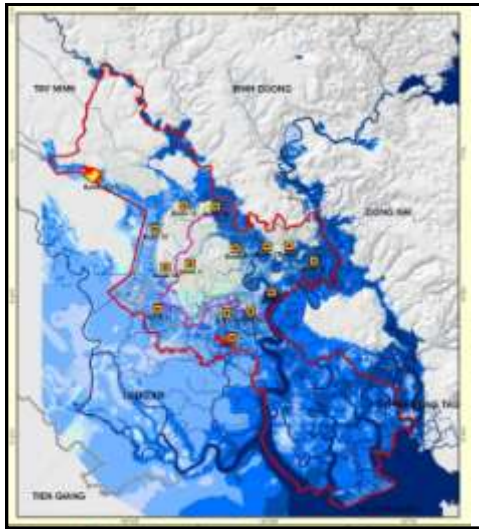
2050 **water supply infrastructure** in extreme flood



2050 **agriculture and forests** and 4ppt saline intrusion in drought without dykes



2050 **water supply infrastructure** in drought



2050 **water treatment** and land fill sites in extreme flood

Risk indicator
0 km: Inundated
<1 km: Very high risk
<5 km: High risk
<10km: Medium risk
>10km: Low risk

2050 Planned water treatment plants at risk with and without the dyke system

Waste water treatment plants	Area (ha)	Capacity (m3/day)	Distance from flood area(km)		
			Regular flood A2	Extreme flood A2	Extreme flood A2 with control flood system
Basin 1, THBNDT	50	512000	0	0	0
Basin 2, West HCMC	11	170000	0.0	1.9	1.9
Basin 3,THLG	73	260000	2.3	0.0	0.0
Basin 4, South HCMC	20	210000	0.0	0.0	0.0
Basin 5, East HCMC	35	350000	0.0	0.0	0.0
Basin 6 North HCMC II	6	54000	0.6	0.3	0.3
Basin 7 North HCMC I	15	151000	0.0	0.0	0.0
Basin 8, Go Vap and Binh Thanh	20	210000	0.0	0.0	0.0
Basin 9, NLTN	40	430000	0.3	0.0	0.0
Basin 10, Nha Be	5	45000	0.0	0.0	0.0
Basin 11, Tac river, dist 9	6	54000	0.0	0.0	0.0
Basin 12, Ba Diem, Nga Ba Dong	5	41000	1.7	0.0	0.0
Basin 13, canal Hoc Mon, dist Hoc Mon	5	41000	5.1	0.0	0.0
Basin 14, Binh Tan and Binh Chanh	5	43000	0.0	1.3	1.7
Basin 15, canal Cau Dua, dist Hoc Mon	10	82000	0.0	0.0	0.0
Basin 16, Cu Chi	10	81000	0.0	0.0	0.0

21

Adaptation options

23

The aim – to increase resilience in vulnerable communities, development sectors and areas

- Engineering options (eg dykes and drainage systems)
- Traditional local strategies
- Social responses (including resettlement and "autonomous" actions)
- Land use planning (eg zoning and development controls)
- Economic instruments (eg subsidies and tax incentives)
- Natural systems management (eg rehabilitation, enhancement)
- Sector specific adaptation practices (eg agriculture – saline tolerant species, cropping regimes)

Associated institutional and administrative innovations required

Some key potential risks from 2050 climate

22

- Extreme and regular climate and hydrodynamic conditions could have extensive and far reaching effects on the City's infrastructure and economy
- 30-70% of planned (i) major ring road construction, (ii) arterial interprovincial and national roads, and (iii) new ports and rail/metro systems are at risk of flooding depending on the infrastructure type.
- Close to 70% of the City's remaining agriculture is at risk from salinity concentrations ≥ 4ppt
- Some 50% of the City's surface and ground water treatment plants are at risk of flooding and salinity of concentrations of ≤ 1ppt.
- 60% of the City's waste water treatment plants and 90% of land fill sites are at risk of flooding

Overall adaptation approach by all sectors

24

1. Adaptation auditing and retrofitting in existing and approved developments beginning with those in vulnerable areas
2. Integration of adaptation into future development planning for areas and sectors (requires guidance on adaptation options and hotspot profiling and assessments)
3. Assessing development plans and project proposals as they come through the planning pipeline against adaptation screening tools (eg as part of Strategic Environmental Assessment and EIA)
4. Monitoring and evaluation of implementation of adaptation measures and the opportunity and authority to require remedial and additional actions.

Integration of adaptation options into plans and procedures

25

1. Integration into overarching socio-economic and spatial and plans eg
   - Socio-economic plan (DPI)
   - Land use plan (DONRE)
   - Urban Master Plan (DUPA)
   - Construction plan (DOC)
2. Integration with sector development plans - Sector-wide adaptation policies and plans
3. Integration with Building Code and sector design standards and guidelines
4. Integrating through area specific adaptation guidelines and development controls

Actions required of HCMC PC

26

- prepare a HCMC climate change adaptation plan
- reform the existing natural disaster management committee into a climate change adaptation and mitigation committee
- establish a climate change adaptation and mitigation fund
- provide special budgetary allocation for adaptation over a five year period to support
  - key sectors to conduct audits of existing facilities,
  - revise their development strategies and plans, and
  - piloting of innovative adaptation measures.

Actions required of DONRE

27

- Review and revise the land use plan as a key instrument for promoting and implementing adaptation
- apply adaptation screening guidance for the review of sector and spatial plans, and
- introduce screening and assessment tools to the SEA and EIA process as another force for integration of adaptation in development planning.

Guiding principles for HCMC adaptation

28

1. Rehabilitate and maintain natural flexibility and resilience in City design
2. Build adaptability into infrastructure and buildings
3. Locate strategic infrastructure away from vulnerable areas
4. Locate communities away from vulnerable areas
5. Locate sensitive industrial and commercial functions away from vulnerable areas
6. Expand and maintain natural systems for greater stability and resilience
7. Keep rivers and canals free flowing and clean