Adapting to Changing-Stormwater Quantities through land-use Planning

Commission for Environmental Cooperation (CEC) of North America, 14-15 July 2015

How can cities adapt to changing conditions? Learning from Montreal and New Orleans.

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Introduction:

- Vulnerability of our communities : caused by climate change ; land use planning patterns at different scales.

- Links between vulnerability, resilience, sustainable development and adaptation to climate change

- Needs to change our urban development choices and to choose long term adaptation strategies

- Sustainable environmental planning: reduce vulnerability while enhancing resiliency

- Needs for interdisciplinary as well as international collaboration.

I. How to locate the most vulnerable areas towards flooding in a climate change context?

Source : Y. Thibault, CSC, 2004

What changes to expect South of QC

www.ouranos.ca

Spring

- Comes earlier
- Less snow
- Quickly melts
- More rain

Summer

- Higher temperatures
- More storms and strong rain
- More drought sin the south of Quebec

Autumn

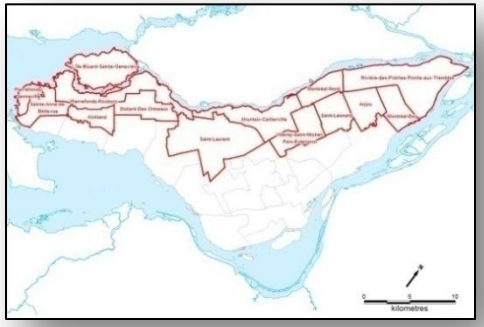
- Later cold and snow arrival
- Longer drought
- Possibility of more rain

Winter

- Higher temperature
- More rain
- More cycles: frost/defrost / floating ice
- Less snow

Source: Ouranos, 2011

Rainfall, melted snow, stormwater runoff



Main Goal :
Analysis of social and environmental vulnerability towards flooding so as to identify the main challenges and their vulnerability to river floods (Rivière des Prairies).


Source : Y. Thibault, CSC, 2009

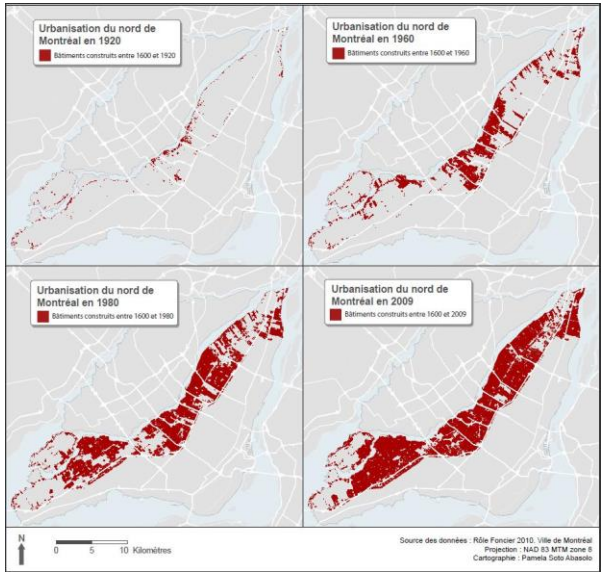

Source : Y. Thibault, CSC, 2008

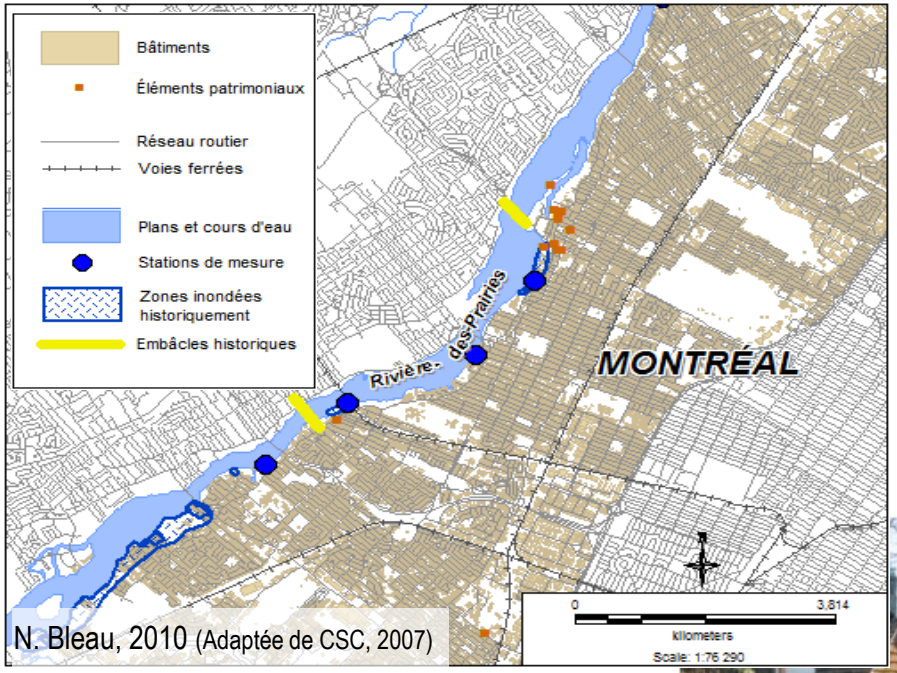

Source : Y. Thibault, CSC, 2004


Source : I. Demers, LA PRESSE, 2009


Frasil en formation et rivière couverte de frasil (source : INRS-ETE)

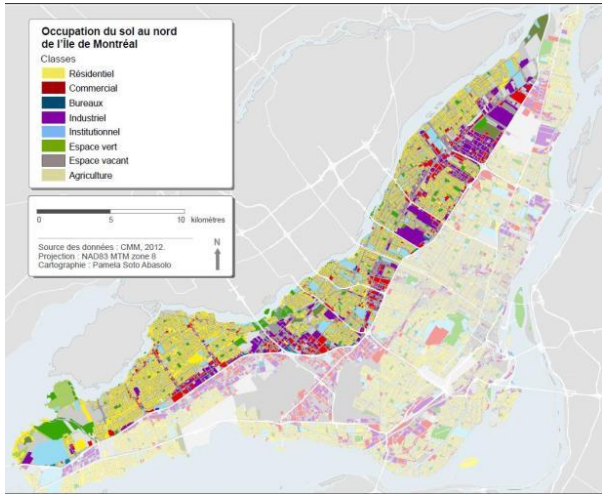
URBAN DEVELOPMENT 1920-2009





N. Bleau, 2010 (Adaptée de CSC, 2007)

LAND USE IN STUDY AREA

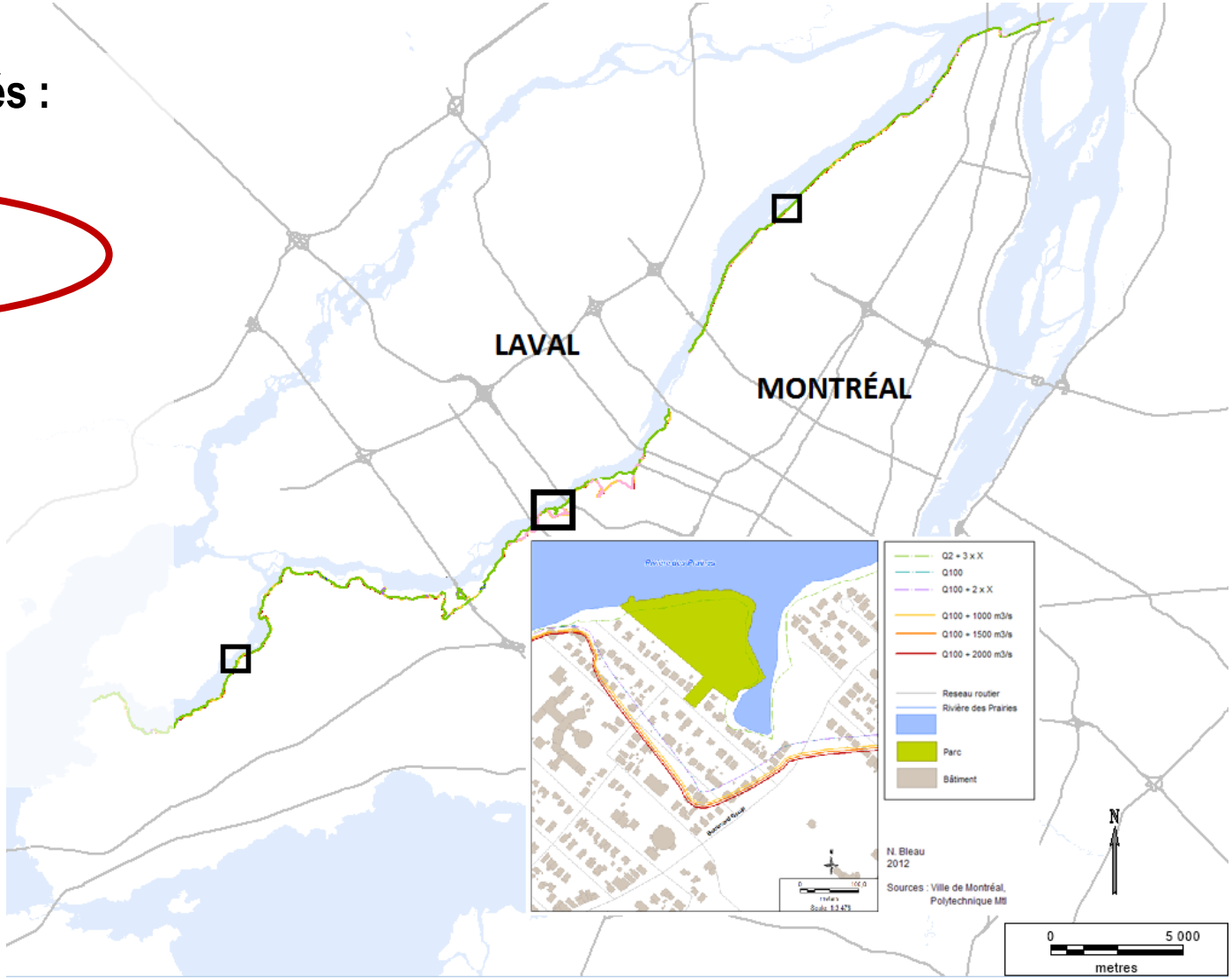


Deux modèles testés :

HEC-RAS ➔ 1D

Hydro-Sim ➔ 2D

What if scenarios



Social sensibility / Two methods tested

Indice de sensibilité sociale (ISS)	Indice de sensibilité sociale par addition d'indicateurs pondérés (ISSAIP)
• Cutter et al. 2003.	• Fedeski et al., 2007 ; Ebert et al., 2009
• Quantitative methode…	• Quantitative and qualitative methode
• Complexe results	• Easier interpretation

Preliminary indicators

Resident numbers	Unemployment rates
Population changes 2001-2006	Small income single parent families
% more than 65 years old	Small income families
% less than 14 years old	% new immigrants (2001-)
% families 3 children and more	% population understanding neither French nor English
% single parent families	% population age 25 without diplomas

WORKSHOP

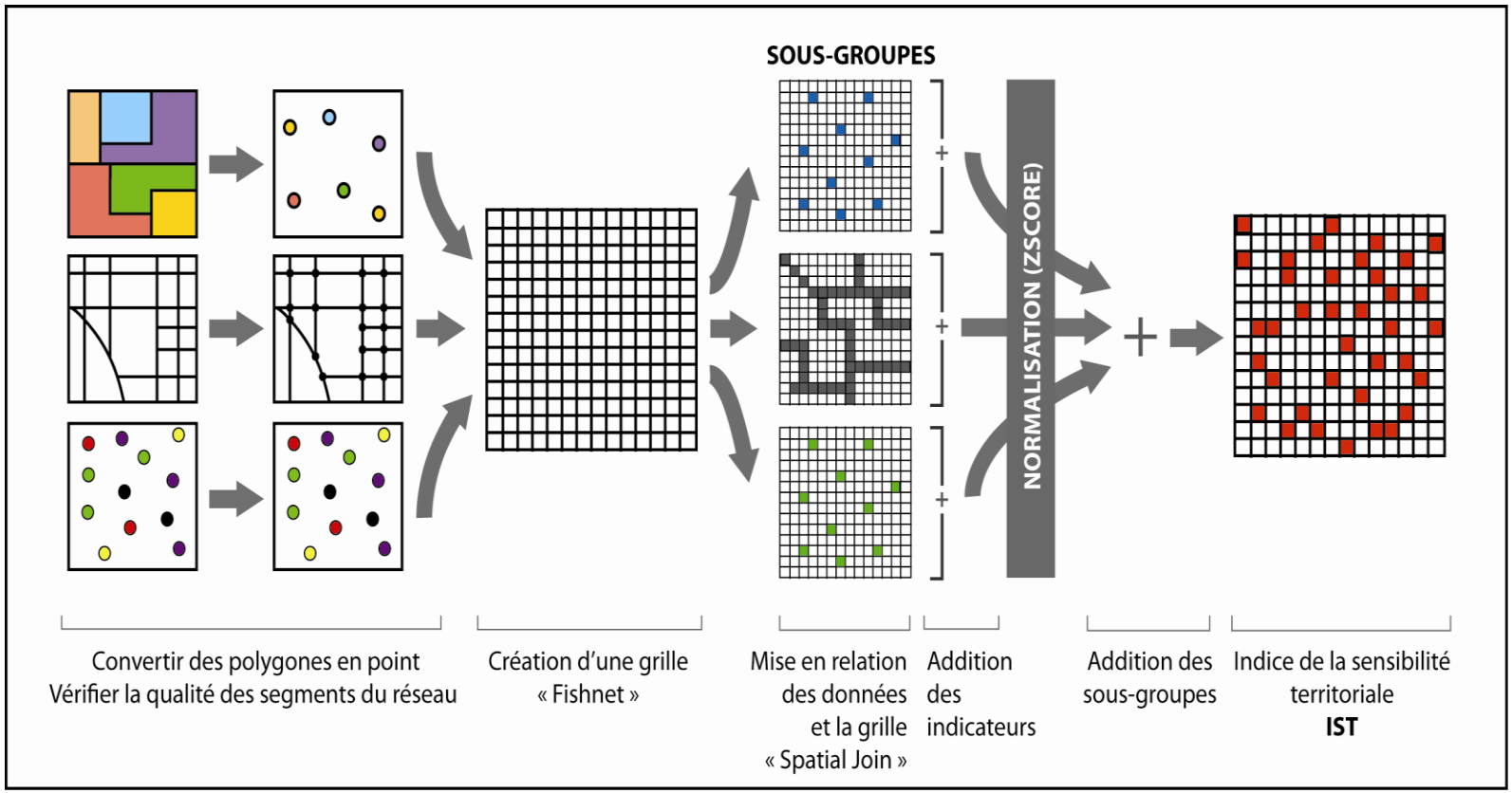
13 participants → 3 working groups

- **Method presentations**
- **Discussions on methods and criteria**
- **Choices on criteria weight**

EDUCATION
DISCUSSIONS
LOCAL PARTICIPATION

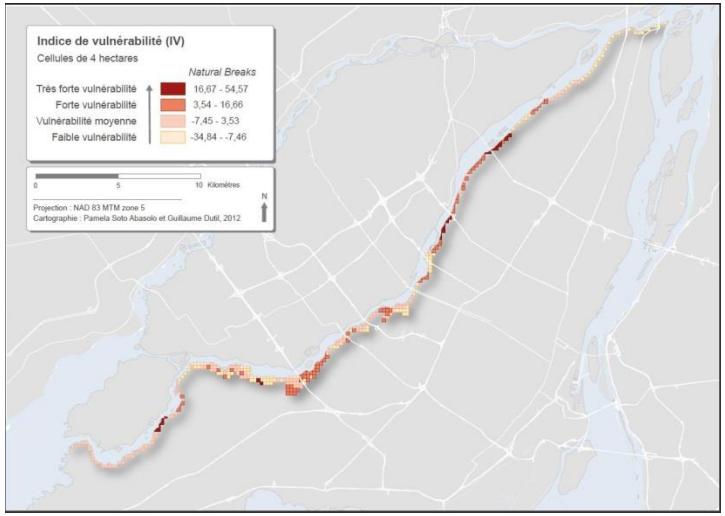
TERRITORIAL SENSIBILITY

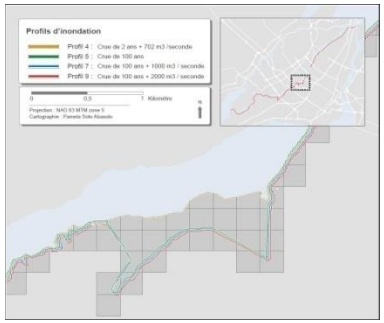
Analysis steps



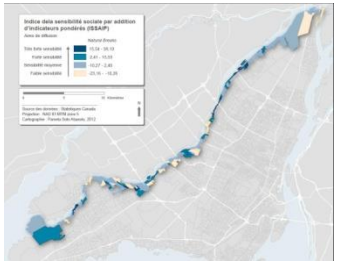
Pamela Soto-Abasolo, 2012

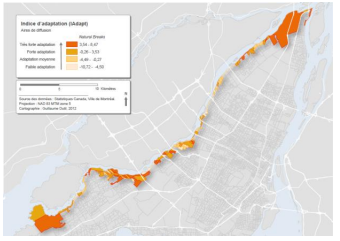
Vulnerability ➔ IVu = (ISSAIP + IST) – Iadapt





Scenario 4 : flood 2 years + 702 m3 /s
Scenario 5 : flood100 years
Scenario 7 : flood 100 years+1000 m3 / s
Scenario 9: flood100 years + 2000 m3 / s





Low vulnerability to high vulnerability

	Scénarios d'inondation			
TYPOLOGIE DE LA VULNÉRABILITÉ (nombre de cellules)	**Profil 4**	**Profil 5**	**Profil 7**	**Profil 9**
Faible vulnérabilité	171	185	192	193
Vulnérabilité moyenne	152	165	170	175
Forte vulnérabilité	99	106	116	119
Très forte vulnérabilité	37	37	40	40
TOTAL	**459**	**493**	**518**	**527**

INFRASTRUCTURES (nombre d'infrastructures)	**Profil 4**	**Profil 5**	**Profil 7**	**Profil 9**
Logements résidentiels privés	7 744	8 608	9 438	9 817
Bâtiments	6 356	7 364	8 143	8 418
Hôpitaux et CHSLD	6	6	6	7
Résidences pour personnes âgées	22	23	28	28

Pamela Soto-Abasolo, 2012

Adapting to changing conditions

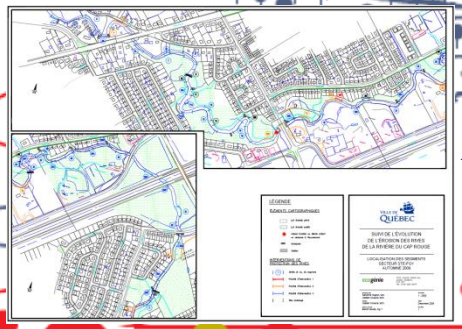
Échelles
- Région/bassin
- Quartier
- Bâtiment

Détournement des flux d'inondation loin des zones affectées

Atténuation des crues et ouvrages de rétention d' eau, y compris l'utilisation d'espaces verts

Ouvrages de protection

Marges de recul et zones de non-construction plus grandes puis, en dernier recours, ouvrages de protection permanentes contre les inondations.



Pratiques de gestion optimale

Matériaux résistants aux inondations.

Élévation du niveau des planchers

Shaw, R. et al (2007)

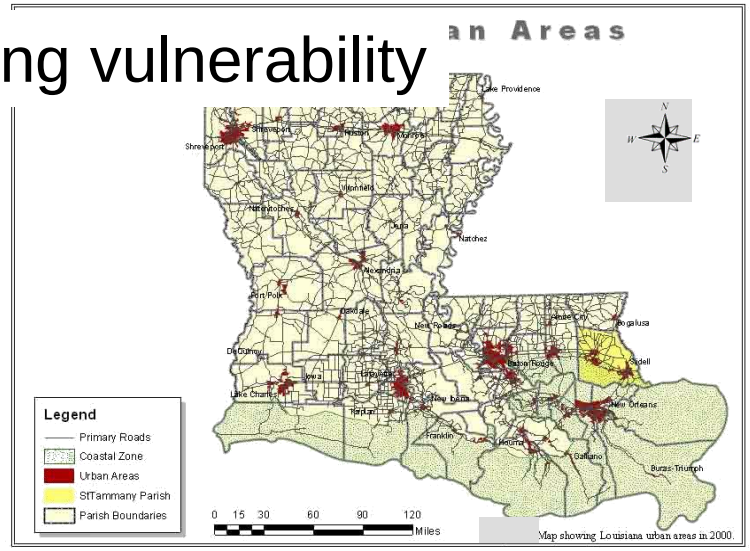
II. What type of stormwater infrastructures can address issues ok water conservation and sustainable use? Lessons from New Orleans

- Resilience: ‘as it suggests focusing on building something up rather than just reducing something, which is the case when talking about poverty or vulnerability reduction’.

  Andrew Collins (Director, Disaster and Development Centre, Northumbria University, UK)

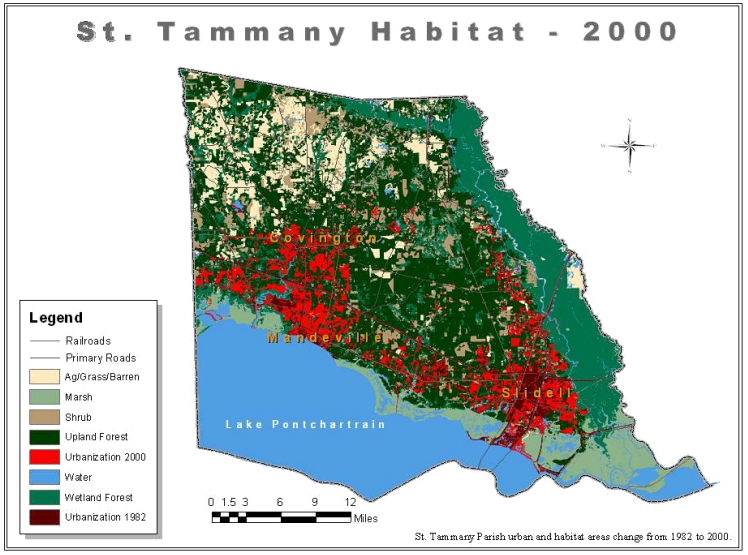
- Disaster resilience activities can ‘lead to actions such as enhancing community coping capacity and livelihoods’, allowing communities to make appropriate choices within the context of their environments.’ Manyena (2006)

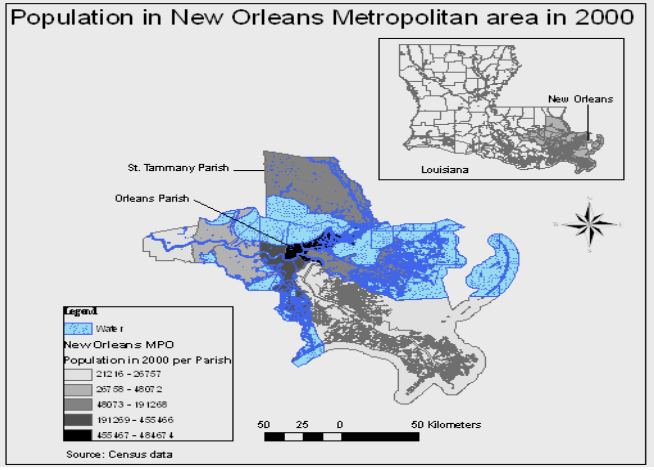
Challenge 1 : Understanding vulnerability



Percent of people living below twice the poverty threshold
by Census block group in Orleans Parish

« *Wetland are not wasteland* »





Geographical location challenge?
Socilal equity and economical equilibrium?
Intergrated governance?
Environnemental protection?

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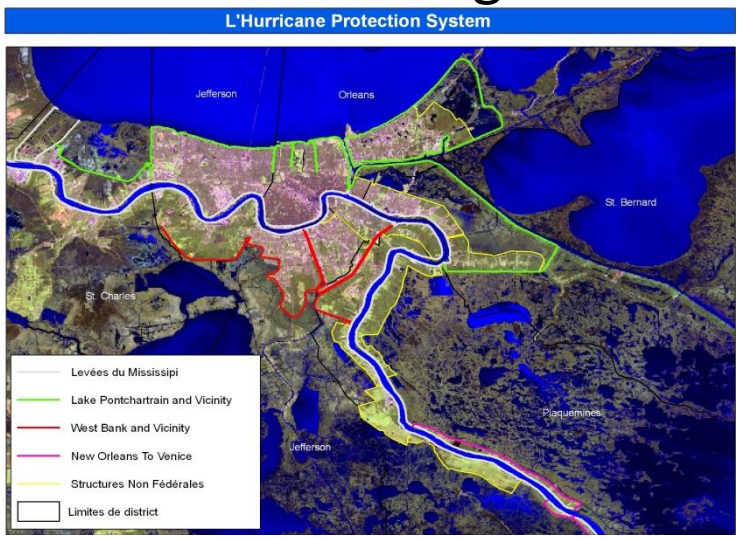
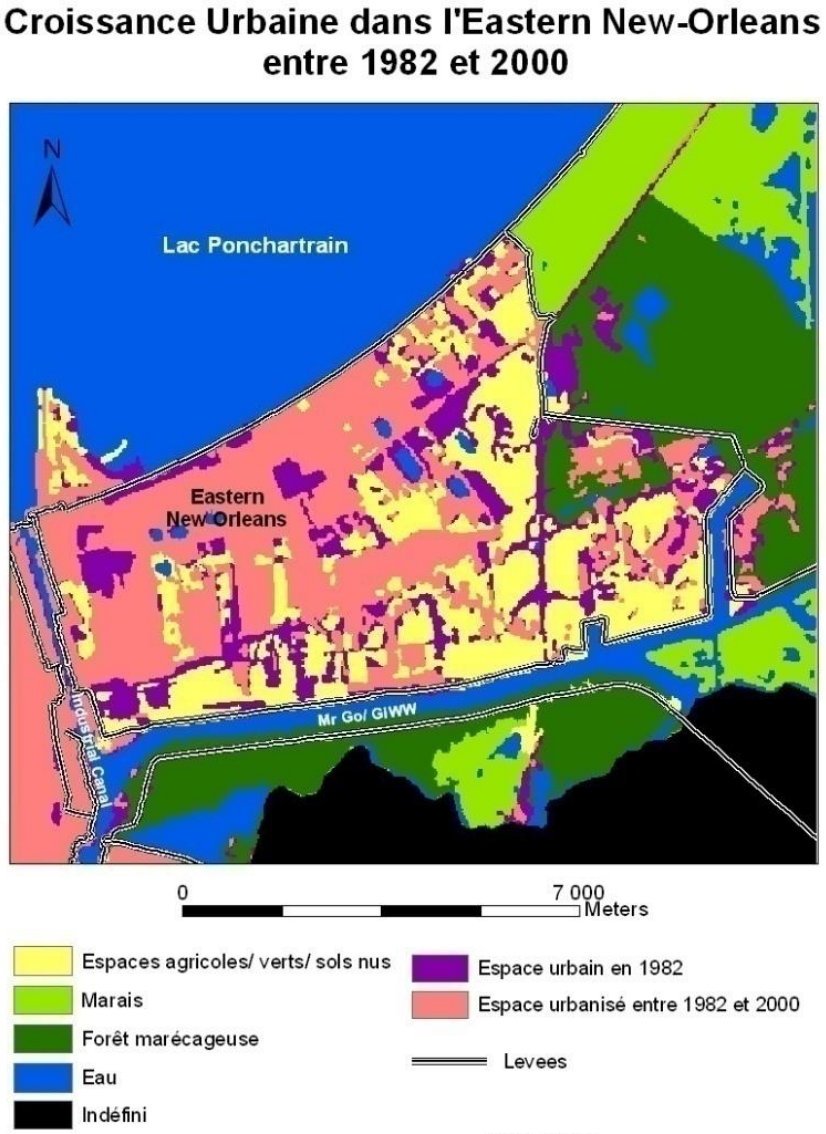
Hazard Knowledge?



Hurricane protection system: Data from New Orleans Regional Planning Commission (NORPC)

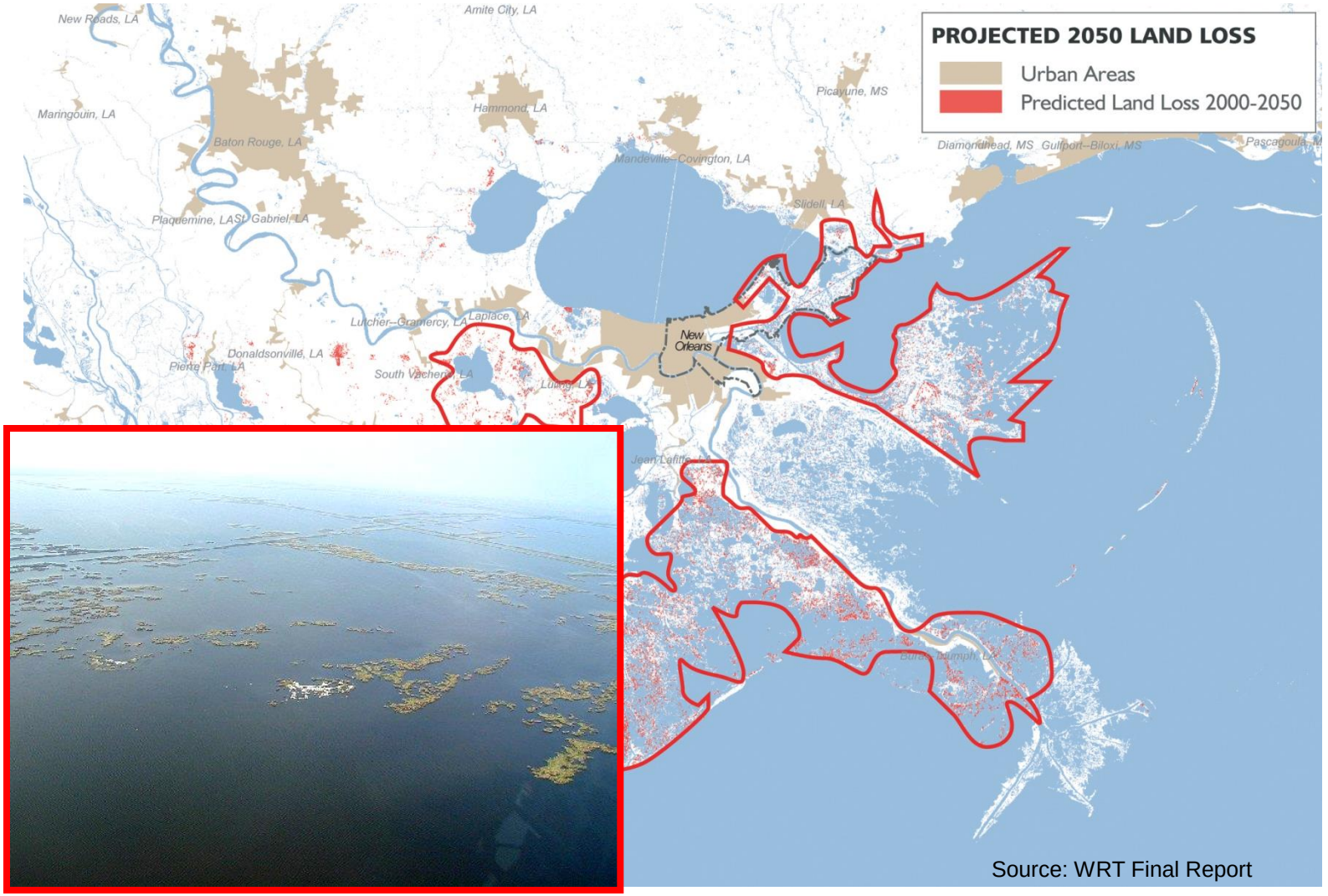
Urban development in flood prone areas



- Sunday August 28th 2005

Photos: CNN

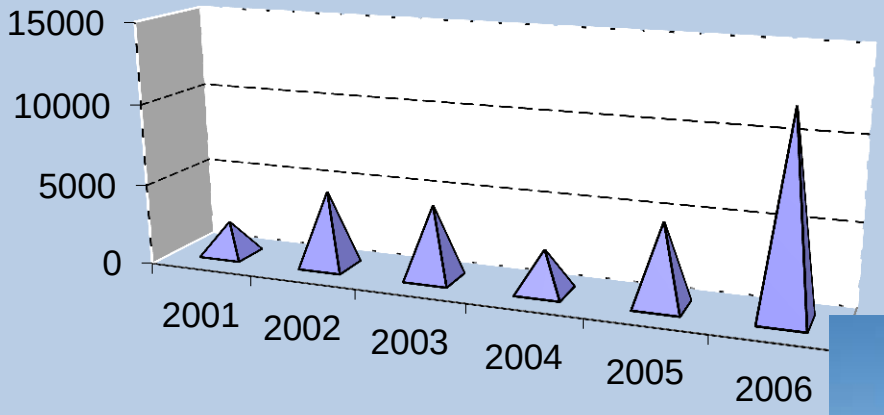
Wetland loss



- > 100 square miles of wetlands destroyed after hurricane Katrina and Rita

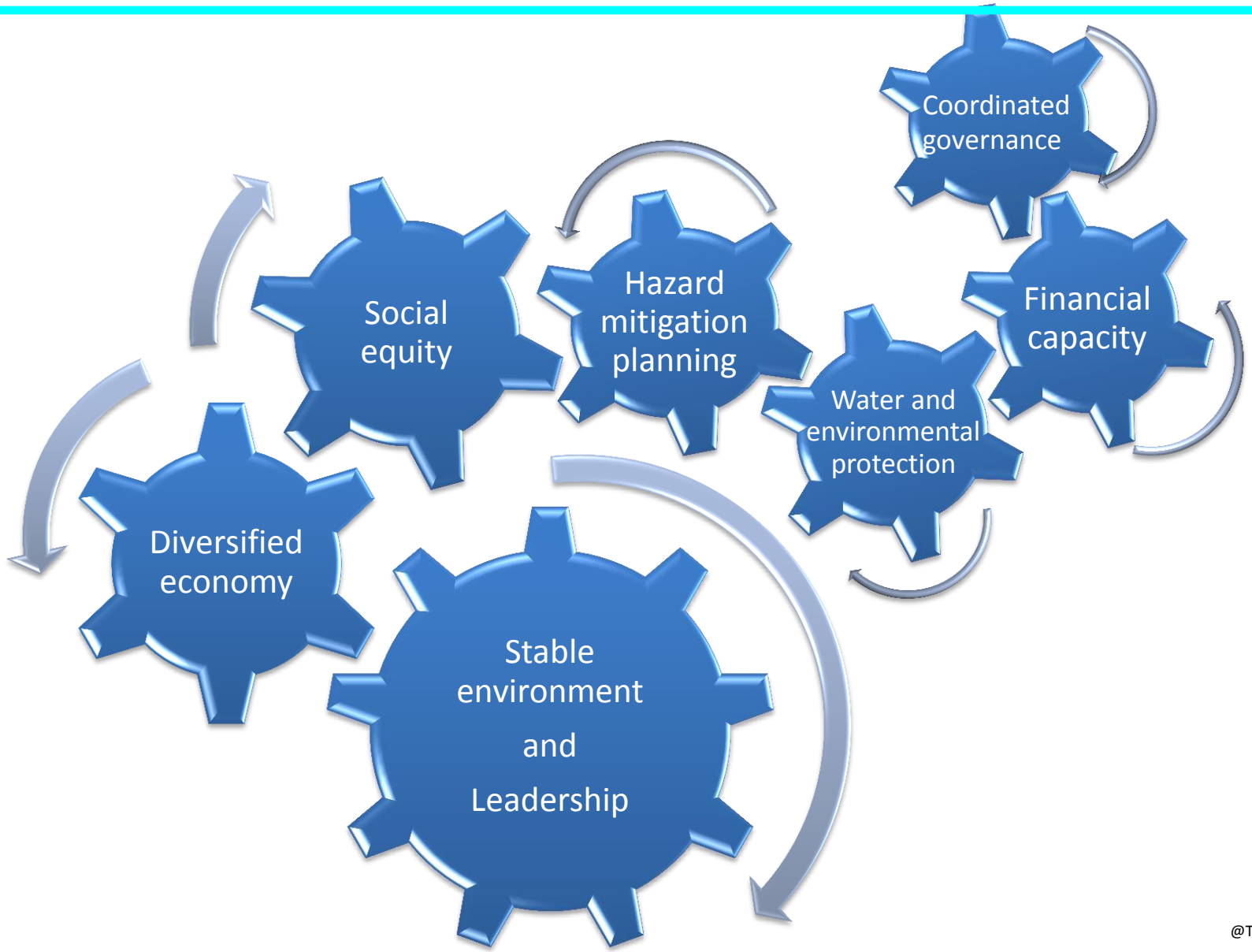
“Hurricane sprawl”:

Yearly Comparison of Building Permits Issued for St. Tammany Parish



Source: Isabelle Thomas

Challenge 2: Resilient and sustainable adaptation and urban rebuilding



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Strategy 1: Short term environmental and urban viable and resilient rebuilding (0-3 years) : Infrastructures ;

- Drinking water, sewage, communication networks, electricity, waste management

-Road network

-Levee protection system enhanced

Source: Isabelle Thomas

Hazard reduction planning, adaptation

Federal level::

- **«Safe development paradox» (Ray Burby)**
- Flood Insurance adjustment / regulations

State level:

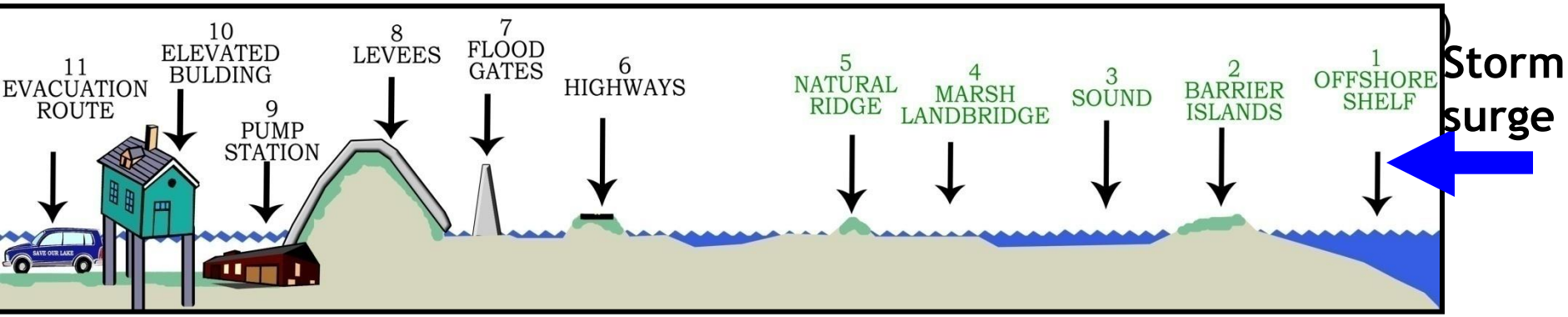
- Building regulations
- Urban Master plans with hazard mitigation regulations

Regional level: more collaboration

- Integrated environmental planning: Coastal Protection and Restoration Authority (CPRA): levees and coastal protection
- Long term wetland restoration
- New environmental mitigation and adaptation strategies

Lines of Defense

Lines of Defense (LOD) are definable geographic areas in which certain natural or manmade features or activities are promoted or implemented, resulting in the reduction of impacts by tropical weather systems in the Louisiana coast.

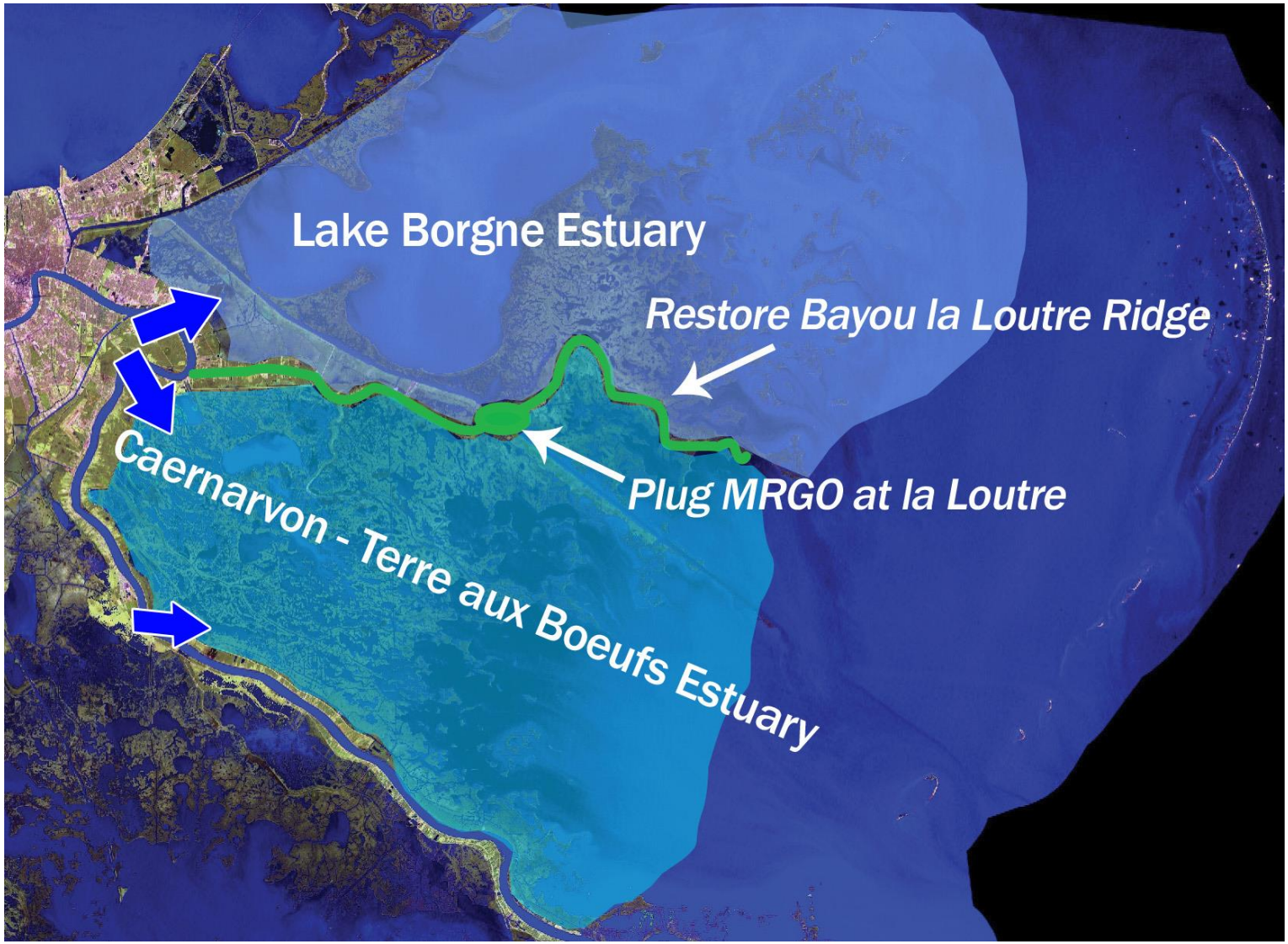


Adopted by:

- LA Department of Natural Resources
- US Army Corps of Engineers

Source: LPBF

Ecosystem restoration



Source: LPBF

Strategy 2: Mid term resilient and viable rebuilding (3-5 years) : population return and economical growth.

-Metropolitan scale: from 7 levee boards to 2 levee boards

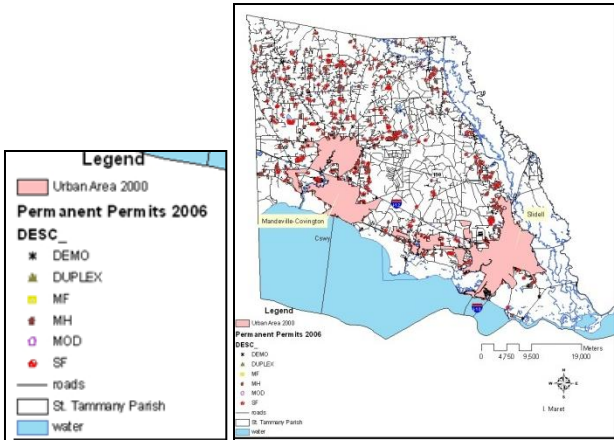
-City scale: urban rebuilding and citizen participation.

-Need for permits and hazards regulations / green buildings

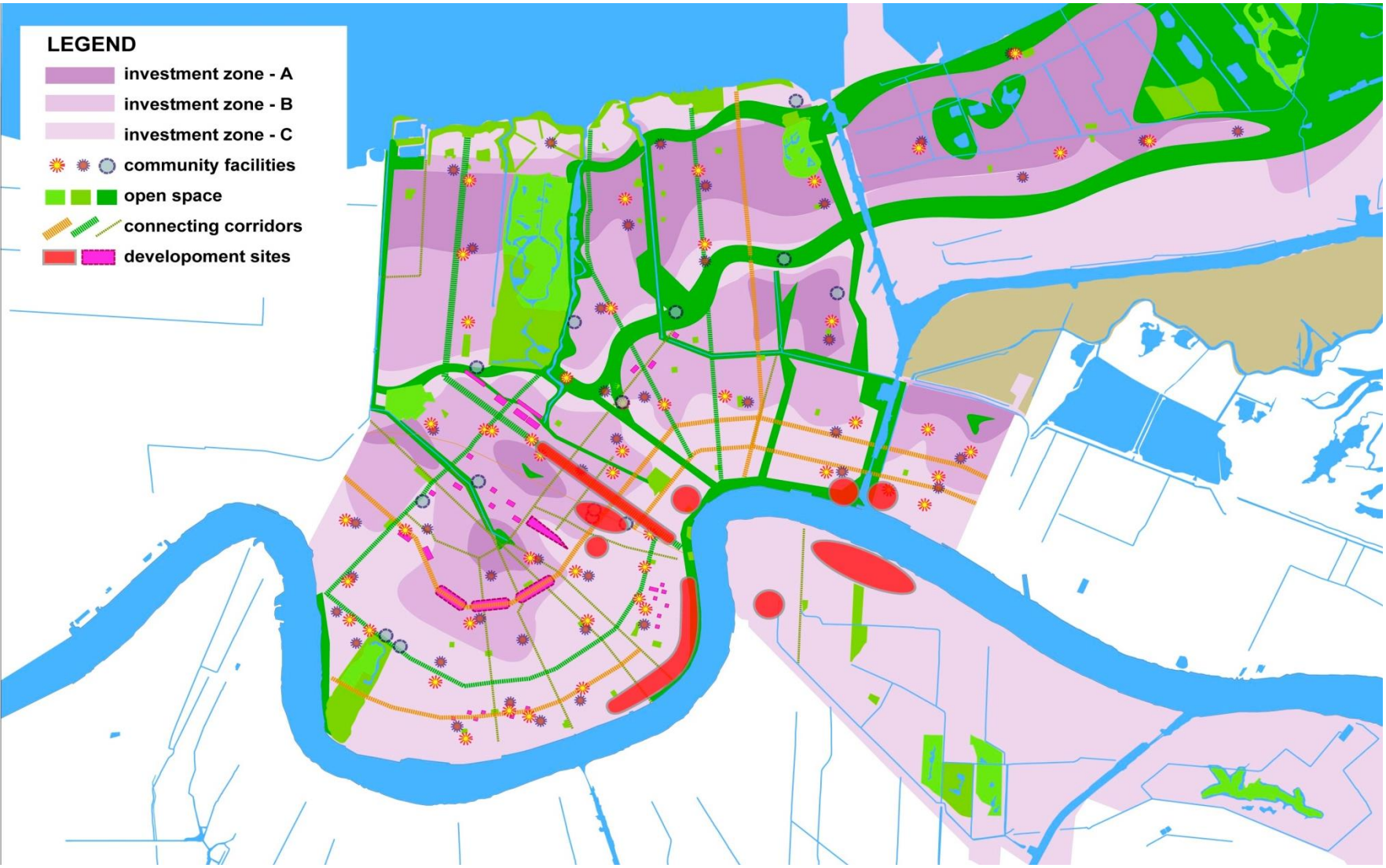
-Neighborhood scales: resource centers / parks

-Viable and sustainable economical growth

-Stop urban sprawl : « hurricane sprawl »



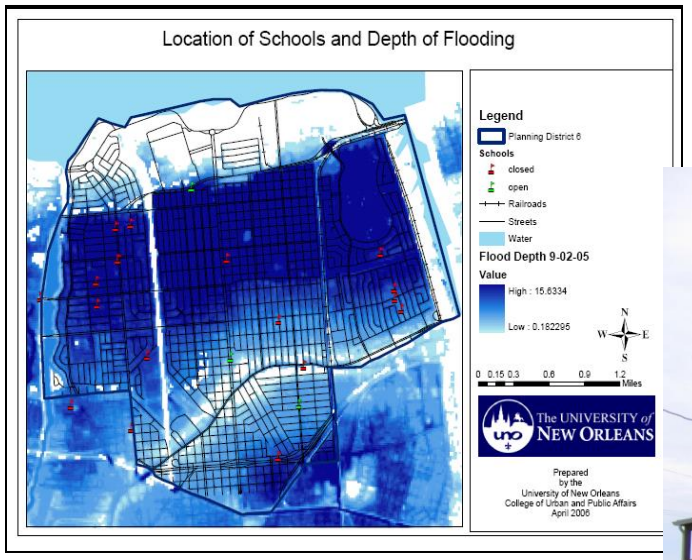
Urban Land Institute



Source: ULI

- ULI Stratégie d'action

Neighborhood challenges: ex: Gentilly



Source: Isabelle Thomas

Strategy 3 : (5-10 years) long term resilient and viable adaptation and planning

- Enhance social and environmental equity

- Enhance education and environmental awareness

-Rebuild viable and ecological neighborhoods and buildings

-Adapt urban redevelopment to flood hazards requirements

Source: Isabelle Thomas

Green rebuilding challenge in Ninth Ward

What link with the other plans?

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Source: Isabelle Thomas

Innovative environmental planning practices ?

VOLUME 2 chapter 7

GREEN INFRASTRUCTURE: PARKS, OPEN SPACE AND RECREATION

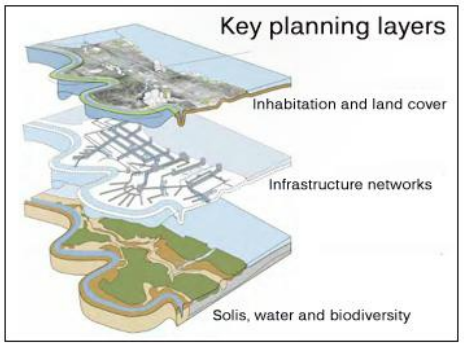
GOAL		POLICIES FOR DECISION MAKERS	FOR MORE INFORMATION, SEE PAGE:
GREEN INFRASTRUCTURE NETWORK			
1	*Protection of remaining wetland areas inside and outside the levee system*	1.A. Ensure that land use and zoning categories for wetlands and coastal areas promote wetland preservation.	7.13 - 7.14
		1.B. Seek conservation solutions for wetlands through permanent protection or acquisition by conservation organizations.	7.14
2	*Restoration and expansion of New Orleans' urban forest to reach 50 percent tree canopy by 2030*	2.A. Promote tree planting on both public and private property.	7.14
		2.B. Restore and plant new trees in parks and neutral grounds.	7.16
		2.C. Promote tree preservation on private property.	7.17
		2.D. Establish storm water management planting practices in public green spaces.	7.17

-Adaptation and planning: Master Plan

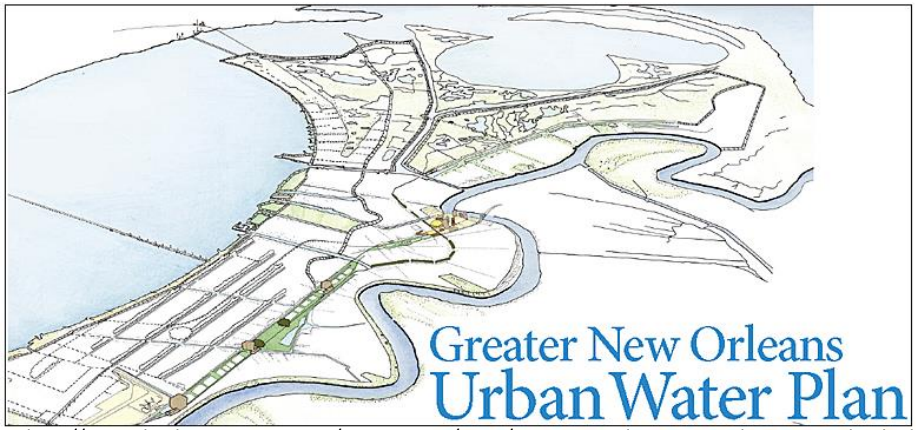
-Urban Water plan : living with water : city as a sponge.

http://www.nola.gov/getattachment/5c3021f1-cf1a-4df6-8c72-c72c2a01d007/Vol-2-Ch-7-Green-Infrastructure/

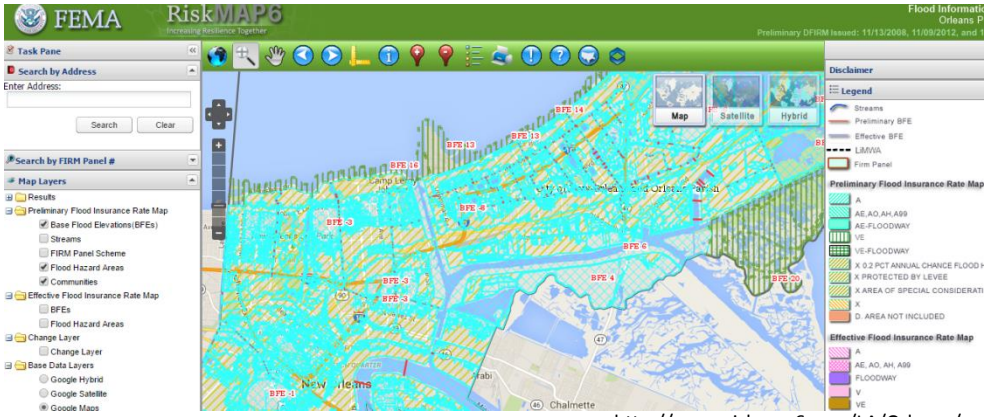
-Citizen participation and stakeholders educations and awareness



-Mitigation and adaptation strategy coordination



http://www.dutchwatersector.com/news-events/news/7217-new-orleans-new-urban-water-plan-builds-

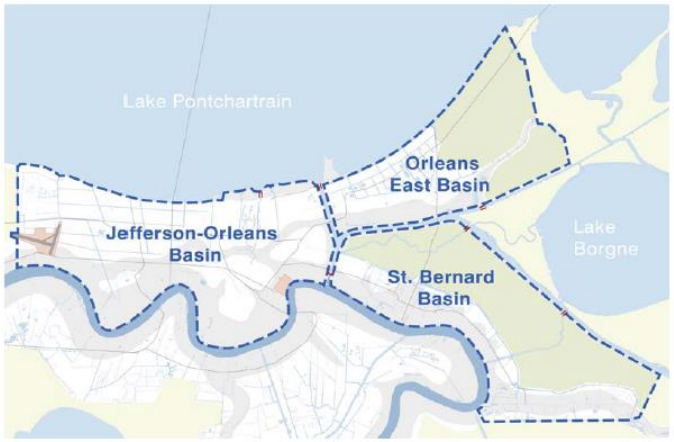


http://maps.riskmap6.com/LA/Orleans/

Greater New Orleans Urban Water Plan, Waggonner & Ball Architects

-Issues: Flooding; Subsidence; Wasted Water Assets

-Principles: Live with water; Slow and Store; Circulate and Recharge; Work with nature; Design for adaptation



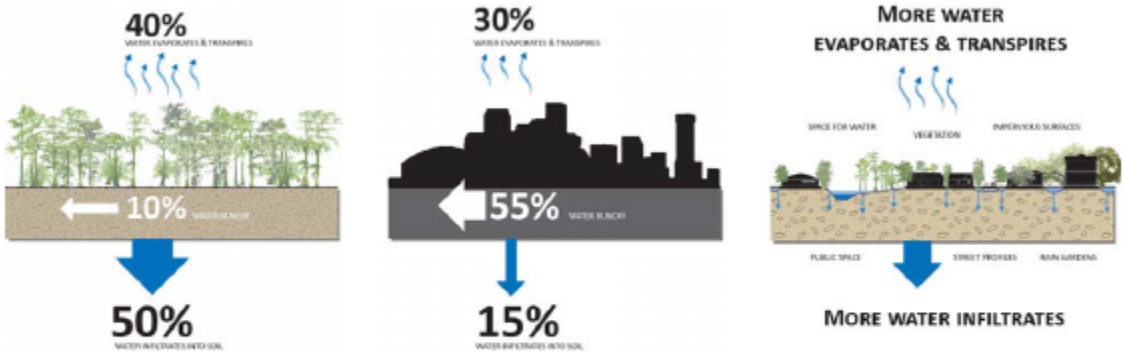
Jefferson-Orleans Basin includes the east banks of Jefferson Parish and New Orleans, west of the Inner Harbor Navigation Canal (Industrial Canal)

Orleans East Basin includes New Orleans East and Bayou Sauvage National Wildlife Refuge

St. Bernard Basin includes New Orleans' Lower Ninth Ward, St. Bernard Parish, Bayou Bienvenue, and the Central Wetlands Unit

Ground as Sponge

Allowing the land to absorb runoff



Natural Landscape

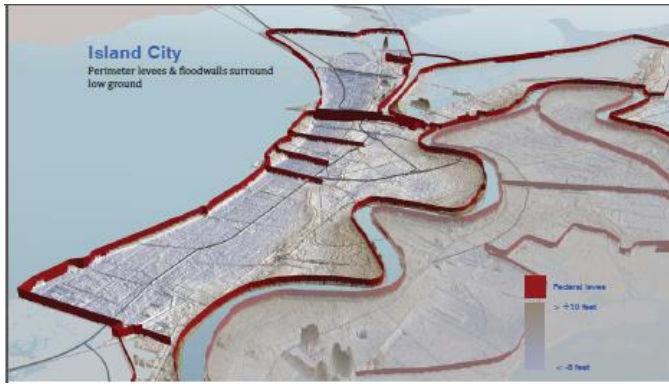
Soil and vegetation naturally absorb 90 percent of rainfall through infiltration into the ground and evapotranspiration into the air. Plants on the delta have adapted to the wet environment.

Hard Urban Surfaces

Rooftops and paved surfaces shed water. Developed areas are responsible for over 5x the runoff from non-urbanized landscapes of the same size.

Ground as a Sponge

In an integrated living water system, pervious paving, trees, plants, and other soft infrastructure can slow, filter, and absorb runoff.



Livingwithwater.com

Greater New Orleans **Urban Water Plan**

Uptown streets

Mirabeau Water garden

Wetlands that Clean

Wetland terraces clean stormwater and empty into a swimming pool and boating area planted with willows and cypresses.

Livingwithwater.com

Vision, environmental adaptation

Cities have to develop innovative strategies to adapt to climate change and current urban patterns

- Hazards can't be eliminated. Floods can be reduced by having knowledge on vulnerability (data; methods) and by developing resilient and viable urban planning practices.
- Enhance collaboration and coordinated strategies at different scales (geographies and governance)
- Develop and integrate innovative environmental adaptation practices in urban planning; cost benefice analysis towards implementation
- Create knowledge, education, networks and collaborations between academics and stakeholders as well as international cooperation.

Questions?

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