Republic of Haiti
Ministry of Planning and External Cooperation
(MPCE)

Urgent Rehabilitation and Reconstruction Support Project for Republic of Haiti

Final Report (Summary)

November 2011

Japan International Cooperation Agency (JICA)

Yachiyo Engineering Co., Ltd.

EID
JR
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Exchange rate (average rate (TTS): 6-month average from May 2010 to Oct 2010)
US$1.00 = JPY88.00 US$1.00 = HTG (Haitian Gourde) 40.00
(Data from Bank of Tokyo-Mitsubishi UFJ)

Preface

Japan International Cooperation Agency (JICA) decided to conduct the Urgent Rehabilitation and Reconstruction Support Project for the Republic of Haiti and entrust the project to Yachiyo Engineering Co., Ltd.

The survey team held a series of discussions with the officials concerned of the Government of the Republic of Haiti, and conducted field investigations. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Haiti for their close cooperation extended to the survey team.

November, 2011

Kiyofumi Konishi
Director General,
Economic Infrastructure Development Department
Japan International Cooperation Agency

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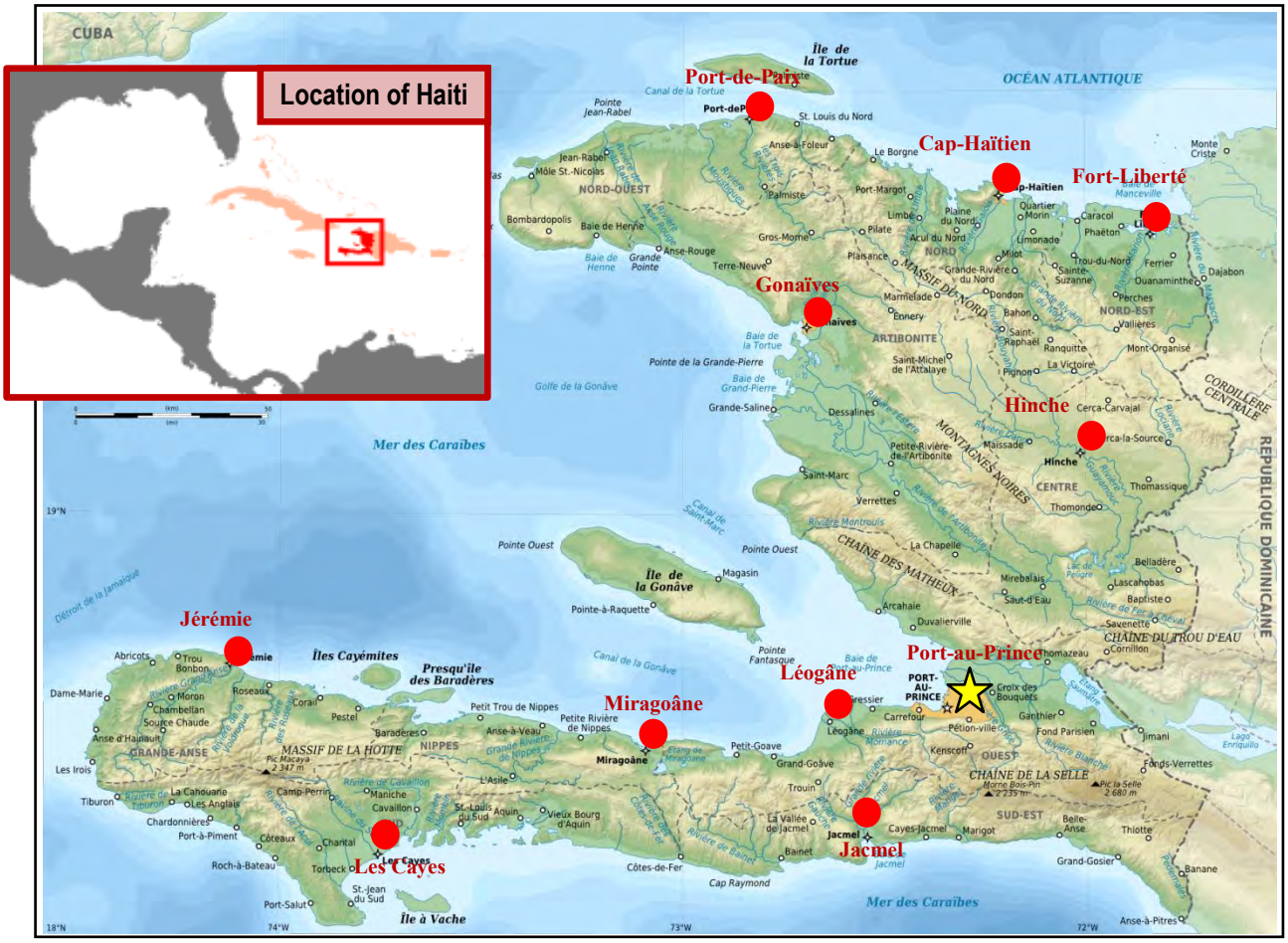
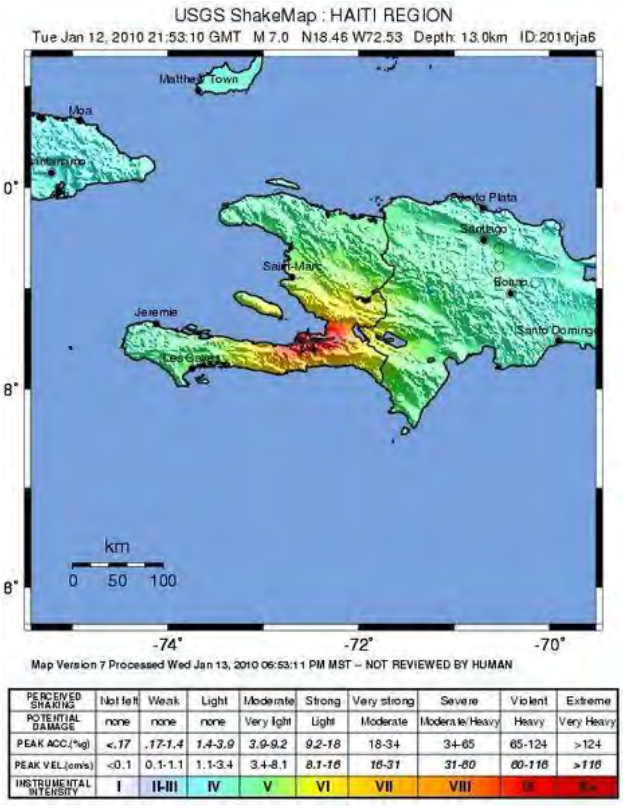


Major Cities of Haiti

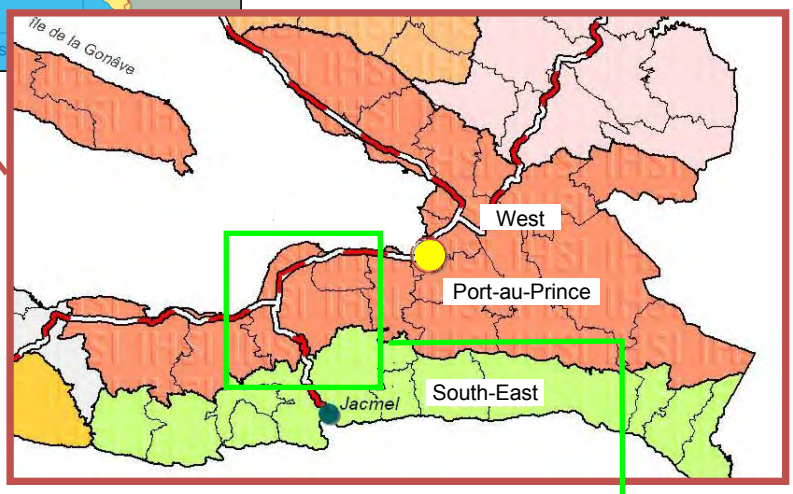


PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Distribution of Seismic Intensity
(US Geological Survey, USGS)

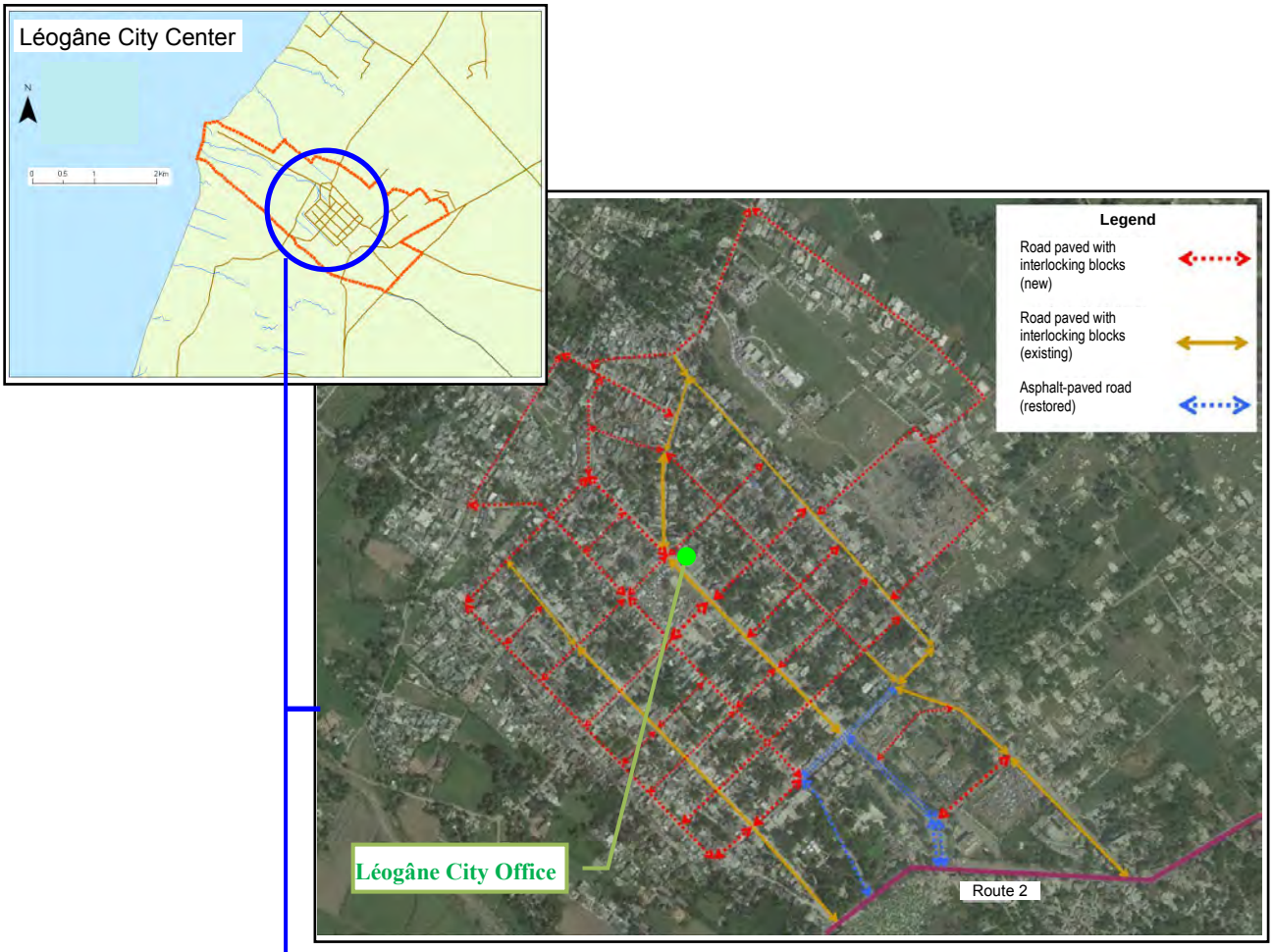
Seismic Center
(US Geological Survey, USGS)

Republic of Haiti



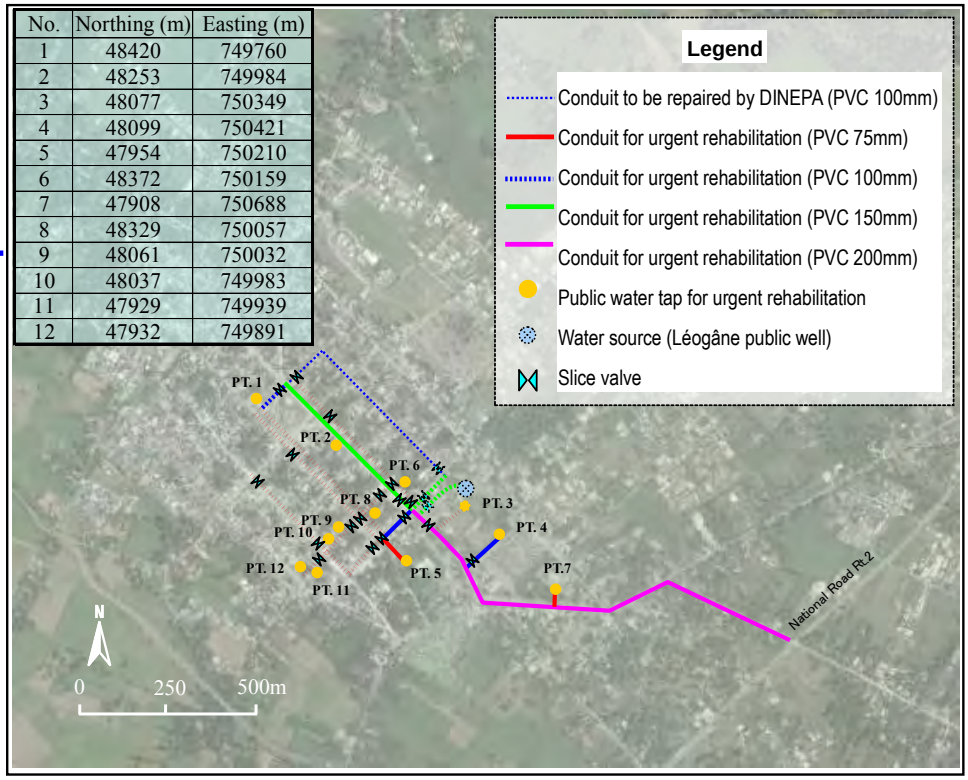
West Department

Léogâne Commune



Location of Roads To Be Improved under the Project for Improvement of Urban Roads and Drainage for Reconstruction of Leogane City

No.	Northing (m)	Easting (m)
1	48420	749760
2	48253	749984
3	48077	750349
4	48099	750421
5	47954	750210
6	48372	750159
7	47908	750688
8	48329	750057
9	48061	750032
10	48037	749983
11	47929	749939
12	47932	749891



Locations of Project for Urgent Rehabilitation of the Water Supply System in the Urban District for the Reconstruction of Léogâne City

Status of Port-au-Prince

Photo 1: Collapsed Presidential Palace (November 2010)

Photo 2: The number of those living in tents has been gradually decreasing since soon after the disaster, but the number is still high. (November 2011)

Photo 3: Evacuee camp occupying a central reserve of a road (November 2010)

Photo 4: Wreckage of many collapsed houses still remained in Port-au-Prince. (July 2010)

Photo 5: There is always lots of domestic wastewater and garbage along roads near the coastline and it raises public-health concerns. (November 2010)

Photo 6: Almost all natural rivers and canals are filled with trash. Drastic measures are required. (November 2010)

Status of Léogâne Commune

Photo 1: Plaza in front of Léogâne City Office, filled with evacuees' tents (November 2010)

Photo 2: Electric poles fell over all over the commune. The transmission network is not functioning. (November 2010)

Photo 3: Urban district covered with water after Hurricane Tomas (November 2010)

Photo 4: Former national road crossing overflowed Momance River after Hurricane Tomas (November 2010)

Photo 5: Sand from the upstream is chronically carried into and deposited on the bottom of Rouyonne River. Drastic measures are required. (January 2011)

Photo 6: Temporary houses were gradually being built. (September 2010)

Road Conditions in Léogâne Commune

Photo 1: Evacuee camp built on unpaved road in urban district (July 2010)

Photo 2: Evacuee camp built on unpaved road in urban district (July 2010)

Photo 3: Unpaved road in urban district (August 2010)

Photo 4: Wreckage left on a road in urban district (August 2010)

Photo 5: Drainage in urban district needs improvement. (July 2010)

Photo 6: Drainage flowing from the urban district to the coastline needs improvement. (July 2010)

Status of Water Supply Facilities in Léogâne Commune

Photo 1: Water from an existing deep well located in the centre of the urban district distributed from a water truck with support from UNICEF, NGOs etc. (July 2010)

Photo 2: Bladders (plastic water tanks) installed in an evacuee camp and fed with water from a water truck (July 2010)

Photo 3: Water supplied to residents with temporary facilities adjacent to the site of Photo 2 (July 2010)

Photo 4: Public water tap in the suburbs of Léogâne, damage d and disabled by the earthquake (July 2010)

Photo 5: Children receiving water from a temporary feed tank in front of a collapsed house (July 2010)

Photo 6: Residents using water from a flowing well – there is a hygiene problem. (February 2011)

List of Abbreviations (1)

Abbreviation in French	French	Abbreviation in English	English
AAN	Administration Aéroportuaire Nationale		National Airport Authority
ACDI	Agence Canadienne de Développement International	CIDA	Canadian International Development Agency
ACTED	Agence d'Aide à la Coopération Technique Et au Développement		Agency for Technical Cooperation and Development
AEP	Alimentation en eau potable		Water Supply
AEPA	Approvisionnement en Eau Potable et Assainissement		Water Supply and Sanitation
AFD	Agence Française de Développement		French Development Agency
AGD	Administration Générale des Douanes		General Administration of Customs
AMPAP	Aire Métropolitaine de Port-au-Prince		Metropolitan Area of Port-au-Prince
APN	Autorité Portuaire Nationale		National Port Authority
ASEC	Assemblée de la Section Communale		Assembly of Section Communale
BHDA	Bureau Haïtien du Droit d'Auteur		Haitian Bureau of Copyright
	Besoins Humains Fondamentaux	BHN	Basic Human Needs
BID	Banque Interaméricaine de Développement	IDB (IADB)	Inter-American Development Bank
BM	Banque Mondiale	WB	World Bank
BMAE	Bureau de Monetisation de l'Aide Externe		Bureau de Monetisation de l'Aide Externe
BMD	Banques Multilatérales de Développement	MDB	Multilateral Development Bank
BNE	Bureau National d'Ethnologie		National Bureau of Ethnology
BRH	Banque de la République d'Haïti		Bank of Republic of Haiti
CAEPA	Comité d'Approvisionnement en Eau Potable et Assainissement		Water Supply and Sanitation Committee
CAMEP	Centrale Autonome Métropolitaine d'Eau Potable		Metropolitan Autonomous Center of Water
CARICOM	Communauté Caribéenne	CARICOM	Caribbean Community
CASEC	Conseil d'Administration de Section		Board of Directors of Section Communale
CCR	Centre Commun de Recherche	JRC	Joint Research Center
CENAPRED	Centro Nacional de Prevención de Desastres (espagnol / Mexique)	CENAPRED	Centro Nacional de Prevención de Desastres (spanish / Mexico)
CEP	Conseil Électoral Permanent (ou Provisoire)		Permanent (or Provisional) Electoral Council
CIA	Agence centrale de renseignement	CIA	Central Intelligence Agency
CIP	Conseil Inter-Départemental		Inter-Departmental Council
CEPALC	Commission Économique Pour l'Amérique latine et les Caraïbes	ECLAC	United Nations Economic Commission for Latin America and the Caribbean
CFI	Centre de Facilitation des Investissements		Investment Facilitation Center
CIAT	Comité Interministériel d'Aménagement du Territoire		Interministerial Committee for Territorial Planning
CIRH	Commision Intérimaire pour Reconstruction d'Haïti	IHRC	Interim Hati Recovery Commission
CMMP	Commission Ministérielle des Marchés Publics		Ministerial Commission for Public Procurement
CNC	Conseil National des Cooperatives		National Council of Cooperatives
CNE	Centre National d'Équipements		National Center of Facilities
CNIGS	Centre National de l'Information Géo-Spatiale		National Center for Geo-Spatial Information
CNMP	Commission Nationale des Marchés Publics		National Commission on Government
CNSA	Coordination Nationale de la Sécurité Alimentaire		National Coordination of Food Security
CONATEL	Conseil National de Télécommunications		National Council of Telecommunications
CPE	Comité de Point d'Eau		Committee of Water Point
CSCCA	Cour Supérieure des Comptes et du Contentieux Administratif		Superior Court of Auditors and Administrative Litigation
CSPJ	Conseil Supérieur du Pouvoir Judiciaire		Supreme Council of Judicial Power
CTPEA	Centre de Techniques de Planification et d'Économie Appliquée		Technical Centre of Planning and Applied Economics
CTE	Centre Technique d'Exploitation		Operation Technical Center
CURL	Cellule d'Urgence pour la Reconstruction de Léogâne		
DAAB	Direction des Affaires Administratives et du Budget		Department of Administrative Affairs and Budget
DATDLR	Direction de l'Aménagement du Territoire, de Développement Local et Régional		Directorate of Planning, Local and Regional Development
DCE	Direction de Coopération Externe		Directorate of External Cooperation
DDA	Direction Departementale d'Artibonite		Departmental Direction of Artibonite
DDC	Direction Departementale du Centre		Departmental Direction of Center
DDGA	Direction Departementale de La Grande-Anse		Departmental Direction of Grande-Anse
DDN	Direction Departementale du Nord		Departmental Direction of North
DDNE	Direction Departementale du Nord-Est		Departmental Direction of North-East
DDNIPPES	Direction Departementale des Nippes		Departmental Direction of Nippes
DDNO	Direction Departementale du Nord-Ouest		Departmental Direction of North-West

List of Abbreviations (2)

Abbreviation in French	French	Abbreviation in English	English
DDO	Direction Departementale de L'Ouest		Departmental Direction of West
DDS	Direction Departementale du Sud		Departmental Direction of South
DDSE	Direction Departementale du Sud-Est		Departmental Direction of South-East
DGDZF	Direction Générale des Zones Franches		General Directorate of Free Zones
DGI	Direction Générale des Impôts		Directorate General of Taxes
DINEPA	Direction Nationale de l'Eau Potable et de l'Assainissement		National Directorate of Water and Sanitation
DIP	Direction d'Investissement Publique		Directorate of Public Investment
DNL	Direction Nationale du Livre		National Office for Book
DPC	Direction de la Protection Civile		Civil Protection Directorate
DPES	Direction de Programmation Économique et Social		Directorate of Social and Economic Programming
DRH	Direction des Ressources Humaines		Directorate of Human Resources
DSNCRP	Document de Stratégie de Réduction de la Pauvreté		Strategy Paper for Poverty Reduction
EBRI	Évaluation des besoins de relèvement immédiat		Assessing needs for immediate rehabilitation
	Commission Européenne	EC	European Commission
EDH	Électricité d'Haïti		Electricity of Haiti
EMA	École de la Magistrature		School of Magistrates
ENAP	École Nationale d'Administration et de Politiques Publiques		National School of Administration and Public Policy
ENARTS	École Nationale des Arts		National Art School
EPA	Eau Potable et Assainissement	WATSAN	Water and Sanitation
EPT	Education Pour Tous	EFA	Education For All
FAES	Fonds d'Assistance Économique et Social		Economic and Social Assistance Fund
FAO	Organisation des Nations Unies pour l'Alimentation et l'Agriculture	FAO	Food and Agriculture Organization of the United Nations
FIC	Fonds d'Investissement Climatiques	CIF	Climate Investment Fund
FMI	Fonds Monétaire International	IMF	International Monetary Fund
GATT	Accord Général sur les Tarifs Douaniers et le Commerce	GATT	General Agreement on Trade and Tariffs
GRD	Gestion des Risques et des Désastres		Risk and Disaster Management
HIMO	Haute Intensité de Main d'Œuvre		High intensity of labor
IDH	Indice de Développement Humain	HDI	Human Development Index
	Déplacés Internes	IDP	Internally Displaced Persons
IHSI	Institut Haïtien de Statistiques et d'Informatique		Haitian Institute of Statistics and Informatics
	Institut Interméricain de Coopération pour l'agriculture	IICA	Inter-American Institute for Cooperation on Agriculture
INARA	Institut National de la Réforme Agraire		National Institute of Agrarian Reform
IPH	Indice de la Pauvreté Humaine	HPI	The Human Poverty Index
ISPAN	Institut de Sauvegarde du Patrimoine National		Institute for the Protection of National Heritage
JICA	Agence Japonaise de Coopération	JICA	Japan International Cooperation Agency
MARNDR	Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural		Ministry of Agriculture, Natural Resources and Rural Development
MAST	Ministère des Affaires Sociales et du Travail		Ministry of Social Affairs and Labor
MCFDF	Ministère à la Condition Féminine et aux Droits de la Femme		Ministry of Women's Status and Rights of Women
MCI	Ministère du Commerce et de l'Industrie		Ministry of Trade and Industry
MDE	Ministère de l'Environnement		Ministry of Environment
MEF	Ministère de l'Economie et des Finances		Ministry of Economy and Finance
MENFP	Ministère de l'Education Nationale et de la Formation Professionnelle		Ministry of National Education and Vocational Training
MICT	Ministère de l'Intérieur et des Collectivités Territoriales		Ministry of Interior and Local Authorities
MINUSTAH	Mission des Nations Unies pour la stabilisation en Haïti		United Nations Stabilization Mission in Haiti
MJSAC	Ministère de la Jeunesse, des Sports et à l'Action Civique		Ministry of Youth, Sports and Civic Action
MJSP	Ministère de la Justice et de la Sécurité		Ministry of Justice and Public Security
MPCE	Ministère de la Planification et de la Coopération Externe		Ministry of Planning and External Cooperation
MSPP	Ministère de la Santé Publique et de la Population		Ministry of Public Health and Population
MTPTC	Ministère des Travaux Publics, Transports et Communications		Ministry of Public Works, Transport and Communication
ND	Non Disponible	N.A.	Not Available
	Association à but non Lucratif	NPO	Non-profit Organization
OCHA	Bureau de la coordination des affaires humanitaires	OCHA / UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
OFATMA	Office d'Assurance Travail, Maladie et Maternité		Office of Labor Insurance, Sickness and Maternity
OIM	Organisation Internationale pour les Migrations	IOM	International Organization for Migration
OIT	Organisation Internationale du Travail	ILO	International Labor Organization

List of Abbreviations (3)

Abbreviation in French	French	Abbreviation in English	English
OMRH	Office de Management et des Ressources Humaines		Office of Management and Human Resources
OMS	Organisation Mondiale de la Santé	WHO	World Health Organization
ONA	Office National d'Assurance Vieillesse		Nation Office of Old-Age Insurance
ONACA	Office National du Cadastre		National Office of Cadastre
ONEV	Observatoire National de l'Environnement et de la Vulnérabilité		National Observatory for Environment and Vulnerability
ONG	Organisation Non Gouvernementale	NGO	Non-Governmental Organizations
ONI	Office National d'Identification		National Identification Office
ONPES	Observatoire Nationale de la Pauvrete et de l'Exclusion Social		National Observatory of Poverty and Social Exclusion
OP	Opérateurs Privés (ou Professionnels)		Private (or Professional) Operators
OPC	Office de Protection du Citoyen		Office of Citizen Defense
OREPA	Offices Régionaux de l'Eau Potable et de l'Assainissement		Regional Offices for Water and Sanitation
PAM	Programme Alimentaire Mondial des Nations Unies	WFP	World Food Programme
PAP (PaP)	Port-au-Prince		Port-au-Prince
PARDH	Plan d'Action pour le relèvement et le dé veloppment d'Haïti		Action Plan for National Recovery and Development of Haiti
PDNA	Évaluation des Besoins Après Désastres	PDNA	Post Disaster Needs Assessment
PIB	Produit Intérieur Brut	GDP	Gross Domestic Product
PNGRD	Plan National de Gestion des Risques et des Désastres		National Plan for Risk and Disaster Management
PNH	Police Nationale d'Haïti		National Police of Haiti
PNUD	Programme des Nations Unies pour le Développement	UNDP	United Nations Development Programme
PNUEH /ONU-Habitat	Programme des Nations Unies pour les Établissements Humains	UN-HABITAT	United Nations Human Settlement Programme
POCHEP	Poste Communautaire d'Hygiène et d'Eau potable		Community Post of Water and Hygiene
PRSP	Document de stratégie nationale pour la croissance et pour la réduction de la pauvreté	PRSP	Poverty Reduction Strategy Paper
RNB	Revenu National Brut	GNI	Gross National Income
RNH	Radio Nationale d'Haïti		National Radio of Haiti
SAEP	Système d' Approvisionnement en Eau Potable		Water Supply System
SAP	Système d'Alerte Précoce		Early Warning System
SEMANAH	Service Maritime et de Navigation d'Haïti		Maritime and Navigation Service in Haiti
SMCRS	Service Métropolitain de Collecte des Résidus Solides		Service Metropolitan Solid Waste Collection
SNAT	Schéma Narional d'Aménagement du Territoire		National Territorial Development Plan
SNEP	Service National d'Eau Potable		National Water Service
SNGE	Système National de Gestion de l'Environnement		National System of Environmental Management
SNGRD	Système National de Gestion des Risques et des		National System for Risk and Disaster Management
SPGRD	Secrétariat Permanent de Gestion des Risques et Désastre		
StC	Save the Children	StC	Save the Children
TCA	Taxe sur le Chiffre d'Affaires		Tax on Turnover
TELECO	Télécommunications d'Haïti SAM		Telecommunications of Haiti SAM
TIC	Technologies de l'Information et des Télécommunications		Technology for Information and Telecommunications
TNH	Télévision Nationale d'Haïti		National Television of Haiti
UCAONG	Unité de Coordination des Activites des Organisation Non Gouvernementales		Coordination Unit of activities of Non-Governmental Organization
UCDD	Unité de Coordination des Directions Départementales		Coordination Unit of Departmental Directorates
UE	Union Européenne	EU	European Union
UNICEF	Fonds des Nations Unies pour l'Enfance	UNICEF	United Nations Children's Fund
URD	Unité Rurale Départementale		Departmental Rural Unit
URSEP	Unité Reforme du Secteur Eau Potable		Water Sector Reform Unit
USAID	Agence des États-Unis pour le Développement International	USAID	United States Agency for International Development
USE	Unite de Suivi et d'Évaluation		Unite Monitoring and Evaluation

Background

On January 12, 2010, a massive earthquake of magnitude 7.0 struck the capital region of the Republic of Haiti. The damage caused by collapsed buildings was enormous, with over 230,000 dead and missing, over 310,000 injured, and approx. 1.5 million people afflicted.

To respond to this disaster, the government of Haiti and the international society established the Interim Haiti Recovery Commission (IHRC), and at the New York donor conference on March 31, 2010, the donors pledged a total of over 5 billion US dollars. The Haitian government has also established the Action Plan for National Recovery and Development of Haiti, March 2010, conducting reconstruction activities.

At the request of the Haitian government, JICA carried out the Urgent Rehabilitation and Reconstruction Support Project for Haiti from May 2010 to August 2011 for prompt rehabilitation and reconstruction after the disaster. The details of the cooperation are as described below.

(1) Assistance for the formulation of the Basic Plan for National Land Development:
Based on the Action Plan for National Recovery and Development of Haiti and experience in Japan, we provided assistance for the formulation of the Basic Plan for National Land Development, mainly for disaster reduction, decentralization and localization.

(2) Development of Léogâne Commune Disaster Recovery Plan:
We proposed a disaster recovery plan for Léogâne Commune, a heavily-damaged area near the capital, that takes into consideration the development of a regional core area that will contribute to decentralization and also the development of a city well-prepared against disasters.

(3) Rehabilitation project planning:
We conducted schematic design study for the Project for Improvement of Urban Roads and Drainage for the Reconstruction in Léogâne City, which has been selected as a result of needs assessment concerning infrastructure reconstruction projects to support quick reconstruction of social and economic infrastructure.

(4) Urgent rehabilitation projects (implementation of an urgent rehabilitation project for the reconstruction of basic infrastructure):
We conducted needs assessment, selection of target projects, planning, design and construction for Urgent Rehabilitation Project of Water Supply for Léogâne City Center, as an urgent rehabilitation project to rebuild basic infrastructure and people's lives in the disaster-stricken area.

In the rehabilitation projects and urgent rehabilitation projects, improvement of livelihoods through employment of local residents etc. and promotion of health through improvement of hygienic environment were taken into consideration.

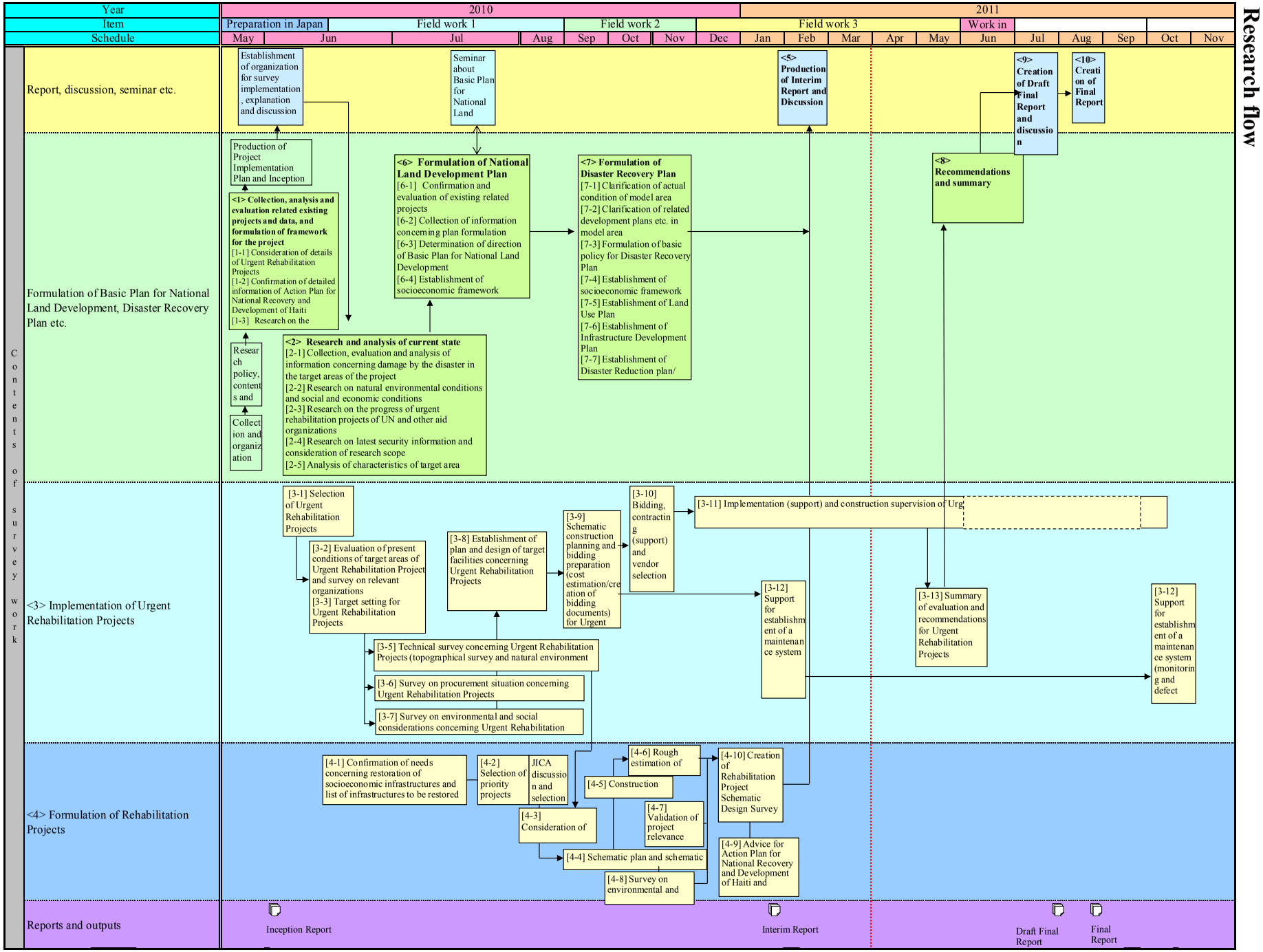
The Project for Improvement of Urban Roads and Drainage for the Reconstruction in Léogâne City, proposed in the above (3), is now being implemented after the Exchange of Notes for Grant Aid was signed between Haitian and Japanese governments in November 2010 and the procurement agency agreement was signed in March 2011.

Urgent Rehabilitation Project of Water Supply for Léogâne City Center, described in the above (4), was completed in May 2011, including some additional expansion works. Defect inspection was conducted in October 2011.

Restrictions of the Project

As Haiti experienced this massive earthquake in January 2010 after long years' of political turmoil and repeated attacks by large hurricanes in 2008, the Project was prepared with very limited data due to scattering of existing documents etc. The country experienced a marked shortage in funds and human resources even before the disaster, but the disaster further weakened the administrative ability, destroying many important facilities and taking many precious human resources. The organizations of local governments are even weaker and can hardly function properly. In this situation, assumptions have to be made based on old data and the data collected this time, as other accurate data is not available. Attention needs to be paid not only to this, but to the possibility that the current states have largely changed after the disaster.

Research flow



A. Assistance for the formulation of Basic Plan for National Land Development

1 Background

In Haiti, although the necessity and importance of the decentralization from the capital city of Port-au-Prince and the necessity and importance of balanced national land development have been cited since the 1980s, no progress was made and the country suffered great damage from the massive earthquake on January 12, 2010 (hereinafter called Great Haiti Earthquake). For the recovery from the earthquake damage, there is a more urgent need for the establishment of a national land development plan that will promote regional development and ease centralization instead of focusing too much on the reconstruction of Port-au-Prince,

In the 1980s the Haitian government started considering its national land development policy centered on decentralization from the capital. In 2006 the government announced its policy for the establishment of the national land development plan (SNAT) and has been working out the concrete details since then. In addition to SNAT, in March 2010, after the Great Haiti Earthquake, the Action Plan for National Recovery and Development of Haiti was established based on the Haiti Earthquake Post-Disaster Needs Assessment (PDNA) with the cooperation of the international society. However, the Action Plan for National Recovery and Development of Haiti only shows policies and frameworks and it is necessary to establish a more concrete basic plan for national land development.

Regarding the assistance to the formulation of the Basic Plan for National Land Development described in this part, it is hoped that recommendations will be made based on Japan's experience in and lessons from decentralization under the National Comprehensive Development Plan and the recommendations will be incorporated in the New National Land Development Plan, which will be created with the national statistics data and guidelines developed by the National Land Improvement and Regional Development Bureau of the Ministry of Planning and External Cooperation (MPCE-DATDLR), so that steady recovery of Haiti from the major disaster will be ensured.

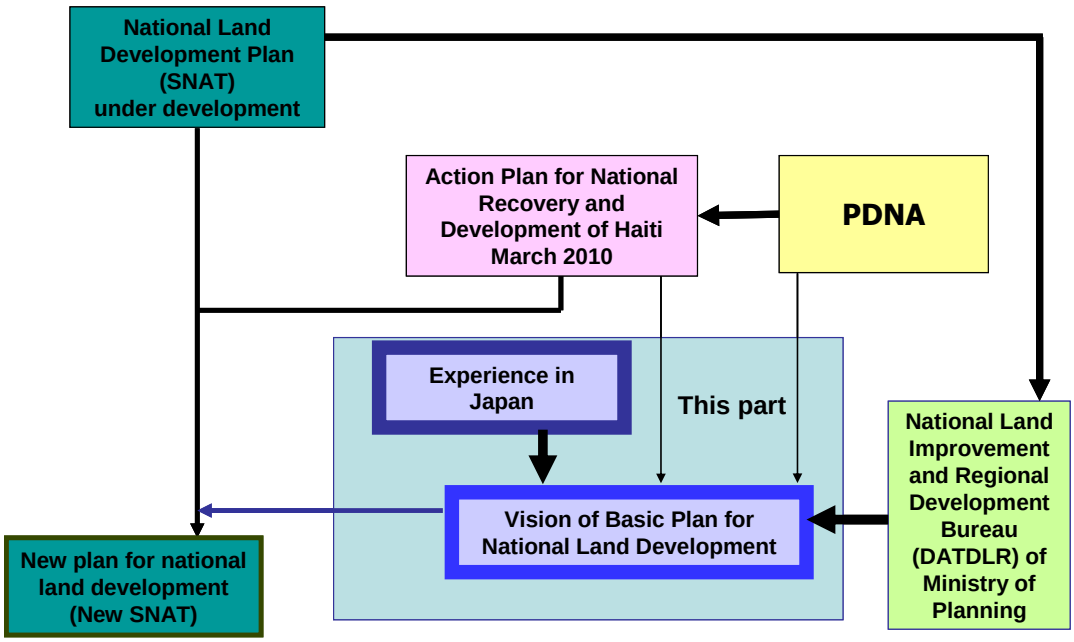


Fig. A1 Positioning of This Part

2 Basic conditions for the Basic Plan for National Land Development (Action Plan for National Recovery and Development of Haiti and experience with decentralization in Japan)

2-1 Damage and loss caused by the Great Haiti Earthquake and reconstruction needs

PDNA estimates that the Great Haiti Earthquake caused enormous damage of about $7.8 billion [$4.52 billion damage and $3.28 billion loss], which is about 6 times larger than the total amount of damage caused by all the natural disasters since 2004, and 1.2 times larger than the 2009 GDP of Haiti. The cost required for the future reconstruction is estimated to be about $1.48 billion in the short term (6 months), about $3.08 billion in the medium term (18 months), and about $7.63 billion in the long term (3 years), totaling $12.19 billion.[1]

2-2 Japan's experience

The extreme damage caused by the Great Haiti Earthquake, including over 230,000 deaths and a total of about $7.8 billion damage, can be attributed to the overconcentration in the capital city of Port-au-Prince and many buildings with weak structures. In Japan, although most development works were carried out in the capital sphere during the first years of recovery from World War II and the period of high economic growth, the government has established the National Comprehensive Development Plan and been producing good results through the implementation of balanced regional development. It is considered that such experience in Japan can be a good reference for the future recovery and development of Haiti after the massive earthquake.

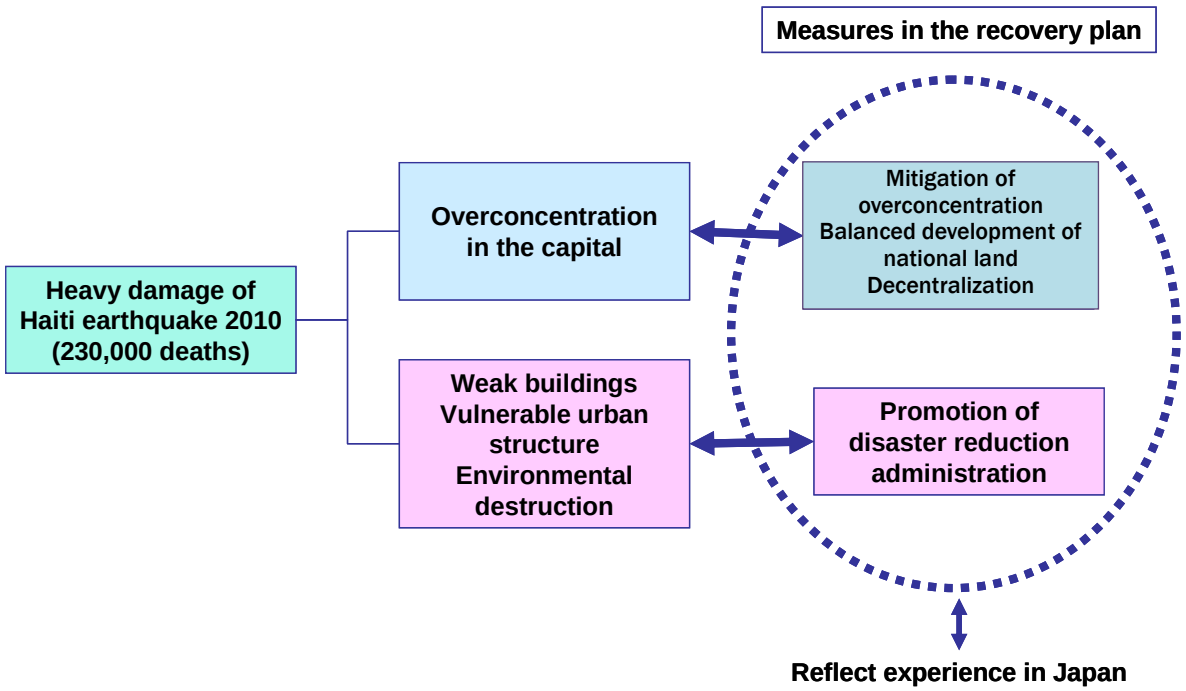


Fig. A2 Characteristics of the Great Haiti Earthquake and the Japanese Experience in Recovery

[1] Haiti Earthquake Post Disaster Needs Assessment: Assessment of damage, losses, general and sectoral needs (PDNA)

2-3 Consideration for the recovery and development of Haiti

As for Japan's experience in reconstruction and development, we can say that it was effective to establish a national land development plan and then establish and implement various infrastructure plans based on this. In Japan, emphasis was placed especially on the improvement of traffic infrastructure that connected major transportation bases in the country and also served as contact points with overseas countries, which significantly contributed to the subsequent economic development. River improvement and dam construction promoted through the establishment of flood control plans helped prevent flood damage and also improved agricultural productivity as it increased water usage. Electricity production was dramatically increased through the production of dams and it contributed to local industry development. Moreover, at the city level, planned land use helped contain damage from disasters and increase disaster-preparedness through the improvement of public space and facilities.

As described above, in order to carry out balanced development while easing overconcentration, it is essential to develop transportation, traffic and other social infrastructures in an integrated manner and establish a comprehensive development plan that provides the foundation for it. In Japan, various long-term plans concerning development of social infrastructures were developed as needed in combination with national land development plans, and development of public facilities based on such long-term plans helped industrial development, taking advantage of ports and other local characteristics. In Haiti, it is important to officially establish and carry out as soon as possible the national land development plan that is now being developed and to create related infrastructure development plans also at an early date.

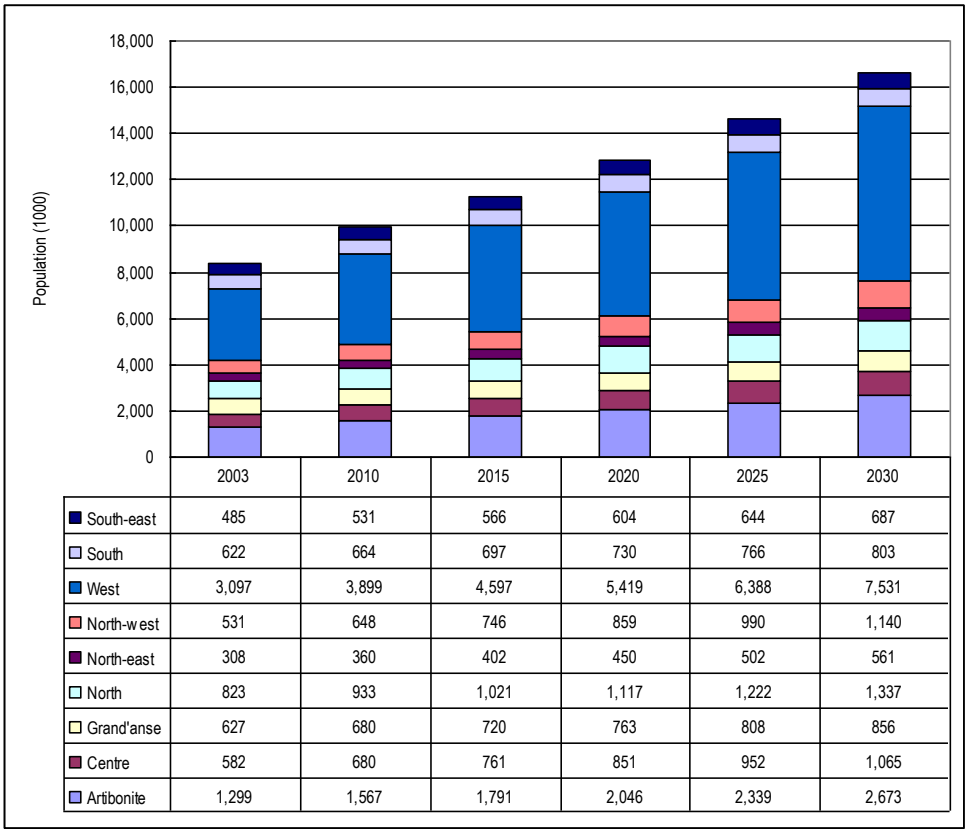
Although there may be various problems looming during implementation, balanced development of national land can be expected with planned formulation of further national land development plans tailored to the recovery stage of Haiti after the Basic Plan for National Land Development, which the Haitian government is now developing, or with flexible and phased revision and improvement of the plan when needed.

3. Preliminary study with disasters taken into consideration

3-1 Population

Haitian Institute of Statistics and Information (IHSI) has forecasted population of each department till 2030 based on the national census of 2003. According to this, the population of 2030 is estimated to be 16.55 million.

Table A1 Population Forecasts (Unit: K people)



	2003	2010	2015	2020	2025	2030
South-east	485	531	566	604	644	687
South	622	664	697	730	766	803
West	3,097	3,899	4,597	5,419	6,388	7,531
North-west	531	648	746	859	990	1,140
North-east	308	360	402	450	502	561
North	823	933	1,021	1,117	1,222	1,337
Grand'anse	627	680	720	763	808	856
Centre	582	680	761	851	952	1,065
Artibonite	1,299	1,567	1,791	2,046	2,339	2,673

Year	*2003*	*2010*	*2015*	*2020*	*2025*	*2030*
Haïti	8,374	9,962	11,300	12,839	14,611	16,653

(Ref.: IHSI, MPCE- DATDLR, 2010)

3-2 Status of industries

According to the Ministry of Economy and Finance (MEF), the economic growth rate from 2005 to 2009 was 2-3%, slightly increasing, and reached 2.9% in 2009.In 2010 the growth rate dropped to -8.5% due to the damage by the Great Haiti Earthquake, but is expected to increase to 10.2% in 2011 with international support for recovery.

The economy of Haiti heavily depends on the support from the international society and money sent from Haitians living overseas (diaspora)[2], and the country needs economic growth to support its recovery. It is hoped that the priority development fields defined in the Action Plan for National Recovery and Development of Haiti (construction, agriculture, processing of agricultural products, tourism and

[2] Social circumstances, water supply and sanitation baseline survey by the research team (D Urgent Rehabilitation Projects 5-1), website of the U.S. Census Bureau (http://www.census.gov/) etc.

industry) will grow.

3-3 Characteristics of the national land and potential of development

The country occupies 1/3 of the island of Hispaniola on the west side. The southwest region protrudes like a peninsula and has a large area of sloping ground and little flatland. The sloping areas have been quite deforested and the forest coverage is said to be 3% or lower. Such areas are vulnerable to damage by large landslides and floods with the advent of heavy rain.

The land Haiti can be divided into the following four zones from the north, based on the natural and socioeconomic conditions.

Table A2 Characteristics by Zone in Haiti

Zone	Natural and socioeconomic conditions
North zone	Tourism resources and historic resources on the northern coasts, the second largest city of Cap-Haitian and harbor facilities
Central zone	Plain field, agricultural zones, central part of the country
West zone (national capital region)	Concentration of capital functions and economic centers, concentration of population and industries
South zone	Long coastlines, mountain areas in the center

Table A3 shows the current state and proposals of potential for development of each of the four categories of national land use.

Table A3 Current State and Potential of Land Use

Land use	Current state and issues	Potential for development
Agricultural land	There is some in the northeastern region, west side of the Central zone, outskirts of the capital and South zone (around Les Cayes) but the range of use is limited. Irrigation and such other measures are not sufficiently conducted.	Agricultural land could be expanded through irrigation and improvement of farmland.
Nonagricultural land	Mostly sloping land. As the land has become quite bare, there is significant soil erosion and loss.	Restoration of forests and prevention of soil erosion and flood damage through tree planting is expected to allow expansion of agricultural land and some urban development.
Urban area	There is overconcentration in the capital area of Port-au-Prince. It is necessary to establish an urban plan and a legal system including land use regulations that will promote expansion of urban areas in local cities as well as preventing sprawl (encroachment) into areas vulnerable to disasters and maintaining healthy agricultural land.	Development can be carried out as proper urban development with restrictions of unregulated sprawl.
Protection area	Existing national parks are the National History Park - Citadel, Sans Souci, Ramiers, which is also a World Heritage site, Parc National la Visite, located in the hills along the border between the West department and the Sud-Est department, and Parc National Makaya, located in the hills along the border of the Grand'Anse department and the Sud department.	National parks and nature preserves can be expanded as such areas have a high potential as tourism resources.

As for the risk of natural disasters, the whole land of Haiti is vulnerable to damage caused by strong hurricane winds and to floods and landslides caused by heavy rain. The low-altitude Central zone has a high risk of having floods. Moreover, there is a high risk of earthquakes in the North zone, the capital area and the southwest region as they are close to active fault zones.

3-4 Purposes of the national land development plan (SNAT)

The Ministry of Planning describes the following purposes of the establishment of the national land development plan (SNAT) in its statement of policy for the establishment of SNAT.

For the improvement of people's living through the effective use of resources and balanced and harmonized development of all national land, the following purposes have been set.

- ◊ Structuring of national land <development centers, axes, links, and nodes>
- ◊ Utilization of regional resources and potentials
- ◊ Environment preservation and effective utilization of resources
- ◊ Satisfaction of BHN of all people
- ◊ Establishment of comprehensive economic, regional and urban development strategies and promotion of decentralization

The purpose of the establishment of SNAT is to achieve rational development of the national land through balanced local development and decentralization of the capital.

4. Suggestion of items to be included in the Basic Plan for National Land Development

4-1 Socioeconomic framework

Based on the 2003 national census conducted by the Haitian Institute of Statistics and Information (IHSI), the population of each zone in 2030 is estimated as shown in Table A4.

Table A4 2030 Population Forecasts (Unit: K people)

Zone	Department	Forecast before earthquake	Decentralization and regional development taken into consideration	Decentralization and regional development taken into consideration	Impact of the plan
North	Nord-Est	561	589	3,291	+253
	Nord	1,337	1,471		
	Nord-West	1,140	1,231		
Central	Artibonite	2,673	2,994	4,208	+470
	Centre	1,065	1,214		
West	West	7,531	6,500	7,228	-990
	Sud-Est	687	728		
South	Grand'Anse	856	1,019	1,926	+267
	Sud	803	907		
Haiti (total)	Haiti (total)	16,653	16,653	16,653	-

(Ref.: IHSI, MPCE-DATDLR, forecasts by the research team, 2010)

For the population forecasts with decentralization taken into consideration, the calculation was made by subtracting the population to be dispersed into local areas (1,031K), estimated based on the rate of evacuees in each department, from the population of the West department, which has the capital of Port-au-Prince, on the assumption that evacuees from the capital Port -au-Prince after the earthquake are likely to move into local areas (data from UNOCHA, March 1, 2010).

4-2 Policy for the establishment of the Basic Plan for National Land Development

Like Haiti, Japan has geographic environment vulnerable to large-scale natural disasters, but the country achieved further development every time it experienced a disaster, aiming at systematic national development for balanced development of national land and at development of urban districts well-prepared against disasters.

For example, to address the issue of densely populated areas with deteriorated houses in urban districts, development and improvement of road networks, adoption of flame-resistant materials for buildings, standardization of seismic building standards, revision and improvement of these standards at a time of each earthquake, improvement of public disaster reduction centers etc. have been carried out based on city plans. Moreover, balanced social and economic development has been achieved through the establishment of National Comprehensive Development Plans and the development of regional development bases and improvement of a transportation network connecting such bases.

Similarly in Haiti, efforts for self-sustaining development can be made through the development and implementation of similar legal systems and development policies and through continued actions for social and economic development with no backward movements to prepare against possible future natural disasters. It is also important to create a system to increase preparedness against hurricanes, earthquakes and other types of disasters that will occur in the future, so that damage will be minimized and quick recovery will be made possible. Considering all of this, the policy for the establishment of the Basic Plan for National Land Development shall be as below.

(1) Decentralization (mitigation of overconcentration) = balanced development of national land
(2) Development of cities well-prepared against disasters = promotion of disaster reduction administration

In order to carry out the above-described policies,

For (1), it is effective to develop nodes for the connection with overseas such as airports and sea ports and connect such nodes and bases through the development of social infrastructures for regional base functions.

For (2), it is important to reduce flood damage and promote water use for life and agriculture through the establishment and implementation of a comprehensive flood control and watershed management plan. For this purpose, disaster reduction administration should be promoted.

Considering the above, the core measures to promote the above-described policies shall be as follows.

- ◆ Development of regional bases and improvement of transportation network
- ◆ Disaster reduction - comprehensive flood control and watershed management

4-3 Concept and vision of the Basic Plan for National Land Development

Based on the vision and concept of the Basic Plan for National Land Development, we propose a concept for the development of regional bases and a transportation network tailored to the development potential to each zone as shown in Table A5.

Table A5 Concept for Development by Zone

Zone	Potential of development	Regional development base	Sub-development center	Transportation network
I. North zone	Industrial development centering on tourism development, free zone and trade	Kap Ayisyen	Fort-Libert, Port-de-Paix	Route 1 Route 2
II. Central zone	Agriculture and processing of agricultural products	Gonaives	Hinche	
III. West zone (Capital region)	Service industry, economic and industrial center	Port-au-Prince (satellite cities: Léogâne, Cabaret and Croix-des-Bouquets)	Miragoane Jacmel	Route 2, Route 4, arterial roads to Dominican Republic
IV. South zone	Agriculture, fisheries, processing of agricultural and fishery products	Les Cayes	Jeremie	

Fig. A3 shows the image of the concepts of Table A5 combined with the development concept proposed by the Haitian government to connect local bases with a network. Establishment of the Basic Plan for National Land Development under this concept is expected to increase the effectiveness of the development of regional bases and a transportation network based on the policy, “Decentralization (mitigation of overconcentration) is equal to balanced development

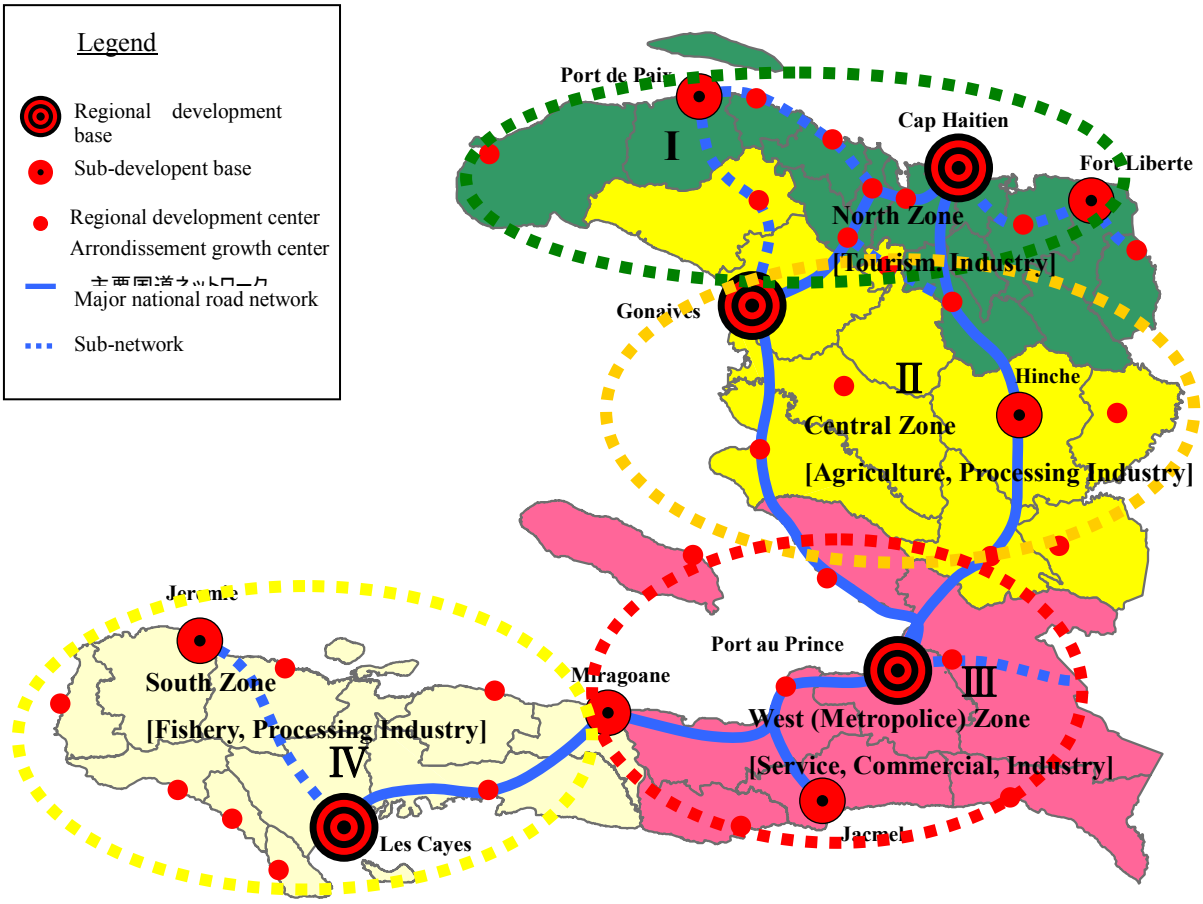


Fig. A3 Concept and Vision of the Basic Plan for National Land Development

(Created by the research team based on a figure proposed by MPCE-DATDLR, 2010)

4-4 Decentralization and development of cities well-prepared for disasters

From the viewpoints of decentralization/mitigation of overconcentration and development of cities well-prepared against disasters, tangible measures of the national land development plan and intangible/institutional measures are proposed as described in Table A6.

Table A6 Decentralization and Disaster Reduction

Tangible measures of National Land Development Plan	Intangible/institutional measures
Decentralization (mitigation of overconcentration)	
◊ Improvement of transportation networks ◊ Improvement of regional development bases <Establish development bases in each zone (growth pole + capital, sub-growth pole). Connect the development bases (growth poles) with arterial roads. Develop airports and sea ports in the development bases (growth poles). > (Develop two poles in Gonaives along Route 1 and Hinche along Route 3 in the Central zone.) ◊ Improvement of infrastructure in development bases [roads, drainage, water supply, electricity, communication, public facilities (such as schools, hospitals, clinics, healthcare centers, government offices, parks and multipurpose meeting places)	◊ Incentives to promote private investment (such as free zones) ◊ Improvement of institutions about land ownership ◊ Improvement of sanitary conditions ◊ Improvement of waste collection and disposal system
◊ Promotion of agriculture and fisheries (Increase of productivity and improvement of market)	◊ Development of seed and livestock banks and microcredit ◊ Instructions for agricultural productivity improvement ◊ Extended agricultural instructions Expansion of cultivation (shrimp, fish, chicken, pig and goat) ◊ Diffusion of alternatives to coal
Urban development to increase disaster preparedness	
◊ Establishment and implementation of an urban development plan (development of regulating reservoirs and parks around the reservoirs, improvement of parks as evacuation centers, tree planting in areas in danger of a landslide, improvement of drainage) ◊ Development of earthquake-resistant infrastructure ◊ Provision of redundancy (multiple systems) to reduce risk ◊ Development of evacuation squares and facilities ◊ Comprehensive flood control plan	◊ Forecast and alarm system, evacuation system ◊ Measures to minimize damage caused by disasters (establishment and implementation of earthquake-resistant structure and wind-resistance standards) ◊ Establishment of a system for quick recovery from disaster (establishment of a system for quick emergency response and a program for prompt recovery) ◊ Improvement of roles of government, private organizations, communities and individuals at the time of a disaster ◊ Promotion of creation of community organizations (for disaster prevention, fire fighting etc.), and support for disaster reduction activities of communities

Table A7 shows possible measures concerning decentralization (mitigation of overconcentration) and disaster reduction that can be taken in the four zones.

Table A7 Decentralization and Disaster Reduction (Measures for each Zone)

Zone	Decentralization (mitigation of overconcentration)	Disaster reduction (important regional measures in addition to the above-described general measures)
North zone	Cap-Haitien, the second largest city in Haiti with a sea port, an international airport, tourism resources and a free-trade zone plan, is the most important city among the development bases. Located between Fort Liberte and Port-de-Paix on the northern coast, it is also the center of the North zone. Cap-Haitien has a potential for tourism development such as invitation of cruise ships, and also for the development of the primary industry to provide services to such tourism industry and population.	Land use plan for disaster reduction
Central zone	It is located in the center of the country and has comparatively large flat land. Improve Route 1 and Route 3, which connect Port-au-Prince and Kap Ayisyen, and make selective investments in the cities along these routes - Gonaives, Saint-Marc and Hinche - as development bases. There seems to be a good potential for agricultural product processing which agricultural products will be value-added and products can be supplied to other zones.	Flood control measures
West zone	It is important to promote a plan to develop satellite cities around the capital. Léogâne, situated 35km away from Port-au-Prince, has a potential to be developed as the most important satellite city in the western part of the capital region.	Reconstruction of buildings with earthquake-resistant structure
South zone	Although there is a potential, the zone has not been developed much. Agricultural and fishery product processing seems promising, with Les Caye as a development center.	Land use plan for disaster reduction

4-5 Disaster reduction measures

In order to deal with repeated natural threats, it is necessary to establish a system to minimize human and material damage and allow quick recovery through mutual cooperation and efforts of government organizations, private organizations, community organizations and individuals.
The important points of each stage of disaster reduction and recovery/reconstruction are as follows.

[Prediction and forecast/alarm] Although it is difficult to predict the risk of future earthquakes, it is possible to predict the areas where earthquakes will occur by analyzing active faults where earthquakes have occurred before. In the areas with a high risk of earthquakes, it is necessary to establish seismic standards for structures and ensure compliance with them.
As for hurricane damage, prediction of course, storm area etc. is conducted in some countries including neighboring countries of USA. It is important to share such information and thoroughly enforce such measures as giving out evacuation directives early through prompt communication of forecasts and alarms. Similar measures should be taken against flood and landslide disasters, whose risk increases when a hurricane occurs. Moreover, hazard maps showing the risk of disaster occurrence in the region should be created so that the residents in dangerous areas can be evacuated according to the forecast and warning.
Use of land in the areas with high disaster risk should be minimized and appropriate land use should be guided and regulated through the establishment of a land use plan. For example, areas in danger of floods should be kept as public land such as parks and green areas.

[Evacuation] Public facilities such as government offices, schools and healthcare centers that will be used as evacuation centers for residents should be built in areas with a minimum risk of disasters. It is also important for such facilities to have quake-resistant structures. More concretely, it is important to use quake-resistant structures (that will allow the facilities to be used as shelters not only at the time of an earthquake but also a hurricane) and improve such facilities so that they can be used as disaster reduction and evacuation centers where emergency supplies are stored. It is also important to improve parks and open spaces so that they can be used as evacuation spaces. Moreover, it is important to widely inform people about these improved evacuation spaces.

[Rescue, relief and emergency assistance activities] It is necessary to have roads of enough width and open spaces for rescue, relief and emergency assistance activities. It is hoped that an urban development planning system will be established and carried out to reserve such disaster reduction spaces and control residence and building construction in dangerous areas where floods and other disasters are predicted. It is also important to develop disaster reduction centers as they will play an important role as a center to receive emergency assistance at the time of a disaster.

Disaster reduction system

As intangible measures to prevent disasters, not only does the government have to establish a disaster reduction plan, a hazard map, a land use plan including land use restrictions in dangerous areas and a

prediction/alarm system but also promote and support community activities for disaster reduction, which are necessary for ensuring the use of such plans and tools among residents.

For this, the existing organization of the Permanent Secretariat of Risk Management (SPGRD) should be strengthened and the existing cooperation in the central government should also be improved so that the basis for a disaster reduction system will be established. At the same time, support of the central government is essential to strengthening the disaster reduction system that covers from the prefecture to communes, section communales and communities and to make the community disaster reduction activities function.

Measures against each type of natural disaster

In the light of the local characteristics of each type of disaster, the following measures are considered necessary.

- **Earthquake**
  - In Grand'Anse, Nippes, West and Nord departments, which are located near the two active faults (Septentorial Fault and Enriquillo Fault) where large earthquakes have occurred in the past, caution should be exercised especially against earthquakes.
  - It is necessary to define and implement building standards with quake-resistance taken into consideration and develop a building confirmation system based on such standards. It is also necessary to promote construction of quake-resistant buildings and control construction of faulty buildings.
  - Quick evacuation in a safe place should be guided in cooperation with disaster reduction activities of communities.

- **Hurricane**
  - In Sud and Grand'Anse departments, where hurricanes pass especially frequently, wind-resistant measures for houses should be promoted.
  - As advance knowledge of weathers etc. can significantly reduces damage, relevant information should be provided through radio, community wireless system etc. and cooperation should be given to evacuation drills and other community activities to ensure measures and evacuation before the arrival of a hurricane.

- **Flood**
  - As with measures against hurricanes, information sharing among residents can be effective
  - Around Gonaïves in the Artibonite department, Cap-Haïtien in the Nord department and Léogâne in the West department, which have wide low-altitude areas, effective measures will be the promotion of construction of houses with raised flooring as well as construction of drainage to prevent/reduce internal water overflow.

- **Tidal waves and tsunami**
  - Low-altitude areas are vulnerable to damage when a tropical cyclone passes. Therefore, disaster reduction measures should be carried out intensively in the low-altitude areas in the Sud

department, where hurricanes frequently pass, and around Gonaïves, which has a very large low-altitude area.

- The north coastal area has a high risk of earthquake and therefore of tsunami. To make tangible measures effective, breakwaters need to be constructed continuously and extensively along the coast but it would cost a lot. Instead, it will be effective to thoroughly carry out intangible measures such as evacuation drills and development of a hazard map.

• **Landslide**

- The country is vulnerable to damage by landslides as forests cover below 3% of the total area as a result of deforestation.
- Although the most important thing is to increase the forest coverage through promotion of tree planting, it would require tremendous amounts of money and time. Therefore, priority should be given to soil erosion prevention works (simple check dam etc.), planting of fruit trees, installation of gabions at toe slope and other measures to prevent soil erosion.

4-6 Items to be included in the plan for each sector

In order to promote balanced development of national land and development of a city well-prepared against disasters at the same time, it is important to establish an infrastructure development plan for each sector based on the Basic Plan for National Land Development and carry out development in a planned manner. The infrastructure development policy for each sector is summarized as below.

(1) Traffic planning

1) Roads

In order to ease overconcentration in the capital and develop regional development bases, it is important to improve arterial roads connecting such bases so that passenger and cargo transportation can be carried out rapidly and at low cost. Improvement of such roads as a road network connecting urban centers will make it easy to secure routes for evacuation and transportation of relief supplies at the time of a disaster.

- Improvement of arterial roads (width, paving, slopes and bridges)
  <Improvement of Routes 1 to 4 and elimination of bottlenecks>
- Improvement of secondary roads (width, paving, slopes and bridges)
- Improvement of urban roads (improvement of paving and intersections, and elimination of bottlenecks)

2) Ports

Ports are used for large-volume transportation, import and export. It is important to improve ports in development bases.

- Improvement of ports (Port-au-Prince, Cap Haitien, Gonaives, Les Cayes etc.)

3) Airports

In order to attract international businesses and tourists by taking advantage of diasporas'

contributions to Haitian economy and culture and also to facilitate their activities, airports in development bases should be improved.

- Improvement of airports (Port-au-Prince, Cap Haitien, Les Cayes etc.)

(2) Water supply and sanitary facilities

The cholera epidemic in October 2010, combined with poor sanitary conditions and medical circumstances, took the lives of many citizens. Development and improvement of water supply and sanitary facilities with proper sanitary control is urgently required especially in densely populated areas vulnerable to damage of infectious diseases, as such facilities are the fundamental facilities most needed for people's life and health as well as for the prevention of infectious diseases including cholera.

- Development of water supply facilities in major cities (water intake, purification, storage and distribution)
- Development of sanitary and drainage facilities in major cities (sewage treatment facilities including septic tanks etc.)
- Development of waste disposal sites

(3) Electric power facilities

Electric power facilities are important basic infrastructure not only for the development of industries and economy but also for people's life. It is suggested to develop environmentally-friendly small-scale hydraulic power generation facilities that do not need fossil fuel, taking advantage of the mountainous geography. It will require forestation and environmental improvement at the same time. In urban districts, development of solar power generation facilities will be effective.

- Development of power generation, transformation and distribution facilities
- Development of small-scale hydraulic power generation facilities
- Development of solar power generation facilities

(4) Communication facilities

Although the development of communication facilities will basically be led by private sectors, it is proposed that cooperation between the government and private sectors should be developed for the emergency public use of widespread mobile phone networks. Forecasts and alarms for such disasters as hurricanes and emergency radio broadcast should be expanded and improved.

- Improvement of mobile phone networks (private sector development)
- Improvement of Internet access (private sector development)
- Improvement of emergency radio networks

(5) Cultural and educational facilities

Education is not only basic human needs but also the basis for economic development. It is hoped that development of school facilities, which have been scarce since before the earthquake, will be promoted and that such facilities will be used as an evacuation center and function as a disaster reduction center when a disaster occurs.

- Reconstruction and development of elementary and secondary schools

- Development of higher education and research facilities
- Development of libraries
- Development of sport facilities

(6) Healthcare facilities

Such facilities are indispensable to public health. It is hoped that such facilities will be constructed with quake-resistant structures so that they can be used during disasters, and will be constructed in areas with a low risk of inundation at the time of a flood.

- Establishment of a referral system and development of related facilities (advanced medical hospitals, base hospitals and clinics)
- Development of public health centers

(7) Urban and local facilities

Government offices are necessary to provide public services. Such facilities should have quake-resistant structures so that they can be used as an evacuation center in case of earthquake, hurricane, flood etc. and can also function as a disaster reduction center. Parks should be improved as emergency evacuation space.

- Improvement of public facilities (government offices, markets and parks)

(8) Flood control facilities

As measures against flood caused by a hurricane etc., the following improvements should be promoted to reduce the risk of a large scale disaster caused by a flood.

- River improvement (improvement of river channels and levees)
- Development of multipurpose dams
- Development of erosion control facilities
- Forestation

(9) Agricultural and fishery facilities

Agriculture and fisheries are key industries of Haiti and support the stable food supply to the public. It is important to develop facilities to support the growth of these industries.

- Development and improvement of irrigation facilities
- Development of farm land and improvement of land plots
- Development of distribution centers for agricultural products and markets
- Development of fishing ports and cold storage facilities

(10)Houses

- Improvement of institutions about land ownership and land ledgers that will be required to promote various types of development
- Development of low-cost houses in and around regional bases
- Development of a housing finance system
- Coordination with quake-resistance standards (financing only for quake-resistant houses)

- Promotion of improvement of construction techniques of private builders (There is no point of setting standards if construction is not properly done.)

4-7 Plan to develop satellite cities around the capital

Although it is not included in the national development plan, in order to reduce disaster-vulnerability, it will be important to ease overconcentration in Port-au-Prince, develop satellite cities around the capital area and relocate and transfer functions to these cities.

In the western part of the West Department, Léogâne, the largest city situated on Route 2, 35 kilometers from the capital, is suitable as a satellite city. It seems to be a good strategy to reconstruct it as a city well-prepared against disasters with schools, government offices etc. of quake-resistant structures that can be used as disaster reduction centers. The city can also develop into an academic city through expansion and reconstruction of existing universities and nursing schools and attraction of agricultural schools and vocational training schools. Croix des Bouquets, a city to the east of the Port-au-Prince airport, is an interchange point of Route 3 and an arterial road toward the Dominican Republic in the east. It is in an important location and therefore has a high potential for development. In the northern part of the West Department, Cabaret, located on Route 1, can be a satellite city.

Mitigation of overconcentration in the capital should be promoted by positioning these three cities as satellite cities of the capital Port-au-Prince and making them share capital functions.

Fig. A4 Plan to Develop Satellite Cities around the Capital

5. Recommendations

It is hoped that the "Items to be included in the Basic Plan for National Land Development" proposed in this part will be used for the national land development plan (SNAT) and that recovery from the large disaster will be steadily achieved in Haiti. Based on the results of the studies conducted in the past, we recommend the followings for the recovery of Haiti.

- They still need more data for the establishment of the basic plan for national land development. It is necessary to investigate the actual state of infrastructure development across the country, socioeconomic conditions of each region etc. and analyze the results.
- The establishment of the Basic Plan for National Land Development should be carried out in coordination with local development plans created by local governments, and it is necessary to collect information and deepen exchanges among relevant organizations and personnel through the support activities for the establishment of local development plans.
- It is hoped that the basic plan for national land development will be utilized for the establishment of the national land development plan (SNAT), which Haitian government has been working on since before the disaster. As there was a delay in establishing the national land development plan (SNAT) due to lack of resources (funds and human resources), resources should be increased/improved. For this, it is necessary to create a road map and establish the plan accordingly.
- The establishment of the basic plan for national land development will require discussion with all stakeholders, including collection of opinions of residents and local and central governments and coordination among relevant government organizations.
- Haitian people, who have survived many natural disasters, have high motivation for recovery, and voluntary reconstruction activities have been actively carried out. To get people's opinions and reflect them in the plan, taking advantage of such potential, activities of 10 department councils, 42 arrondissement councils, 138 commune councils and 565 section communal councils in the country should be promoted so that regional development plans will be prepared and different opinions will be adjusted through discussion about the basic plan for national land development. It is also important to provide information widely to the public and listen to people's voices by holding public hearings at the levels of commune, arrondissement, department and country.
- If government buildings destroyed by the disaster are relocated and rebuilt in other regions than the capital (e.g. Léogâne or Cabaret), related services can be developed in the surrounding areas and decentralization can be promoted. In such cases, roads to connect the relocation destination and the capital will have to be improved.
- A land system and a land register system need to be developed before land development can be started. There have been many cases where a land ownership issue was a bottleneck in construction of temporary housing.

Referring to the experience in Japan, we can also say the followings.

- Reconstruction after World War II started in 1945, soon after the war. To correct the disproportionate emphasis on the reconstruction of large cities and carry out well-balanced development across the country, the Comprehensive National Land Development Act was established in 1950. Based on this law, several comprehensive national development plans have been developed and carried out, easing overconcentration in the four large cities (Tokyo, Nagoya, Osaka and Kitakyushu) and contributing to balanced national land development. It seems effective also in Haiti to establish and carry out a national land development plan based on such a law.
- It is necessary to establish a national development plan presenting an appropriate future vision and clearly showing effective and efficient measures to achieve the vision. An implementation plan for each sector should be established and promoted based on the national development plan.
- It is important to repeat the steps of carrying out priority projects based on a national development plan, reviewing the plan every 5-10 years, and establishing a new national development plan and priority project plans.

B. Development of the Léogâne Commune Disaster Recovery Plan

1. Current state of Léogâne Commune

Léogâne Commune (commune de Léogâne, in French) [3] is located about 35 kilometers west of the capital Port-au-Prince. It is bordered on the northwest by the bay of Gonaïves, on the east by Gressier and Carrefour Communes, on the south by Jacmel Commune, and on the west by Grand-Goâve Commune. Léogâne Commune has an administrative area of 385 square kilometers and consists of 13 section communales.

About 70% of Léogâne Commune is covered by steep mountains and the remaining 30% is an alluvial plain. In mountainous areas, unregulated cultivation and abandonment have been repeated and the land has become quite denuded with only a small area of natural forests. The plain field is used for agriculture and mainly sugar canes, bananas and mangos are grown. Existing urban districts have been formed mainly in and around the city of Léogâne (ville de Léogâne in French – not an administrative city district but the area within the commune designated as an urban district) and along national roads.

The population of Léogâne Commune is 157,221 as of 2003 (data from IHSI), about 70% of which lives in the three section communales in the plain area.

The Great Haiti Earthquake has created many IDPs (internally displaced persons) in Léogâne Commune. According to the record released by the International Organization for Migration (IDM) in July 2010, there are 281 IDP camps in the commune, with 53,962 families and a population of 234,136.

2. Policy for the development of the disaster recovery plan

Léogâne Commune, especially Léogâne City, was severely damaged by the Great Haiti Earthquake. However, as many poorly-constructed buildings were destroyed, this can be considered as a good opportunity to rebuild it into a better regional base. Based on the policy for the establishment of the basic plan for national land development described earlier, the policy for the establishment of the Léogâne Commune Disaster Recovery Plan shall be as follows.

- ◊ Establish a regional development plan for the recovery of the whole commune of Léogâne Commune and work toward effective and efficient recovery.
- ◊ Absorb population and industries as an important satellite city to ease overconcentration in the capital and support the capital's functions, and aim for sound development of the economy and infrastructures.
- ◊ Make efforts to increase the disaster-preparedness by establishing a land use plan for the whole city of Léogâne and designating areas for priority reconstruction measures.

As farmland occupies most of Léogâne Commune for geographical reasons, reinforcement of the agricultural sector is essential to the recovery of social and economic activities in the community. Therefore, it seems important to put the following items concerning agriculture at the center of the

[3] The local governments in Haiti consist of 10 departments, 42 arrondissements, 138 communes and 565 section communales. Although densely-inhabited areas are classified as a city (ville), they are not administrative organizations but controlled by higher-level communes.

economic and social activities defined in the disaster recovery plan.

- Conservation of farmland and recovery of deserted farmland
- Efficiency improvement of agricultural production
- Restriction of urban sprawl (encroachment)
- Sustainable agricultural development in mountainous areas

For the area around Léogâne City, the central district of Léogâne Commune, a land use plan that can be a guideline for the development management in the whole city district should be established according to the following development policy so that sound and balanced expansion of the city with no sprawl will be promoted.

- Achievement of sound urban environment
- More efficient and compact urban functions
- Restriction of urban sprawl
- Promotion of urban agriculture

Moreover, based on the above-mentioned land use plan, areas where recovery measures should be preferentially carried out will be designated as "zones for reconstruction" and reconstruction works should be carried out according to the following policy.

- Development management through regulation and guidance
- Reconstruction of better living environment
- Promotion of construction of houses well-prepared against disasters
- Reinforcement of the community

The outline of the disaster recovery plan including development strategies based on the above-described policy is as described in Table B1.

Table B1 Outline of Disaster Recovery Plan for Léogâne Commune and Léogâne City

Area	Léogâne Commune	Léogâne City	
Purpose	• Contribution to easing of overconcentration in the capital • Support for return of IDPs (internally displaced persons)	• Increase disaster-preparedness of the city	
Guideline for development management	Broad zoning	Land use plan	Designation of areas for reconstruction
Development policy	• Conservation of farmland and recovery of deserted farmland • Efficiency improvement of agricultural production • Restriction of urban sprawl • Sustainable agricultural development in mountainous areas	• Achievement of sound urban environment • Efficiency improvement of urban functions • Restriction of urban sprawls • Promotion of urban agriculture	• Development management through regulation and guidance • Reconstruction of better living environment • Promotion of construction of houses well-prepared against disasters • Reinforcement of the community

Area	Léogâne Commune	Léogâne City	
Development strategy	• Conservation of farmland and natural forests and restriction of urban sprawl through zoning • Soil conservation and control of rainwater runoff through reforestation • Watershed management for sustainable agricultural development • Development of agricultural roads in plain areas • Sustainable agricultural development in mountainous areas • Promotion and efficiency improvement of agro-industry	• Rationalization of infrastructure investment through enclosure of existing urban areas • Planning of appropriate density • Flood control of the Rouyonne River • Active conservation of farmland in and around urban areas • Coexistence of urban land use and agriculture • Proper placement of disaster reduction bases (such as parks, open spaces and public facilities) • Attraction of population through improvement of educational and healthcare facilities • Development of environment to improve sanitation	• Development of public facilities in urbanization promotion areas • Restriction of housing development in other areas than residential and commercial/service areas • Improvement of living environment by communities • Redevelopment of dense urban areas • Land readjustment in areas where urbanization is in progress • Community reinforcement and reconstruction of houses through the use of NGOs • Effective utilization of the bank s of the Rouyonne River

(Data from JICA research team)

3. Framework for the plan (Ttarget year 2020)

Based on the future population forecast of each department by IHSI and MPCE, we have estimated future population of Léogâne Commune. As shown in Table B2, it is estimated that the population will be around 278,000 in 2020, the target year of the disaster recovery plan.

Table B2 Estimated Population of Léogâne Commune

	2003 (Census)	2010	2020
Population	157,221	198,346	278,478

(Data from JICA research team)

As development control based on a land use plan will be carried out in Léogâne City, the future population will be controlled according to the target population density for each land use. Based on the land use plan to be described later, the estimated population of Léogâne City in 2020 is 41,000[4].

4. Zoning of Léogâne Commune

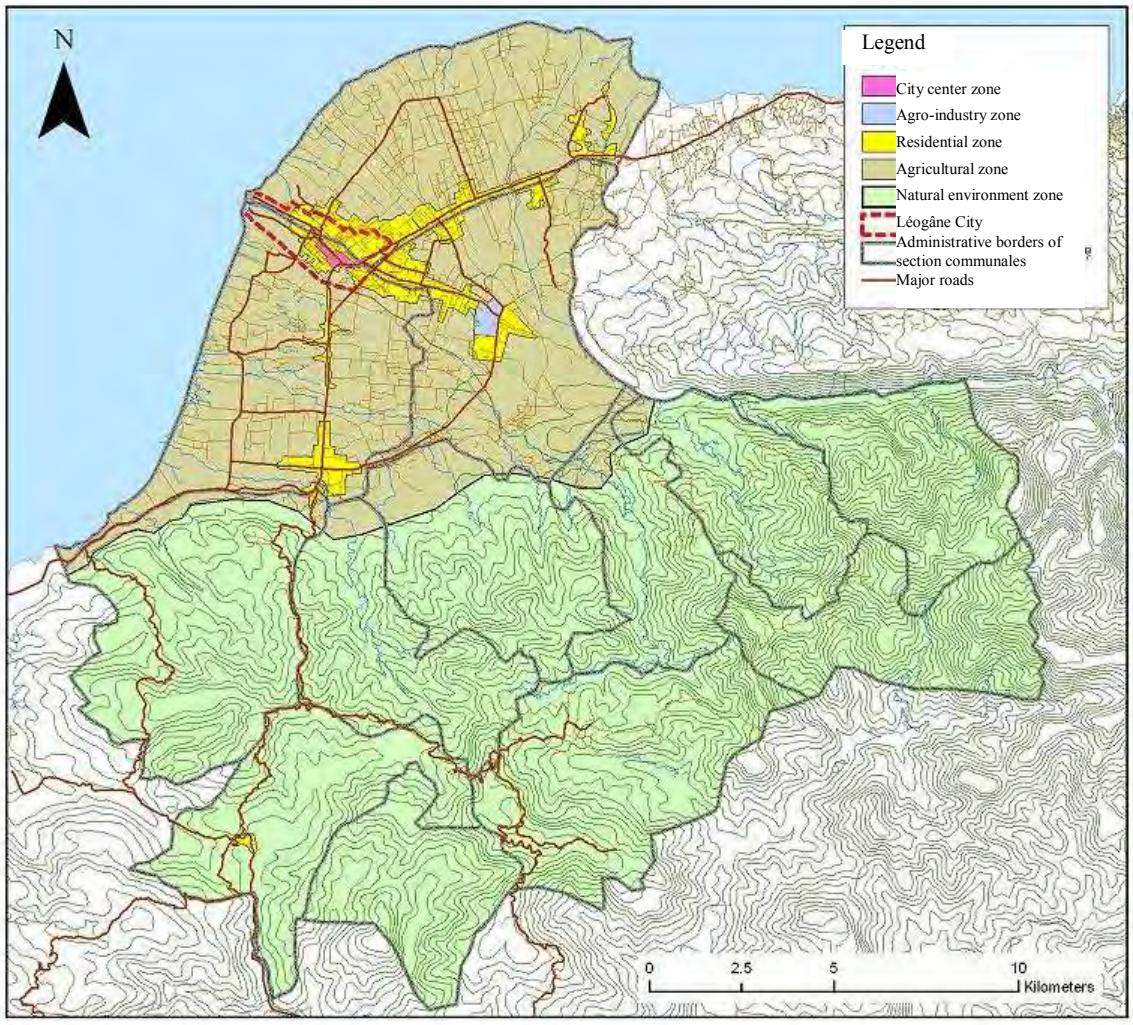
Based on the above-described policy for sound agriculture and absorption of population and industries, effective and efficient land use should be encouraged through zoning of Léogâne Commune into two main land use categories, nonurban land use and urban land use. The nonurban land use area will consist of agricultural zone and nature zone, while the urban land use area will consist of city center zone, agro-industry zone and residential zone. Plain areas and mountainous areas have been zoned based on the natural terrain.

As seen in Fig. B1, sound development of the city and conservation and development of good

[4] For the calculation of the population of the whole West Department, which has the capital Port-au-Prince, we used a population increase rate lower than the simple trend as the population concentration in Port-au-Prince will be controlled in a planned manner. (See A4-1.) However, for Léogâne Commune, we used the high increate rate set by IHSI as it will absorb some population of Port-au-Prince.

farmland will be aimed for with clear distinction between urban land use areas (city center, residential and agro-industry zones) and agricultural zone. Based on the policy to protect the natural environment and promote agriculture, urban land use in agricultural and nature zones should be restricted while effective and dense land utilization should be promoted in the urban land use area. The plain area is about 117 square kilometers (about 30% of the whole area of the commune), and the population density in 2020 will be about 1,650 per square kilometer.

Mountainous areas should be preserved as a natural environment zone, where efforts will be made for reforestation and sustainable agriculture in harmony with the nature, except in Fond de Boudin and Trouin in the southwest, where residential areas will be developed.



(Data from JICA research team)

Fig.B1 Zoning of Léogâne Commune

5. Land use plan in Léogâne City (Ville de Léogâne)

To prevent the negative effects of deregulated land use and encourage efficient recovery, a land use plan should be established. After the land use plan is agreed on, it will be necessary to study legislation for its implementation.

5-1 Land use classifications

Considering the actual state of current land use and the above-mentioned policy for the establishment of the disaster recovery plan, the land use plan in Léogâne City should be based on the following land use classifications.

(1) Residential area: Area with residential quarters

The residential area consists of two types of areas – low-density residential area and medium-density residential area. As shown in Table B3, definition of target intensity of land use is expected to contribute to the improvement of living environment.

In residential areas, sound living environment will be promoted through the improvement of urban infrastructures such as front roads, drainage and water system. In low-density residential areas, systematic conversion to urban areas will be carried out with the purpose of replacing deregulated urban sprawl with effective land use. In medium-density residential areas, communities well-prepared against disasters will be developed through such actions as securing front roads by developing dense residential areas.

Table B3 Target Intensity of Land Use for each Block

Land use classification	Population density (people/ha)	Residential density (houses/ha)	Building coverage (%)	Floor space index (%)
Low-density residential area	150	35	40	60
Medium-density residential area	210	50	40	80

Note: Building coverage (%) = building area/land area x 100
Floor space index (%) = total floor area/land area x 100
(Data from JICA research team)

(2) Commercial and service area: Area with many shops and offices

This type of area has community facilities such as schools and churches in addition to general houses. It is considered important to make this area a regional economic center.

(3) Public facility area: Area that should be used for relatively large government facilities, schools, gymnasiums, hospitals etc.

Currently most of such public facilities are located in the area between the grid pattern urban district of Léogâne City and former Route 2. Such facilities should be improved as disaster reduction bases through land use regulation.

(4) Suburban rural area: Suburban area with rural villages (covering a large area of existing forests)

For the purpose of preventing sprawl in residential areas, development of urban infrastructure should

not be conducted and housing development should be restricted in this type of areas.

Area along the Rouyonne River (buffer green zone): Area to be developed as a buffer green zone to reduce damage caused by flooding of Rouyonne River

It is considered desirable to carry out development of a buffer green zone where residence will be restricted and bank protection of the Rouyonne River with the aim of reducing damage caused by the overflowing Rouyonne River. The width of the green zone will be 200 meters, as defined by the Ministry of the Environment. However, the width can be 100 meters in areas part where 200 meters of width cannot be secured due to some residential areas that have already been formed. Residence in the buffer green zone will basically be prohibited.

(5) Urban farmland preservation area: Area that should be preserved as urban farmland

There is a large area of farmland around the existing urban areas of Léogâne City, which add a sense of liberation and interest to the landscape of the city as well as being important sites for local economic activities of urban agriculture. Although areas where urban sprawl has already progressed should be efficiently urbanized, remaining small area of farmland around urban areas should be kept as future assets through proactive preservation and housing control as such land can contribute to disaster reduction as a buffer zone.

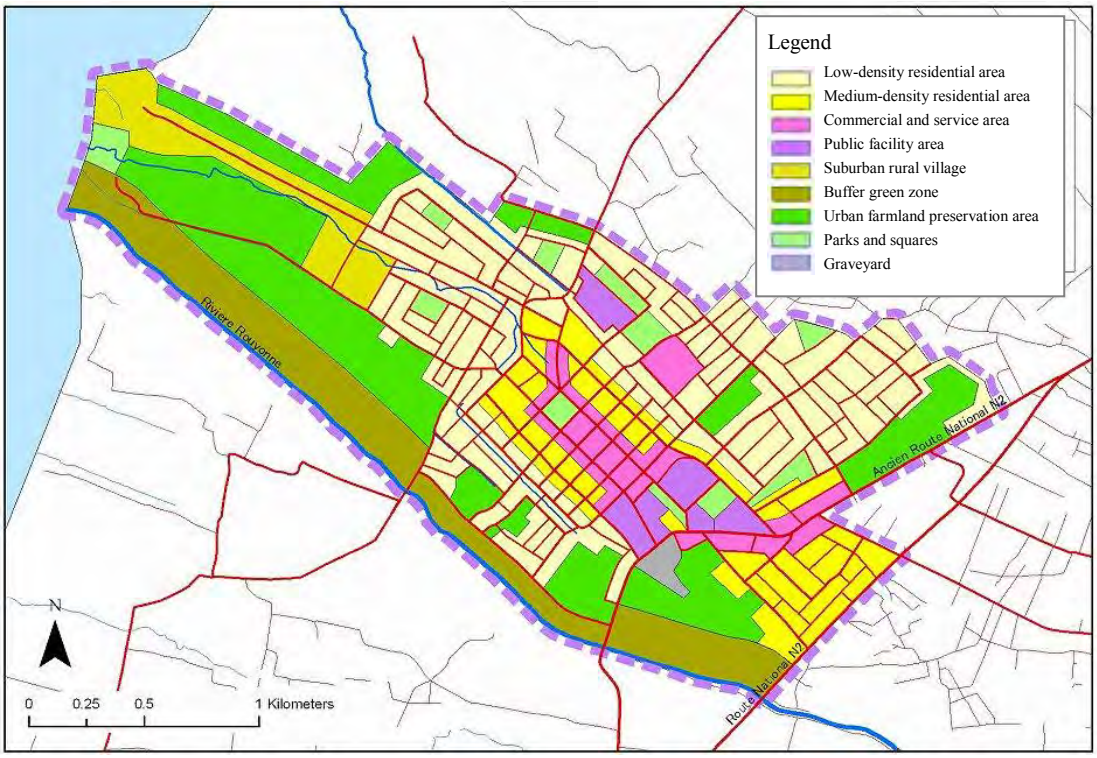
(6) Park and square area: Area with parks and squares

As a general rule, there should be a park or square in each neighborhood unit to provide space that has a function as an evacuation center at the time of a disaster as well as a place for community recreation and other activities.

(7) Grave area: Existing graveyard. The areas should be kept as they are.

5-2 Land use plan

The land use plan of Léogâne City is as shown in Fig.B2. The trend of urbanization, environmental elements to be preserved and disaster reduction necessities have been taken into consideration.



(Data from JICA research team)

Fig.B2 Land use plan in Léogâne City

In addition to existing urban areas, areas where many houses have already been built should also been designated as residential areas. In these areas, sprawl into other areas should be prevented and sound urban environment should be formed through systematic development of urban infrastructure such as roads, water supply and sewage systems, and suburban parks, as well as through promotion of efficient use of land. As for commercial and service areas, to reflect the current situation, the areas along former Route 2 and the central area of the old town (grid pattern urban district) and the open space (Chatuley) that Léogâne City has been planning to develop a market should be designated as commercial and service areas and be developed. As much farmland near existing urban areas as possible should be preserved as buffer zones against disasters, together with the buffer farmland and green zones along the Rouyonne River.

Table B4 shows the area and estimated population of each land use classification in 2020, the target year of the disaster recovery plan.

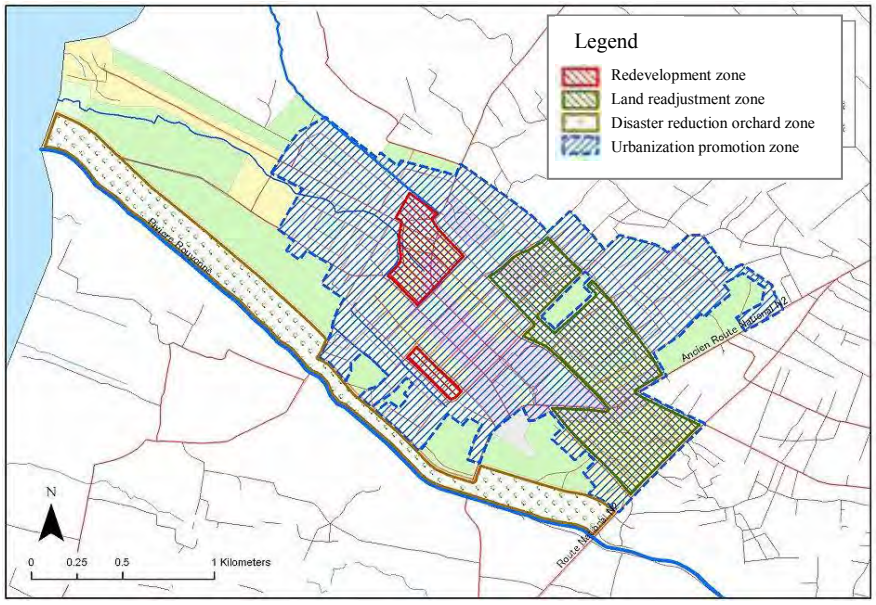
Table B4 Land use plan in Léogâne City and Estimated Population (2020)

Land use	Area		Target population density (people/ha)	Estimated population in 2020
	(ha)	Coverage (%)		
Low-density residential area	154.1	32.2	150	23,115
Medium-density residential area	55.1	11.5	210	11,571
Commercial and service area	27.5	5.8	110	3,029
Public facility area	16.2	3.4	40	650
Suburban rural village	28.2	5.9	40	1,128
Buffer green zone	66.4	13.9	-	-
Urban farmland preservation area	109.2	22.8	15	1,638
Parks and squares	18.3	3.8	-	-
Graveyard	3.0	0.6	-	-
Total	478.1	100.0	-	41,131

(Data from JICA research team)

6. Designation of zones for disaster recovery

Based on the development policy for each area, described in the above section concerning the land use plan, four zones should be designated as zones where projects for the disaster recovery of Léogâne City will be preferentially carried out as shown in Fig.B3. Designation of these zones is also a means to achieve the above-described land use plan.



(Data from JCIA research team)

Fig.B3 Plotting for Disaster Recovery of Léogâne City

The general description and purpose of each zone are shown below.

(1) Urbanization promotion zone: Zone where urban functions should be concentrated in a planned manner (area of 275 hectares)

This zone includes “low-density residential area and medium-density residential area”, “commercial and service area”, “public facility area”, and “parks and open spaces”, described in the section concerning land use plan. The zone has an area of 275 hectares. In this zone, sound urbanization will be aimed for by making it mandatory for government agencies to develop urban infrastructure and provide public services concerning roads, drainage facilities, water supply system, parks, electric power

distribution and waste collection. Housing development outside this urbanization promotion zone will have to be strictly restricted to avoid inefficient infrastructure development in the future.

(2) Redevelopment zone: Zone within the above-mentioned urbanization promotion zone where houses have been densely built without development of front roads and improvement works should be preferentially carried out from the viewpoint of disaster reduction (2 locations, total area of 15.4 hectares)

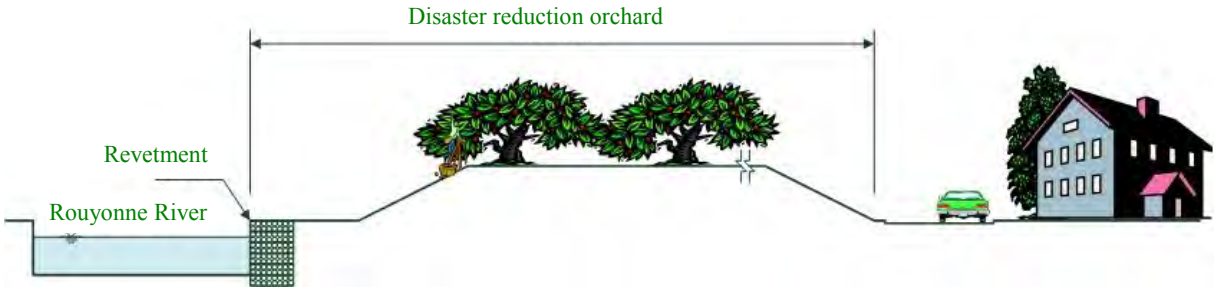
In these zones, redevelopment of urban areas will be carried out with public intervention, but the success will largely depend on the community involvement. Therefore, projects will start with consensus building on reconstruction in the community. Reconstruction should be carried out through various measures including joint construction and operation of commercial buildings and collective housing by land owners, technical and financial support from the government for the improvement of urban environment (front roads, drainage facilities, water supply system etc.), and technical and financial support from the government and NGOs for the construction of quake-resistant housing. For the construction of commercial buildings, private fund infusion should be actively promoted.

(3) Land readjustment zone: Zone around existing urban areas where there are still relatively large area of empty lots but urban sprawl is certainly happening (area of 54.6 hectares)

If no measures are taken, the zone will be overcrowded with houses without necessary urban infrastructure and the living environment will deteriorate. Therefore, land readjustment should be carried out in an integrated manner and road improvement should also be preferentially conducted. The zone has an area of 54.6 hectares. As with the above-mentioned redevelopment zone, the first step to forming a project will be consensus building in the community. In principle, land for public use such as roads will be obtained for the project implementation, partially from landowners. Technical and financial support from the government will be essential to the improvement of urban environment such as front roads for houses.

(4) Buffer green (disaster reduction orchard) zone: Zone to be developed mainly for the purpose of reducing flood damage caused by the overflowing Rouyonne River (area of 54.1 hectares)

Development of the zone within 200 or 100 meters from the revetment of Rouyonne River as disaster reduction orchard will reduce flood damage caused by the overflowing Rouyonne River, and, as an additional effect, provide new comers with opportunities for cash income from fruit cultivation with the participation of residents. Fig. B4 shows the concept of the disaster reduction orchard.



(Data from JICA research team)

Fig.B4 Concept of Disaster Reduction Orchard

7. Infrastructure and public facility plan

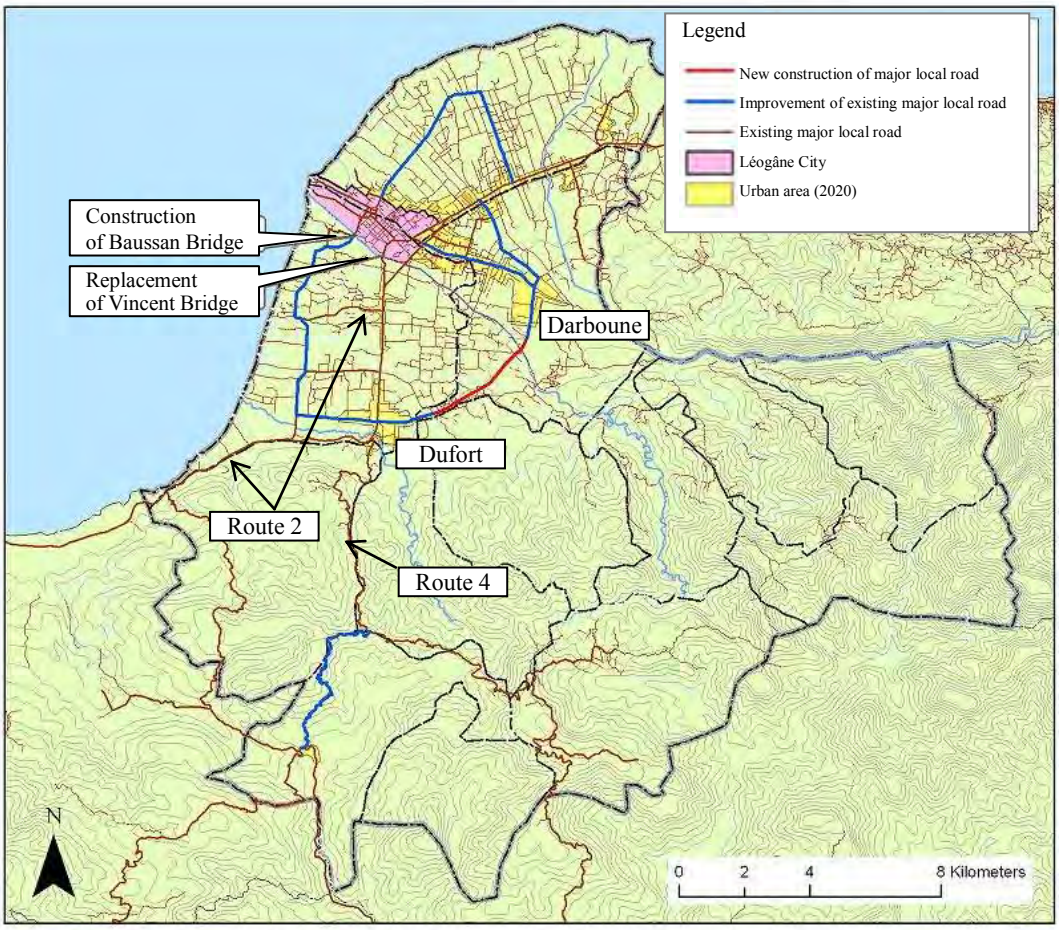
Establishment and implementation of plans for infrastructures and public facilities in each sector will be necessary to carry out the Léogâne disaster recovery plan.

The details of such development plan for each sector (roads and bridges, water supply, electricity, drainage, bank protection and rivers, and public facilities) are described below.

7-1 Roads and bridges

(1) Plan for road network improvement in Léogâne Commune

The road surface condition in the commune is extremely bad because all roads except national roads are unpaved and road maintenance is not properly conducted. Such bad road condition affects the transportation of agricultural products from the production area. Some say 35% of the agricultural products are wasted due to poor access from the place of production to the market. Considering such situation, existing major local roads (Route Secondaire) that form loop roads will be improved as shown in Fig.B5.



(Data from JICA research team)

Fig.B5 Plan for Road Improvement in Léogâne Commune

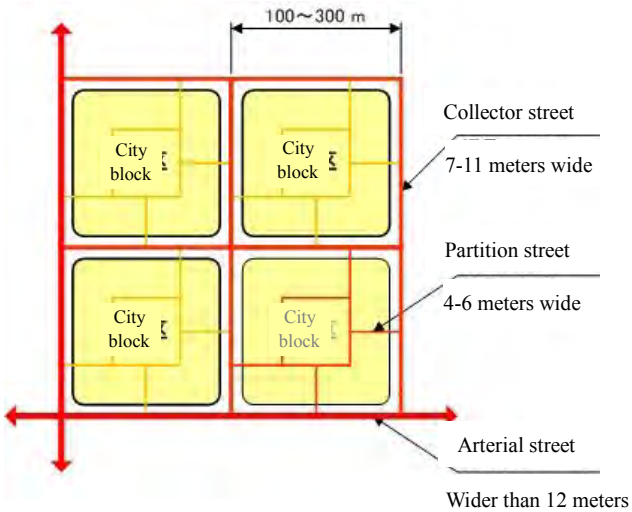
As the loop road connecting Dufort, the branch point of Route 2 and Rout 4, and Darboune, where a public sugar refinery is located, is partially discontinued, new road construction will be required for the

part (3.8 kilometers). As part of the major local road (6.4 kilometers) connecting Route 4 and Trouin, a section communal in the south, which forms a relatively large community, cannot accommodate auto traffic, the part of this road should be improved. As for the length of the target roads for road network improvement, the total length of existing local major road sections for improvement will be 33.7 kilometers and that of sections for new road construction will be 3.8 kilometers.

(2) Street improvement plan in Léogâne City

The tasks concerning street improvement in Léogâne City are access improvement in the town center, which has become densely-housed without sufficient front roads, and measures against urban sprawl that has been progressing without street improvement.

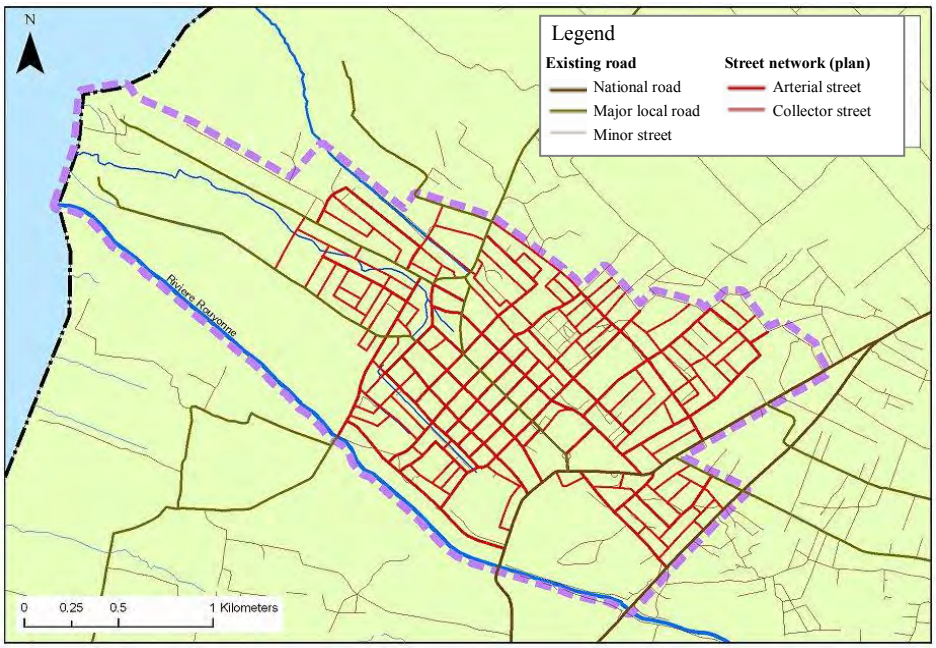
Therefore, when streets are improved, sound urbanization should be promoted through the phased arrangement of streets of varying width with a land use plan, positional relation of the city center and major urban facilities, urbanization trends etc. taken into consideration. Fig.B6 shows the concept of phased arrangement of streets.



(Data from JICA research team)

Fig.B6 Phased Arrangement of Streets

A block surrounded by arterial streets and collector streets should be treated as a city block, and the standard length of a side should be around 100-300 meters. As a basic rule, all house lots in each city block should face a road for disaster reduction reason. Access to house lots in each city block is secured by partition street. Fig.B7 shows a street improvement plan with phased arrangement of streets based on the land use plan of Léogâne City etc.



(Data from JICA research team)

Fig.B7 Street Improvement Plan in Léogâne City

(3) Road paving in urban areas

As the existing grid pattern roads in the city center are still largely unpaved, pavement improvement works will be started in 2011 with a Japanese grant aid for the purpose of improving the environment for economic activities.

(4) Replacement of existing bridges and construction of new ones

As the Vincent Bridge over the Rouyonne River, which runs in the southwest of Léogâne City, has become a bottleneck where the river course cross-section becomes too small when the river is swollen due to insufficient cross-section caused by accretion of sand discharged from the upper river basin, river bank erosion and some structural issues (short span and small clearance), there is an urgent need to replace this bridge. As Baussan, downstream from the Vincent Bridge, is an important traffic route for neighboring community, construction of a new bridge needs be planned where the road crosses the river.

7-2 Water supply

The task of Léogâne City concerning water supply is the restoration and expansion of water supply service, which has stopped since 2008, when a hurricane washed out the water line laid from a spring near the Momance River. Stable and safe water supply is essential to the improvement of people's living and economic activities. Therefore, restoration and reconstruction of water facilities will be important.

7-3 Electricity

Issues concerning electricity supply in Léogâne Commune are lack of stable power supply capacity, inadequate capacity of distribution lines to cope with future demand increase, and lack of emergency power supply in public facilities. To solve these issues, we propose the following concept for electricity

supply development.

- Ensuring of stable life of residents through early restoration of the existing electricity network
- Ensuring of stable electric power supply by forecasting electricity demand and reviewing electricity network improvement plan in consideration of relocation of residents
- Coordination between the emergency electricity network of Léogâne Commune and other networks from independent power sources in neighboring areas
- Improvement of electricity supply capacity through the construction of new electric power lines (69kV)
- Securement of emergency alternative power source through the installation of emergency generators in public facilities and introduction of renewable energy such as solar power

7-4 Bank protection and rivers

To reduce damage by flooding of the Rouyonne River, bank erosion needs to be controlled with bank protection measures such as installation of wire cylinders in the downstream from Neuf Bridge, in addition to the above-described replacement of Vincent Bridge. Bank protection works will be carried out on the right bank of the Rouyonne River to reduce flood damage in urban areas, but it will also be necessary in the future to carry out bank protection works on the left bank so that flood damage in surrounding farmland will be reduced.

7-5 Drainage

To reduce damage by flooding of the Rouyonne River, drainage development in urban districts will also have to be tackled. Improvement of drainage facilities will contribute to the improvement of sanitary conditions as well.

In 2011, road drainage construction will be conducted with a Japanese grant aid around the city center together with road pavement construction. As the purpose of this work is emergency reconstruction, it will only be to discharge waste water from existing urban areas to existing drainage. In the future, a watershed management plan for the whole watershed will have to be established and implemented.

7-6 Public facilities

Public buildings that had been built poorly, such as cultural and educational facilities including schools and libraries, healthcare facilities including public health centers, clinics and hospitals, public facilities including city office, and recreation facilities including parks, were all severely destroyed by the Great Haiti Earthquake and need to be reconstructed soon. For the maintenance of people's good health, it is necessary to create spaces for health education in school, for preventive medicine and health management in public health centers, for medical treatment in clinics and hospitals etc.

8. Building administration improvement plan

To prevent formation of dense residential areas with poorly-constructed houses and promote sound urban environment, land use management, through the use of the building coverage and floor space index, and strict application of building standards can be effective. In order to carry out such measures, the local government has to enhance the qualifications of individual officers through administrative support from various donors and training on urban planning and building administration systems and at the same time to foster people's trust in the government. Since construction of houses except public ones is carried out by private individuals or corporations, introduction of low-cost method for quake-resistant housing construction and improvement of access to funds as well as compliance with building standards are sought after.

9. Agricultural sector development plan

Agricultural sector is one of the most important economic sectors in Haiti, where over 50% of the population are farmers (Section 4.2.1, Action Plan for National Recovery and Development of Haiti, 2010). Farmland covers as high as 40-85% of the land in the 13 section communales in Léogâne. High priority should be given to this sector because products can be produced immediately and be used as daily foods.

The tasks in the agricultural sector include reforestation of mountainous areas devastated as a result of repeated cultivation and abandonment, development of sustainable agriculture in mountainous areas, modernization of agricultural techniques and improvement of market access. To tackle such tasks, agricultural development should be promoted in the agricultural sector of Léogâne Commune under the following development policies.

- Sustainable development of agriculture in mountainous areas through the restoration of natural forests with replanting and fruit cultivation
  (It will increase water retaining characteristics, contribute to disaster reduction and promote effective land use.)
- Upgrade and expansion of existing irrigation systems and improvement of agricultural roads to maximize potential of agricultural production
  (Existing irrigation systems and agricultural roads need upgrading and expansion. Priority should be given to the improvement of existing facilities, rather than new development.)
- Construction of reservoirs in mountainous areas to obtain irrigation water and drinking water
  (Reservoirs will increase productivity and promote use of daily life water.)
- Supply of agricultural kits, seeds and implements
  (It will be direct support for the improvement of agricultural productivity.)
- Fostering of agricultural extension workers for the implementation of sustainable agriculture
  (A system for human resource development and diffusion of techniques will be established to continue and extend the activities of agricultural extension workers, and through their guidance, expansion of sustainable agriculture will be promoted.)

- Structural reform of agriculture in mountainous areas through the introduction of techniques for cultivation in greenhouse and freshwater fish farming
  (Add value to agricultural products, increase income and improve people's living.)
- Efficiency improvement of the distribution system for agricultural products
  (Income increase can be achieved when not only production but also the distribution system is improved. Take advantage of the location close to the capital.)
- Concentration of agro-industry as a means to create employment and development of related infrastructure such as transportation/distribution facilities, storage facilities, water supply and sewerage systems, and electricity and communication systems
  (Economy and income should be expanded through the introduction and promotion of agro-industries, such as agricultural product processing, food processing and production of alcoholic beverage.)

10. Disaster reduction plan

Issues of Léogâne Commune concerning disaster reduction include that there is no efficient disaster reduction service organization in the government due to the shortage of manpower and budget; therefore that disaster reduction services cannot be provided to the residents because information related to disaster reduction cannot be collected, analyzed or communicated and cooperation with the central government offices or private services is difficult; that the residents have few self-defense tools against disasters; and that there is a lack of an urban plan to promote creation of a sound and disaster-prepared city and there is also a lack of an organization for the implementation of such a plan.

Government- and community-level measures to address these issues include the followings.

(Central government)

- Establishment of quake-resistant building standards
- Promotion of quake-resistant measures and prevention of construction of weak buildings through the development of a building confirmation system
- Prevention of formation of dense residential areas with laws concerning urban planning
- Establishment of a flood control plan for major rivers
- Support from the Disaster Prevention Bureau of the Ministry of Interior for the creation of hazard maps etc.

(Local government)

- Establishment of a flood control plan for local rivers
- Implementation of measures such as bank reinforcement based on the flood control plan
- Announcement of dangerous areas with a hazard map etc. and awareness-raising concerning disaster reduction

(Community)

- Promotion of formation of a community at the level of city block where there is no community formed
- Promotion of information sharing within a community and community disaster reduction activities

Disaster reduction measures against each type of natural disasters that may occur in the Léogâne Community are as described in Table B5.

It is necessary for the government, private bodies, communities and individuals to carry out measures in cooperation so that disaster damage will be minimized and quick recovery and reconstruction will be promoted.

Table B5 Disaster Reduction Measures

Disaster	Category	Prevention/reduction	Recovery and reconstruction
Earthquake	Tangible measure	・ Construction of quake-resistant structures and reinforcement of existing buildings ・ Construction of simple frame quake-resistant buildings ・ Installation of disaster reduction radio system ・ Development of disaster reduction centers ・ Stock of materials for temporary facilities	・ Development of disaster reduction bases and centers
	Intangible measure	・ Support for the promotion of community disaster reduction activities ・ Publicity of the easy-to-swaying map	・ Designation of wide-area evacuation sites ・ Communication of information concerning disasters, hurricanes, weather forecasts etc. by radio, advertising equipment etc. ・ Rescue and support among communities
Flood	Tangible measure	・ Reinforcement of river banks and installation of revetment ・ Widening of river channels and dredging ・ Construction of drainage ・ Development of prediction and alarm system	・ Repair of river banks ・ Dredging of river channels and drainage
	Intangible measure	・ Support for the promotion of community disaster reduction activities ・ Publicity of hazard map ・ Evacuation drill to actual evacuation sites	・ Communication of information concerning disasters, weather forecasts etc. by radio, advertising equipment etc.
Hurricane (strong wind)	Tangible measure	・ Wind-resistant measures for building structures	・ Wind-resistant measures for building structures
	Intangible measure	・ Support for the promotion of community disaster reduction activities ・ Evacuation drill to actual evacuation sites	・ Communication of information concerning disasters, hurricanes, weather forecasts etc. by radio, advertising equipment etc.
Hurricane (tidal waves)	Tangible measure	・ Establishment of breakwaters and protection forests against storm surge	・ Establishment of breakwaters and protection forests against storm surge
	Intangible measure	・ Support for the promotion of community disaster reduction activities ・ Creation and publicity of hazard maps ・ Evacuation drill to actual evacuation sites	・ Communication of information concerning disasters, hurricanes, weather forecasts etc. by radio, advertising equipment etc.
Mudflow	Tangible measure	・ Construction of retaining walls, erosion control works ・ Improvement of drainage ・ Tree planting	・ Designation of evacuation sites ・ Removal of sediment
	Intangible measure	・ Support for the promotion of community disaster reduction activities ・ Creation and publicity of hazard maps ・ Evacuation drills to actual evacuation sites	・ Communication of information concerning disasters, hurricanes, weather forecasts etc. by radio, advertising equipment etc.

(Data from JICA research team)

11. Project implementation plan

Table B6 and Table B7 show the priority projects and programs that are to be implemented by 2020 for the disaster recovery of Léogâne Commune.

Table B6 List of Priority Projects and Programs (1/2)

No.	Sector	Title	Outline	Executing agency	Priority	Estimated cost (Mil. US$)	Implementation schedule 2011 – 2016
1	Urban redevelopment	Improvement of living environment in urbanization promotion area	Develop infrastructure such as roads, drainage facilities and water supply facilities in the urbanization promotion area (275ha) designated for disaster recovery of Léogâne City to improve living environment.	Léogâne Commune, MTPTC	D	150.0	
2		Redevelopment of dense residential areas	Conduct redevelopment and improve living environment in the areas (15.4ha) where houses were already densely built before the earthquake and dangerous residential areas inappropriately prepared against disasters are expected to be formed again in the urbanization promotion area of Léogâne City if no measures are taken.	Léogâne Commune, MTPTC	C	10.0	
3		Land readjustment around urban districts	Acquire sites for public facilities by readjusting and consolidating land plots and improve living environment by developing such facilities in the blocks (54.6ha) within the urbanization promotion area of Léogâne City where deregulated urbanization has progressed, especially around existing urban districts.	Léogâne Commune, MTPTC	D	30.0	
4		Improvement of administrative capacity in the field of urban management	Concerning urban development control, improve administrative capacity of administrative officers of Léogâne Commune and branch offices of other related government organizations.	MTPTC	C	3.0	
5		Community reinforcement for participative development	Community's consensus is essential to integrated alternation of certain areas of a city and improvement of living environment. Therefore, foster leaders and promote resident participation in planning as well as deepening residents' understanding by establishing a residents' council etc.	Léogâne Commune, MTPTC	C	3.0	
6	Agricultural development	Rehabilitation and expansion of existing irrigation system	Rehabilitate the existing irrigation system in the plain area that was damaged by urban sprawl into farmland and floods, and extend the irrigation system to unused land that can potentially be used as farmland.	MARNDR	C	5.0	
7		Improvement of major agricultural roads	Improve road surface conditions of existing major agricultural roads leading to a national road or major local road, especially in the plain area.	MARNDR	D	2.0	
8		Sustainable development of agriculture in mountainous areas	As the excessive deforestation in mountainous areas is increasing flood damage around the downstream basin, investigate the possibility of development of sustainable agriculture in mountainous areas based on forest [illegible]	MARNDR	D	2.0	
9		Reafforestation in denuded land in mountainous areas	Restore forests through reafforestation in denuded land in mountainous areas, and expand livelihoods of farmers in mountainous areas through promotion of fruit cultivation.	MARNDR	C	9.0	
10		Fostering of agricultural extension workers	Foster agricultural extension workers who will visit farming villages and give guidance to secure farmers, farmland and farming techniques, to achieve stable food supply, and to realize sustainable agriculture.	MARNDR	D	3.0	
11		Program for improvement of processing and distribution system for agricultural products	Promote development of an agro-industry zone that is planned to have a public sugar refinery in Darboune as a core, through construction of facilities to support efficiency improvement and modernization of processing and distribution of agricultural products as well as storage facilities.	MARNDR	C	4.0	
12		Improvement of management of public sugar refinery	Conduct business diagnosis of a public sugar refinery in Darboune, which has various issues concerning funding, human resources, maintenance, market competitiveness etc., and establish a restructuring plan.	MARNDR	D	1.5	
13		Modernization of agriculture in mountainous areas	With the purpose of promotion of fishing industry through introduction of farming technology and diversification of commercial crops through greenhouse cultivation, carry out pilot projects and explore the possibility of modernization of agriculture in mountainous areas.	MARNDR	D	4.0	
14		Support to small-hold farmers	With the purpose of reconstruction of small-hold farmers' living, provide agricultural kits, seeds and agricultural implements.	MARNDR	D	0.5	
15		Watershed management program for major rivers	Establish watershed management plans for the 3 major rivers of Momance, Rouyonne and Cormiers to manage agricultural and municipal water while preventing flood and preserving the environment.	MARNDR	D	2.5	
16	Disaster reduction	Revetment work along the downstream of the Rouyonne River	Build revetments along the downstream of the Rouyonne River from Route 2 to prevent flood and bank erosion.	MTPTC	B*	4.0	
17		Revetment and repair work along the mid- and downstream of the Momance River	Finish the unfinished revetment work along the downstream banks from around the exit of the Momance River Valley. Also repair the damage made by the earthquake.	MTPTC	D	25.0	
18		Development of disaster reduction orchards	Develop disaster reduction orchards in buffer green zones designated in the land use plan of Léogâne City. Technical assistance will be necessary concerning the selection of tree species and knowhow of the operation.	Léogâne Commune	D	3.0	
19		Prevention of sediment discharge from mid- and downstream torrents, afforestation	Prevent flash floods as well as soil erosion in forests through the construction of simple dams etc. along small torrents in the mid- and downstream. Prevent outflow of soil by covering slope faces with plants, e.g., planning trees along the upper- and midstream or planning fruit trees on terraced land.	MTPTC	B	NA	
20		Prevention of erosion of roads in mountainous areas	The lower face of road slopes in mountainous areas may be eroded by flowing rain water etc. If erosion progresses, it may cause landslide, which then cause damage or stop traffic in adjacent areas. Therefore measures to prevent erosion should be taken.	MTPTC	D	NA	
21		Awareness-raising concerning disaster reduction	Raise awareness of disaster reduction by spreading knowledge about natural disasters such as earthquake, flood, hurricane, tidal waves and landslide. Seek maximum cooperation from the community leader.	Léogâne Commune	C	0.6	

Priority - A: Top priority B: High priority C: Highly important D: Important (A*and B*: See Annex B "Project Profile".) NA: Cost not calculated due to lack of data

(Data from JICA research team)

Table B7 List of Priority Projects and Programs (2/2)

No.	Sector	Title	Outline	Executing agency	Priority	Estimated cost (Mil. US$)	Implementation schedule 2011 – 2016
22	Transportation	Improvement and extension of major local roads	Improve local loop roads created in farmland in plain area and the major local road in a mountainous area connecting Route 4 and Trouin. Construct new roads where roads are disconnected.	MTPTC	D	10.0	
23		Replacement of Vincent Bridge	Replace the existing Vincent Bridge with a new one designed in consideration of the flood level of the existing bridge to eliminate bottlenecks.	MTPTC	B*	1.0	
24		Construction of Baussan Bridge (tentative name)	Construct a new bridge where a major local loop road crosses the Rouyonne River in the Baussan area.	MTPTC	D	0.7	
25		Improvement of a bus terminal	A roundabout intersection near former Route 2 in Grand Rue is currently used as a bus terminal, but it holds up traffic. Therefore, improvement of the bus terminal, including consideration of relocation, should be conducted.	MTPTC	D	2.0	
26		Road paving work in the city center of Léogâne	Road paving work in the city center of Léogâne. Repair existing asphalt roads and lay interlocking pavement on unpaved roads. Also construct road drainage facilities.	MTPTC	A*	12.3	
27	Urban environment	Urgent rehabilitation of water facilities (QIP)	Replace water pipes in the urban district of Léogâne City. Use public wells as a temporary alternative to the La Porte Well.	DINEPA	A	0.3	
28		Restoration of water supply facilities	Secure safe and stable water sources and improve water facilities in the urban district of Léogâne City including Gressier.	DINEPA	A*	10.0	
29		Integrated improvement of urban drainage in Léogâne City and surrounding urban areas	Based on the Watershed management plan for major rivers, improve urban drainage in an integrated manner in Léogâne City and surrounding urban areas including Darboune.	MTPTC	D	6.0	
30		Establishment of a waste management plan	Establish a comprehensive waste management plan concerning collection, transportation and final disposal of waste in Léogâne City and surrounding urban areas.	MTPTC	D	2.5	
31		Development of a final waste disposal site	Based on a waste management plan, develop a environmentally-friendly final disposal site with such measures as sanitary landfill.	MTPTC	D	10.0	
32		Spread of septic tanks etc.	As the water quality of existing drainage and irrigation channels has seriously worsened due to the discharge of domestic wastewater, promote installation of septic tanks etc. through such measures as a mandatory building license system and educational activities.	Léogâne Commune	D	3.0	
33	Electric power distribution	Establishment of a power distribution network development plan	Reassess electricity demand, considering relocation of residents, and review the power distribution development plan.	EDH	C	0.7	
34		Power distribution network enhancement program	Repair and enhance power distribution network, considering relocation of residents.	EDH	C	3.0	
35		Emergency power generator installation program	Install emergency power generators in the Léogâne City office and other major public facilities.	Léogâne Commune	C	0.0	
36		Renewable energy introduction program	Conduct feasibility study concerning the introduction of renewable energy (solar power generation, small hydraulic power generation, solar street lights etc.). Implement feasible projects.	EDH	B*	5.0	
37		Stable power system operation program	Connect distribution lines to a nearby distribution network (Grand Goave) and develop new distribution lines (69kV).	EDH	B*	9.0	
38		Rural community electrification program	Conduct electrification in rural communities.	EDH	D	10.0	
39	Reconstruction of houses	Spread of quake-resistant housing for low-income earners	Spread quake-resistant houses that low-income earners can build on their own. The National center for Prevention of Disasters (CENAPRED), who develops such quake-resistant house construction methods in neighboring Mexico, can be a good candidate aid organization.	Léogâne Commune, MTPTC	C	3.0	
40		Capacity improvement of building administration officers	Improve capacity of building administration officers of Léogâne Commune for proper implementation of the building standards that MTPTC is trying to establish. It will be effective if this is implemented at the same time as the above-described CENAPRED's activities for the spread of quake-resistant house construction methods.	Léogâne Commune, MTPTC	C	3.0	
41		Reconstruction of collective housing with aid from NGOs	Obtain technical and financial aids from NGOs and build houses with quake-resistant method through the establishment of an associative responsibility system among land owners of an certain area.	NGO	C	NA	
42	Public facilities	Reconstruction of public schools	Reconstruct 7 public elementary schools, a public secondary school and a public high school that were destroyed by the earthquake.	FAES	C	NA	
43		Development of an agricultural vocational training school	Develop an agricultural vocational training school to raise the overall level of agricultural production.	MARNDR	D	NA	
44		Construction of the office of Léogâne Commune	Rebuild a quake-resistant office building. Incorporate functions of a disaster countermeasure center at the time of a disaster while reserving enough working space.	Léogâne Commune, MTPTC	D	6.0	
45		Construction of Chatulet Market	Construct a one-storied market building (8,000 square meters) in the Chatulet square, where there is an open market now.	Léogâne Commune, MTPTC	D	NA	
46		Reconstruction of Sainte-Croix Hospital	Reconstruct hospital facilities damaged by the earthquake.	MSPP	C	NA	
47		Reconstruction of Sigueneau Sanatorium (tuberculosis sanatorium)	Reconstruct the medical ward, administrative building etc. destroyed by the earthquake.	MSPP	C	NA	

Priority - A: Top priority B: High priority C: Highly important D: Important (A*and B*: See Annex B "Project Profile".) NA: Cost not calculated due to lack of data

(Data from JICA research team)

12. Recommendations

Based on the above-described study results, we recommend the followings.

- ◊ This project plan needs be finalized through opinion exchange, interaction and cooperative activities led by the department of Léogâne Commune in charge and with other organizations that conduct activities in Léogâne, such as the National Land Improvement and Regional Development Bureau of the Ministry of Planning and External Cooperation (MPCE – DATDLR), civic organizations, NGOs, international organizations and the Fund of Economic and Social Assistance (Fonds d'Assistance Economique et Sociale or FAES).
- ◊ Léogâne Commune needs to create a department for urban planning, as a permanent department in charge of the establishment and management of recovery plans and urban development plans, and acquire necessary budget and personnel. Means to secure financing could be direct financial assistance from donors and NGOs and subsidies from the central government through donors' help. The urban planning department will need at least a general manager and two staff members.
- ◊ Appointing consultants (advisers) from home and abroad who have plenty of experience in disaster recovery or urban planning and its implementation will be one of the effective means to promote this plan.
- ◊ The urban planning department of Léogâne Commune will be required to understand correctly and summarize the needs in the commune, using the above-mentioned organizations that are in action.
- ◊ To have a correct understanding of the needs of Léogâne Commune, they will need to cooperate with citizens and NGOs that carry out grass-roots activities concerning promotion of hygiene and community disaster reduction.
- ◊ The needs collected by the Urban Planning Department of Léogâne Commune will have to be immediately reported to the Ministry of Planning and External Cooperation (MPCE) through the mayor of Léogâne City.
- ◊ It is hoped that, in close communication and coordination with NPCE-DATDLR, Léogâne Commune will promote the project implementation led by the central government ministries including the Ministry of Public Works, Transport and Communication (MTPTC).

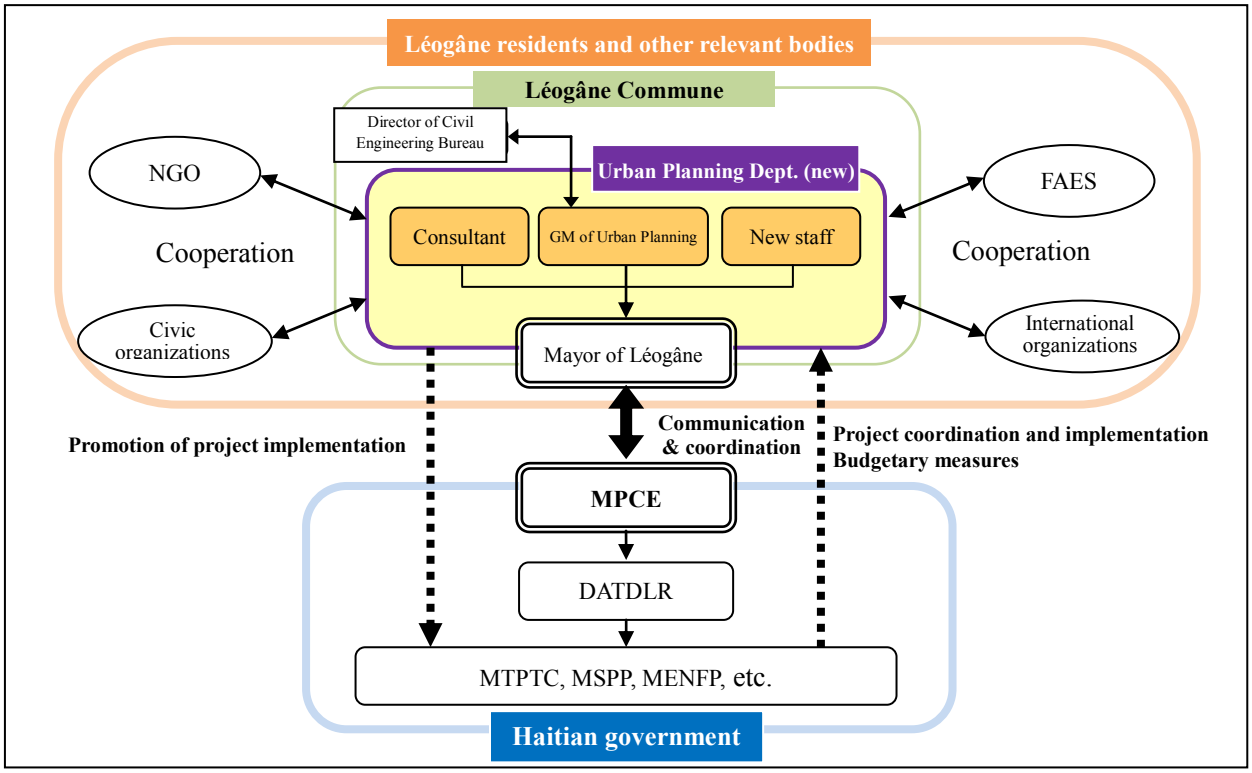


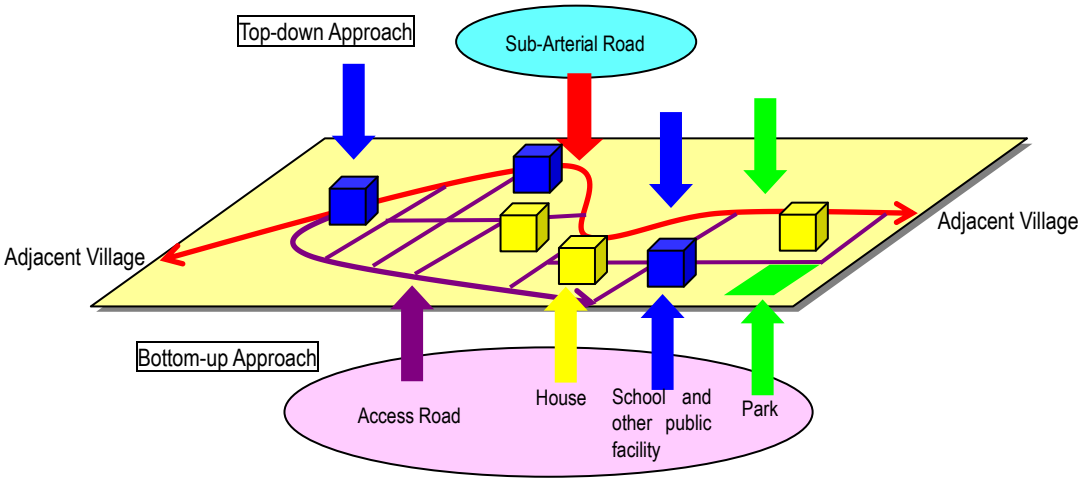
Fig. B8 Proposed Structure for the Implementation of Projects for the Reconstruction and Urban Planning of Léogâne Commune

Opinions of Local Residents

In Haiti, neither local governments nor resident organizations are well-developed. However, in Léogâne, Citizens United for the Rebuilding of Léogâne (CURL), a resident organization, has been formed and started discussion about reconstruction. The Foundation for Social Studies and Analysis (FAES) also holds meetings with local residents to hear their opinions before implementing FAES projects. There are other actions including a workshop organized by a NGO supervised by University of Notre Dame, USA, and its professors, with the participation of local residents and other parties concerned. Moreover, support is provided to local residents in various forms including JEN's hygienic promotion activities, and the opinions of the residents are incorporated in such support activities.
The Léogâne Commune Disaster Recovery Plan is for the local residents, and their participation and cooperation is essential to the recovery of the commune, which has weak administration and fragile financial conditions. It is necessary to promote residents' activities such as those mentioned earlier and establish a well-balanced, efficient and effective plan in close communication and coordination with each other.

Example in Indonesia

After the North Sumatra Earthquake and Tsunami hit Banda Aceh, Indonesia, in 2004, a reconstruction and development plan for the city was established with the support of the international community in a top-down approach and a city-wide conference was held at a hall. At that time, a sampling survey was conducted to get the views of the community and the result was reflected as much as possible. At the same time a bottom-up approach was also taken; each village conducted mapping, analyze issues and created a village plan and the administrative organizations (city and district) held an explanatory meeting in each village. In the meeting the city's draft reconstruction and development plan was presented.



(Ref:: THE STUDY ON THE URGENT REHABILITATION AND RECONSTRUCTION SUPPORT PROGRAM FOR ACEH PROVINCE AND AFFECTED AREAS IN NORTH SUMATRA (URGENT REHABILITATION AND RECONSTRUCTION PLAN FOR BANDA ACEH CITY) FINAL REPORT (1), 2005, JICA)

Fig.B9 Bottom-up Approach and Top-down Approach for Urban Development Plan (example in Indonesia)

<Priority activities>

The following activities should be given priority for the reconstruction and development of Léogâne Commune.

◊ Promotion of agriculture is the most important in Léogâne Commune. Agricultural development in devastated land should be conducted urgently in a way to contribute to the prevention of soil flowage while increasing agricultural production through the improvement of existing irrigation facilities and agricultural roads, educational activities of agricultural extension workers etc. Processing of agricultural products and foods, such as sugar, rum and juice, should be promoted.

◊ Flood control measures should be give priority as the Rouyonne River often overflows and the western part of Léogâne City is covered with water. The measures should include afforestation in the upstream region (that will promote agricultural production), improvement of the Rouyonne River (bank improvement, dredging etc.) and replacement of the Vincent Bridge.

◊ Improvement of access, water supply, drainage and electric power distribution is required for the recovery of the urban district of Léogâne. For the improvement of roads and drainage in the urban district, a project has been carried out with a Japanese grant aid. As for water supply, temporary recovery measures have been taken for the facilities in the city center through urgent rehabilitation work of this project. Water supply facilities will still have to be expanded and connected to more stable water sources. As for electricity, it is important to introduce renewable energy (solar power generation and small hydraulic power generation) and establish and implement a plan for stable operation of the electricity system.

◊ It is important to reconstruct city office, schools, public health centers and other public facilities with quake-resistant structures so that they can be used as evacuation centers when a disaster occurs. It is also important to establish a prediction and alarm system for hurricanes and other disasters and prepare against natural disasters such as earthquake and flood on a daily basis. Moreover, community disaster reduction activities should be promoted to ensure prompt evacuation at the time of a disaster.

◊ Léogâne has many educational facilities including a university that has been totally destroyed by the Great Haiti Earthquake, a nursing school and an agricultural school (currently planned). Educational facilities should be expanded through the reconstruction of these schools and introduction and attraction of new schools. Such actions will increase the number of students and teachers and expand related service demand.

◊ Education is a basis for the whole country as well as individual personality. The public support system for education should be expanded.

C. Rehabilitation project planning

C1 Consideration of rehabilitation project planning

1. Consideration of priority rehabilitation projects (list of priority rehabilitation projects)

There is a tremendous need for long-term development in Haiti, and especially recovery from the earthquake damage is given high priority.

Considering such factors as necessity and urgency, activities and plans of donors and NGOs, especially feasibility based on the project scale, maintenance and sustainability, and acquisition of additional land lots, we have made a list of candidates for priority rehabilitation projects to be carried out with a Japanese grant aid in each sector. Fig.C1-1 shows the locations of these projects.

2. Evaluation of rehabilitation projects

We have evaluated the above-mentioned project plans in terms of beneficiary, maintainability, environmental and social considerations/land acquisition, characteristics/utilization of Japan's knowledge, overlap with projects of other donors, and necessity.

3. Priority rehabilitation projects

As a result of the above-mentioned study, the Project for Improvement of Urban Roads and Drainage for the Reconstruction of Léogâne City has been selected as a priority project to be carried out with a Japanese grant aid.

The details of this project will be described in the next section.

Locations of grant aid projects for the Urgent Rehabilitation and Reconstruction Support Project for Haiti

Port-au-Prince

2 Restoration plan of Route 2 between PaP and Léogâne
5 Labor-intensive urban road paving in PaP
7 Drainage improvement in PaP
14 Reconstruction of public primary and secondary schools in PaP
21 Power distribution network restoration in PaP
22 Power transformation facility improvement in PaP
25 Reconstruction of the office building of the Ministry of Planning and External Cooperation in PaP

Léogâne City

3 Restoration of Route 2 between Léogâne and Miragoane
4 Labor-intensive urban road paving in Léogâne
8 Restoration of flood control function of Rouyonne River in Léogâne
9 Watershed, afforestation and agro-forestry plan in Léogâne
10 Rehabilitation of water supply facility in Léogâne City
13 Reconstruction of primary and secondary schools in Léogâne City
17 Support for the establishment of remote medical education in Léogâne City
18 Development of vocational training school in Léogâne City
20 Rehabilitation of power distribution network in Léogâne City
23 Installation of solar lamps
24 Reconstruction of Léogâne City office
27 Construction of Chatulet market
28 Reconstruction of Sainte-Croix Hospital
30 Reconstruction of Sigueneau Sanatorium (tuberculosis sanatorium)
31 Rehabilitation of State-owned Darboune sugar refinery
32 Development of agricultural irrigation system

Gressier area

12 Rehabilitation of water supply facilities in Gressier area
15 Reconstructino of public primary and secondary schools in Gressier area
26 Reconstruction of multi-purpose government office in Gressier area

Jacmel City

1 Restoration of Route 4 between Léogâne and Jacmel
6 Labor-intensive road paving in Jacmel City
11 Rehabilitation of water supply facilities in Jacmel
16 Reconstruction of public primary and secondary schools in Jacmel City
19 Development of small hydraulic power generation in Jacmel City
29 Reconstruction of Saint-Michel Hospital

Fig.C1-1 Locations of Priority Rehabilitation Projects

C2 Project for Improvement of Urban Roads and Drainage for the Reconstruction of Léogâne City

1. Background, history and outline of the project

1-1 Background and history

The total distance of roads in Haiti is 3,572 kilometers and the distance per 1,000 people is 0.35 kilometers, much below the average of 7.1 kilometers in Latin America and the Caribbean (PDNA).

In this situation, some donors such as the Inter-American Development Bank and the World Bank plan to support the improvement of arterial roads connecting major cities, which has been required since before the earthquake.

Decentralization and local development to ease overconcentration in the capital has been an unsolved issue in Haiti since before the earthquake, and roads and road drainage in local cities are less developed compared with roads in the capital. Reconstruction of local cities that were severely damaged by the earthquake is especially an urgent task, and the country is required to improve infrastructure such as roads and drainage that will be the basis for such reconstruction.

Léogâne Commune, located about 35 kilometers west of the capital Port-au-Prince, was severely damaged by the Great Haiti Earthquake, with over 90% of the buildings collapsed. Urban streets were filled with rubble and temporary structures made by the victims and road access was blocked. Many of the collapsed buildings have been left untouched. Although U.N. agencies and other various NGOs have been conducting support activities, reconstruction of people's living is making very slow progress and the residents are having trouble making a living with no house or job.

Léogâne Commune has a total of 14.9 kilometers long urban roads, but they are mostly either unpaved or paved with asphalt that is severely damaged, except some roads with interlocking block paving. Such road condition prevents smooth access and has become a large adverse factor. There is also a problem with rain water drainage. Heavy rain causes floods in some areas, worsening sanitary conditions.

In Léogâne, which has vast flatland close to the capital, agriculture has developed in the delta area. Therefore, in Léogâne Commune, which is in the ideal location as a development base for decentralization, it is absolutely necessary to develop paved roads to secure access and traffic – the basis for sustainable reconstruction and development – in the urban area.

Based on the above-described background and history, the Haitian government has requested the Japanese government to provide support for improvement of major urban roads (about 11 kilometers) and dredging of existing drainage (2 kilometers) from the urban area to the coastline aimed to improve drainage in the urban area.

Mitigation of overconcentration in the capital Port-au-Prince has been an unsolved issue in Haiti since before the earthquake. The Action Plan for National Recovery and Development of Haiti (March 2010), developed based on PDNA, cites development of national land (urban development, restoration of road networks, development of regional bases etc.) as urgent recovery measures. Based on this, the overall goal of the project is the promotion of the reconstruction of Léogâne City, a development base close to the

capital that is in great difficulty due to the natural disaster and economic distress.

The purposes of the project are to improve traffic access through paving works in the urban area of Léogâne City and to improve sanitary conditions through the improvement of drainage.

1-2 Outline of the project

This project aims to improve traffic access in the urban area of Léogâne by upgrading unpaved roads with interlocking block paving, for which residents' labor power can be used. Asphalt paving will also be used for some roads with heavy traffic.

In addition to the improvement of urban roads, dredging and repair of the existing drainage channel from the urban area to the coastline should also be conducted so that drainage issues will be solved and then sanitary conditions will be improved.

Moreover, the project will promote reconstruction of people's lives in the affected area through the provision of cash income opportunities with employments for local residents.

(1) Facilities to be developed

The following facilities will be constructed in the project.

- ◊ General urban roads: Interlocking block paving and road drainage (about 10 kilometers)
- ◊ Heavy traffic roads: Asphalt paving and drainage (about 1 kilometer)
- ◊ Dredging of drainage: Dredging of existing drainage from the urban area to the coastline (about 2 kilometers)

(2) Road paving plan

Existing road sections with interlocking block paving that were not affected by the Great Haiti Earthquake (shown with yellow line in Fig. C1) will not be repaved but used as they are.

Considering provision of employment opportunities in the area and maintainability after the completion of the works, unpaved sections should be paved with interlocking blocks.

As the existing asphalt road sections have been quite damaged since before the Great Haiti Earthquake, they should be repaved. However, for the existing asphalt roads in the urban area, where the traffic volume seems smaller than national roads, interlocking block paving should be conducted like other roads in surrounding areas.

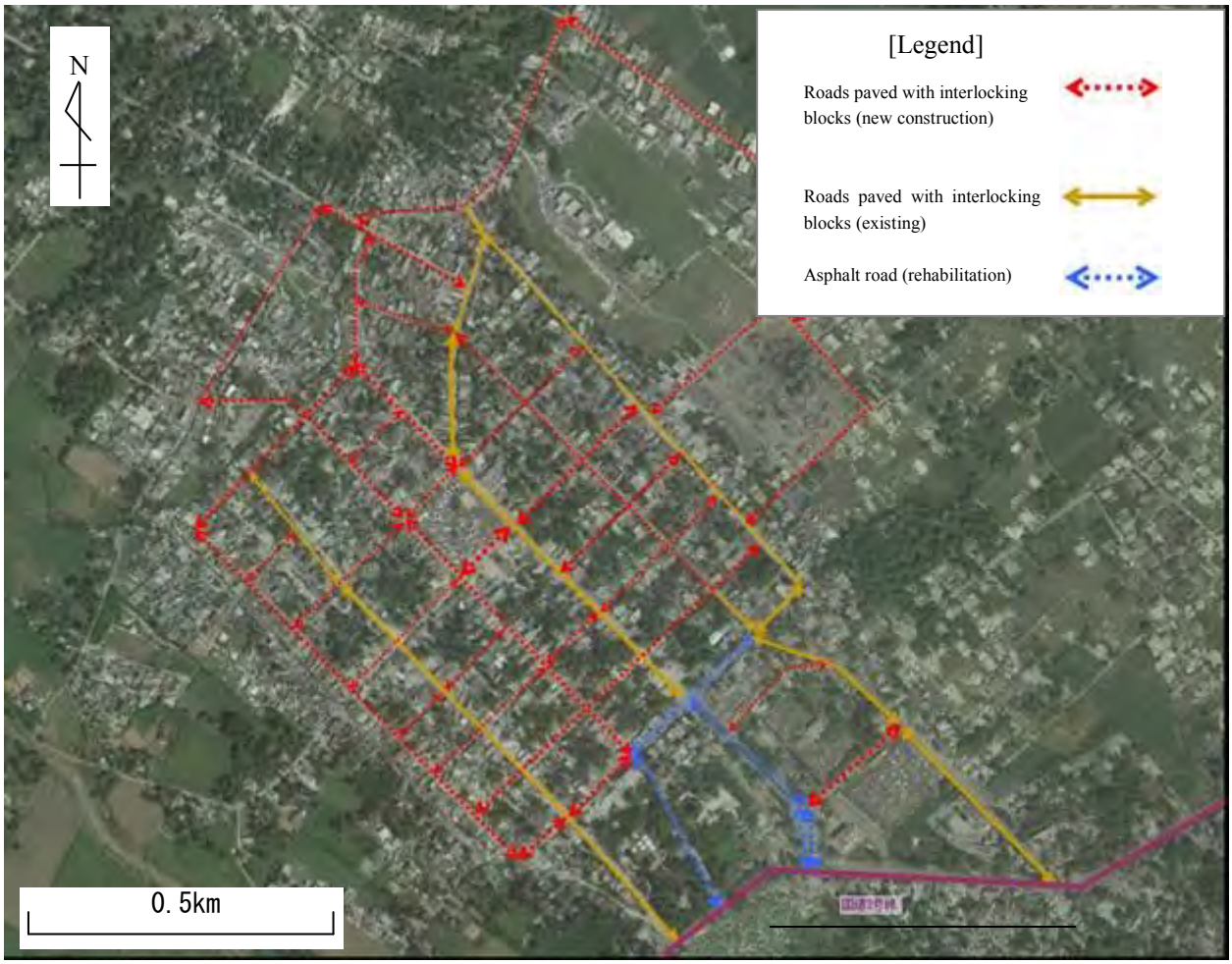


Fig.C2-1 Paving Plan

Paving thickness has been set as below.

Table C2-1 Paving Thickness

Layer	Asphalt paving		Interlocking block paving	
Surface layer	Dense-graded asphalt concrete	4cm	Interlocking block	9cm
			Sand	5cm
Upper subbase	Gravel for mechanical stabilization	15cm	Gravel for mechanical stabilization	15cm
Lower subbase	River gravel	30cm	River gravel	30cm

(3) Road drainage improvement plan

Rainwater drainage should be planned within the area of road paving improvement works to be conducted in this project.

Existing drainage channels should be used whenever possible after confirming there are sufficient cross-sectional flow areas to drain rainwater.

In the section of about 2 kilometers at the end of the rainwater drainage from the urban area to the coastline, dredging of waste and sediment will be carried out to facilitate discharge and create employments for neighboring residents.

The drainage basin area where road drainage channels will be developed is about 2.5 square kilometers.

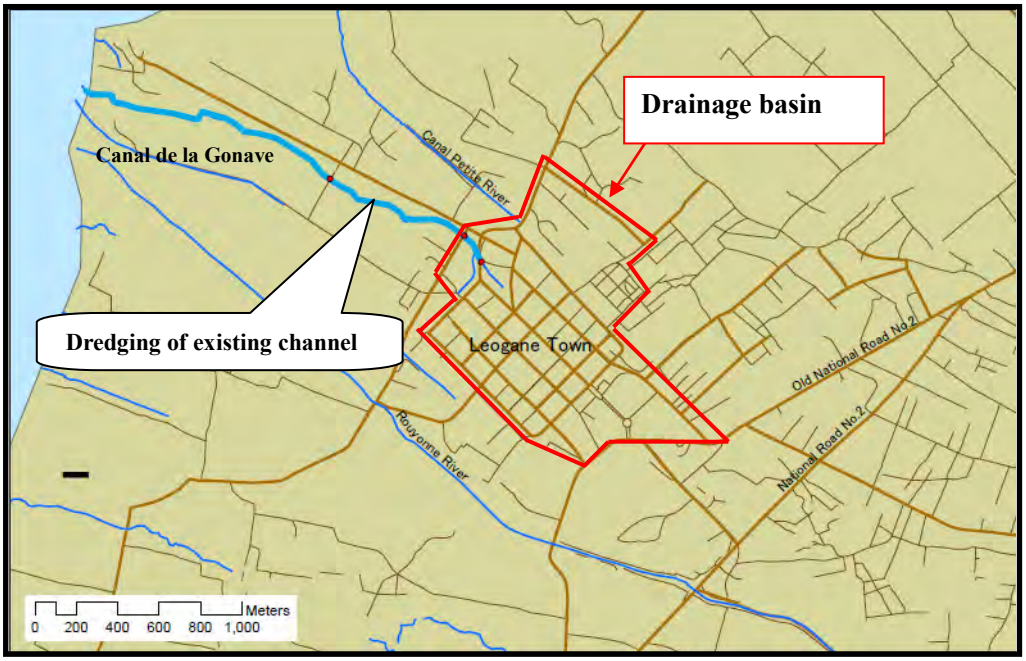


Fig. C2-2 Drainage Development Area and Location of Drainage Chanel for Dredging

(4) Drainage channel dredging plan

Dredging of an existing drainage channel from the urban area to the coastline (about 2 kilometers) will be carried out by the (manual) labor force mainly of residents in Léogâne.

2. Construction period and estimated construction cost

If the project is carried out with Japanese Grant Aid for Peace, the project cost is estimated to be 1050 million yen (1048 million from Japanese side and 2 million from Haitian side). Major components to be covered by the Haitian side will include the support for the relocation of evacuees (IDPs) who have been forced to live in tents in the streets after the Great Haiti Earthquake and bearing of bank charges. The project period will be around 17.5 months from bidding to the completion of constructions.

Table C2-2 Summary of Estimated Project Costs to be Covered by the Japanese Side (Unit: M yen)

Category	Cost	Note
(1) Construction cost	827	
(2) Equipment procurement cost	0	
(3) Soft component	0	
(4) Procurement agency cost	88	
(5) Design and supervision cost	133	Including 45M yen for the implementation and management of resident employment and job training
Total	1,048	

3. Project evaluation

The following effects are expected through the implementation of the project.

Direct effect

- ◊ The distance of paved roads in the urban area of Léogâne will increase from the current distance of 3,700 meters to 14,900 meters, and all the roads in the city center will be paved.
- ◊ Provision of employment opportunities to the local residents (a total of about 8,000) will be facilitated and the livelihood of local residents will be improved.

Indirect effect

- ◊ As rainwater drainage in the urban area of Léogâne Commune will be improved, the sanitary conditions for the residents will also be improved.
- ◊ As the reconstruction and development of Léogâne Commune will be facilitated, stable public security and reconstruction and development of the society and economy will also be promoted.
- ◊ As good access to public facilities etc. will be ensured, travel time will be reduced.

Number of beneficiaries: The number of beneficiaries of this project is about 23,000 residents in the urban area of Léogâne. Most of the residents in the area will be covered.

Relevance and urgency: As the project aims to rebuild infrastructure in the area affected by the earthquake, it meets the purpose of Japanese grant aids concerning BHN, education and human resource development.
Moreover, as the project is expected to contribute to the improvement of road infrastructure and employment situation of the residents of Léogâne City by supporting the reconstruction processes of Léogâne City, which was most severely damaged by the Great Haiti Earthquake, and carrying out debris removal and road improvement in labor-intensive methods, the relevance of the project implementation is high.

Operation and maintenance ability: The Haitian organizations have been conducting operation and maintenance for road facilities since before the earthquake and are deemed to have sufficient ability.
Position in the recovery plan: This project is considered to be for the recovery of the affected areas, cited in the recovery plan. As it will also help infrastructure improvement in local cities to ease overconcentration in the capital, it is also considered to be for the preparation of basic conditions for regional base development described in the plan.

Profitability: Although the road project is expected to have major economic effects, there will be no direct financial benefit.

Environmental consideration: The road improvement in the plan will be repair of existing facilities. As problematic materials such as asbestos will not be used, there will be no negative health impact and will basically be no negative impact on the environment.

Possibility of project implementation with Japanese grant aid: The project can be implemented with no particular difficulty in the scheme of Japanese grant aid for peace building (program type).

As observed above, the project will broadly contribute to the improvement of BHN of the residents and is also expected to have tremendous effects. As there is also a necessity for urgent road restoration, the relevance of a Japanese grant aid can be confirmed.

The Haitian side will have to ensure that structures occupying roads will be relocated from where construction will be carried out, or temporary moved to another road or a neighboring area, according to the construction schedule. It will also have to be ensured that operation and maintenance will be carried out after the service has started.

D. Urgent Rehabilitation Project of Water Supply for Léogâne City Center

1. Position of the Project for Urgent Rehabilitation of the Water Supply System

The overall goal of the project is to support the resumption of economic activities and reconstruction of people's lives through the improvement of basic infrastructure in Léogâne Commune, which was seriously damaged by the earthquake. Therefore, the purposes of the project are to recover functions of the existing water supply facilities, to supply safe water to the residents in Léogâne, and to improve people's lives, hygiene and health.

2. Current state of the sites for the urgent rehabilitation project

Léogâne Commune, located about 35 kilometers west of the capital Port-au-Prince, has a total population of about 157,000 (2003 census), 23,000 of which live in the urban district of Léogâne City.

3. Status of water use and existing water supply facilities

3-1 Status of water use

As the existing water supply facilities in Léogâne Commune were totally destroyed by a hurricane in 2008 and the Great Haiti Earthquake, the residents in Léogâne Commune used water from shallow wells with a hand pump and water from water wagons arranged by NGOs. On the other hand, there are five private water vendors in the urban district of Léogâne City and it has become one of the means of water supply for drinking.

3-2 Status of existing water supply facilities

Major water sources for Léogâne Commune are Mapou Spring and La Porte Well, located about 7 kilometers southeast of the urban district of Léogâne City, and a public well located inside the urban district.

Fig.D1 shows the locations of the existing water supply facilities in Léogâne Commune. The facilities in Léogâne Commune, developed in 1988 with water from Mapou Spring, are not functioning any more. The distance of water distribution pipes is a total of about 25 kilometers and PVC (polyvinyl chloride) pipes are mainly used.

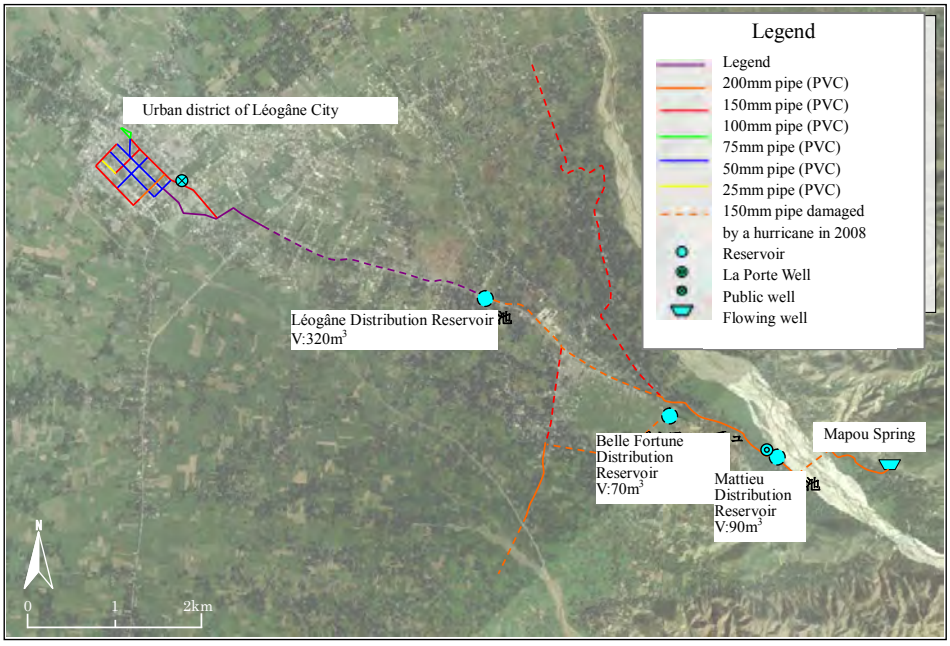


Fig. D1 Locations of Existing Water Supply Facilities in Léogâne Commune

4. Selection of urgent rehabilitation projects

As the water supply conditions in Léogâne City were so poor, repair of the water distribution network in the City was an urgent task for DINEPA (National Water and Sanitation Bureau). The water wagon service failed to supply the amount of water required per person per day and forced people to bear inconvenience as they had to carry water to their house. Therefore, the functions of the existing facilities had to be restored as soon as possible.

Under such circumstances, in April 2010, the JICA research team for detailed design and the relevant Haitian organizations confirmed the implementation of Urgent Rehabilitation Project of Water Supply for Léogâne City Center. From May to June 2010, the JICA project consultation team also confirmed the implementation of a water supply project in Léogâne City, conducted as a project for urgent rehabilitation of the water supply system. From this project, synergetic effects of the goal of restoring water supply service in Léogâne City and the urgent projects by DINEPA itself were expected.

Based on the result of the investigation of urgent measures conducted by DINEPA, the research team considered the candidate projects for urgent rehabilitation and determined the contents of the projects through consultation with the project team and DINEPA.

The scopes of project implementation by the project team and DINEPA are as below.

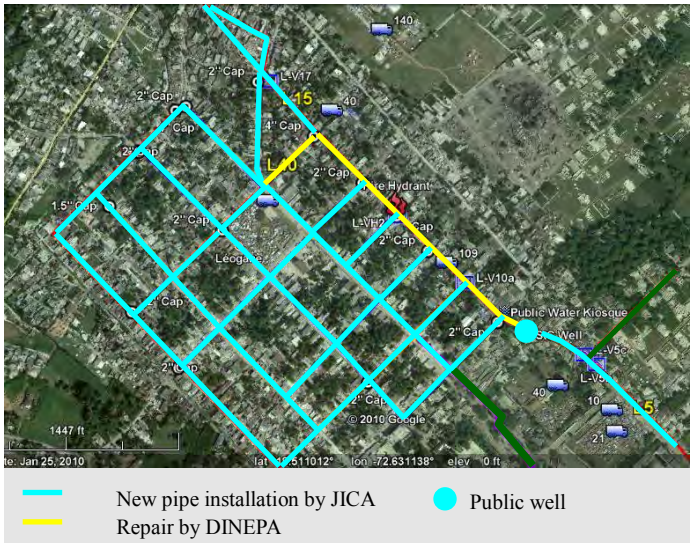


Fig.D2 Routs for New Pipe Installation by the Project Team

(See Fig. D2.)

- Scope of works by the project team: Replacement of water distribution pipes in the urban district of Léogâne City, installation of a submersible pump in the public well, and installation of public water taps
- Scope of works by DINEPA: Leakage check and repair works of the existing channel from La Porte Well to Route 2 and some of the existing channels[5] in the urban district of Léogâne City

5. Investigation of social and natural conditions

5-1 Base line survey concerning social conditions and water supply sanitation

To contribute to the improvement of the water supply service in Léogâne City, we have collected basic information concerning socioeconomic conditions and water use at the level of households in the city center. We have also conducted a sample survey[6] through interviews with 500 families, using a questionnaire, to understand the awareness of the residents concerning water use and water services. The results are as follows.

(1) Household composition etc.

The average number of people per household is 5.4 with a male-to-female ratio of 4.7:5.3. The male-to-female ratio of household heads is 3.9:6.1 and the average age of household heads is 42.0. The residence form varies from owner-occupied house and rental, to temporary housing on property or in an evacuation camp, and tent.

(2) Working environment and income

47.2% of the households have at least one adult worker aged 18 or older. The employment rate of the adult members aged 18 or older of the surveyed households is 18.3%, 51.7% of which have full employment. As for the daily income of the households with (a) working member(s), 56.3% of the households make 101 gourds (2.56 USD) to 500 gourds (12.8 USD), and the response rate was 67.2%.

As for the job category, tertiary industries that consist of retail, education, medical and welfare, and other service industries have the largest portion, i.e., 68.4%, of all the workers. Secondary industries that consist of construction industry have 25.6%, and agriculture, public service, NGO etc. account for the remaining 6%.

8.6% of the surveyed households receive pension or allowance, and 41.9% receive cash from home and abroad.

(3) Water consumption per unit and time required for water intake

We have calculated the average water consumption per unit and the time required for water intake, separately for the rainy season and the dry season. Results were 58.2 liters/person/day and 70

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5 The distance of the pipes for DINEPA to repair has decreased due to the lack of qualified engineers to supervise leak tests and repair works of the pipes.

6 A sample survey is a method to presume characteristics of the population by surveying a limited number of samples selected from the population, while a census is a survey of all people in the population.

minutes/day in the rainy season and 76.8 liters/person/day and 91.3 minutes/day in the dry season.

(4) Users' intention to use water facilities, intention to pay, water rates etc.

The current average spending on water use among the surveyed households is 36.5 gourds (0.94 USD) per day in the rainy season and 52.7 gourds (1.35 USD) per day in the dry season.

As for the future use of improved water facilities, 96.2% of the surveyed households showed intention to use public water taps, 76.9% if they have to pay. The average amount that the respondents will be willing to pay is 26.7 gourds (0.68 USD) per day. If water is supplied to each house, 90.4% of the surveyed households showed intention to use the service and pay. The average amount of payment that the respondents will be willing to pay is 130.4 gourds (3.34 USD) per month.

(5) Hygiene and waterborne diseases

52.1% of the surveyed households have private lavatories. 83.8% of such households (43.7% of all the households surveyed) have a pit latrine and 40.2% (20.9%) have a flush toilet. On the other hand, 27.6% of the surveyed households use public lavatories and 20.3% use other types of lavatories (mainly outdoor).

Although no causal connection is proved, 58.9% of the surveyed households are paying attention to waterborne diseases. 38.2% of such respondents cited symptoms of the digestive system (mainly diarrhea), and 59.7% cited symptoms concerning skin diseases (mainly scab) and communicable diseases. 38.0% of the surveyed households said they use water from a shallow well, which has a high risk of water contamination, both for drinking and cooking, and as seen in the survey result by sector below, they have relatively low awareness about hygiene. Therefore, there is a high risk of communicative diseases like cholera, which is spreading across the country as of November 2010.

(6) Resident need survey

As a result of prioritization and numeric rating of residents' needs concerning their community life, health (medical care and health) came first, followed by water supply in the 2nd place, education in the 3rd, electricity in the 4th, roads in the 5th, drainage in the 6th and sanitation in the 7th.

5-2 Water volume research

Table D1 shows the result of water volume measurement of major water sources and a flowing well in the city center of Léogâne, which is used by many residents.

Table D1 Water Source Capacity of Léogâne Commune

Water source	Month of measurement	Water volume estimated by DINPEPA (liter/sec)	Actual measurement (liter/sec)	Conditions of water volume measurement
Mapou Spring	Aug 2010	50 liters/sec or more	15 liters/sec or more	Measured in locations where measurement was possible.
La Porte Well	Aug 2010	20 liters/sec or more	22 liters/sec or more	Actual measurement based on the result of the pumping test conducted by DINEPA (critical yield)

Water source	Month of measurement	Water volume estimated by DINPEPA (liter/sec)	Actual measurement (liter/sec)	Conditions of water volume measurement
Public well	Aug 2010	N.A.	17 liters/sec or more (For reference, measurement by JICA in May was 8 liters/sec.)	Water level was stable from the ground level to 2.8 meters when water is pumped at 17 liters/sec.
Flowing well	Sep 2010	N.A.	0.5 liters/sec	Measured with 20-liter cans

5-3 Water quality analysis

As a result of simple analysis of 15 water quality test items, coliform was detected in the water from the flowing well and the turbidity was slightly higher than the WHO guideline value for drinking water. The water quality of the public well was good.

As a result of a laboratory analysis of 36 items, coliform was detected twice in the water from Mapou Spring, but the public well and La Porte Well met the WHO guideline for drinking water. Mapou Spring will need disinfection facilities before it can be used as a water source.

6. Planning and design of Urgent Rehabilitation Project of Water Supply for Léogâne City Center

6-1 Outline of the urgent rehabilitation project

Based on the agreement with and approval of DINEPA, the project aims to restore the functions of the existing water supply facilities as a project for urgent rehabilitation that is expected to contribute to rebuilding people's lives in Léogâne City.

The number of beneficiaries of Urgent Rehabilitation Project of Water Supply for Léogâne City Center is about 9,000. The number is expected to be about 22,000 if water is supplied from La Porte Well. Fig. D3 shows the scope of works of the project for urgent rehabilitation of water supply by the Japanese side and the scope of works by DINEPA.

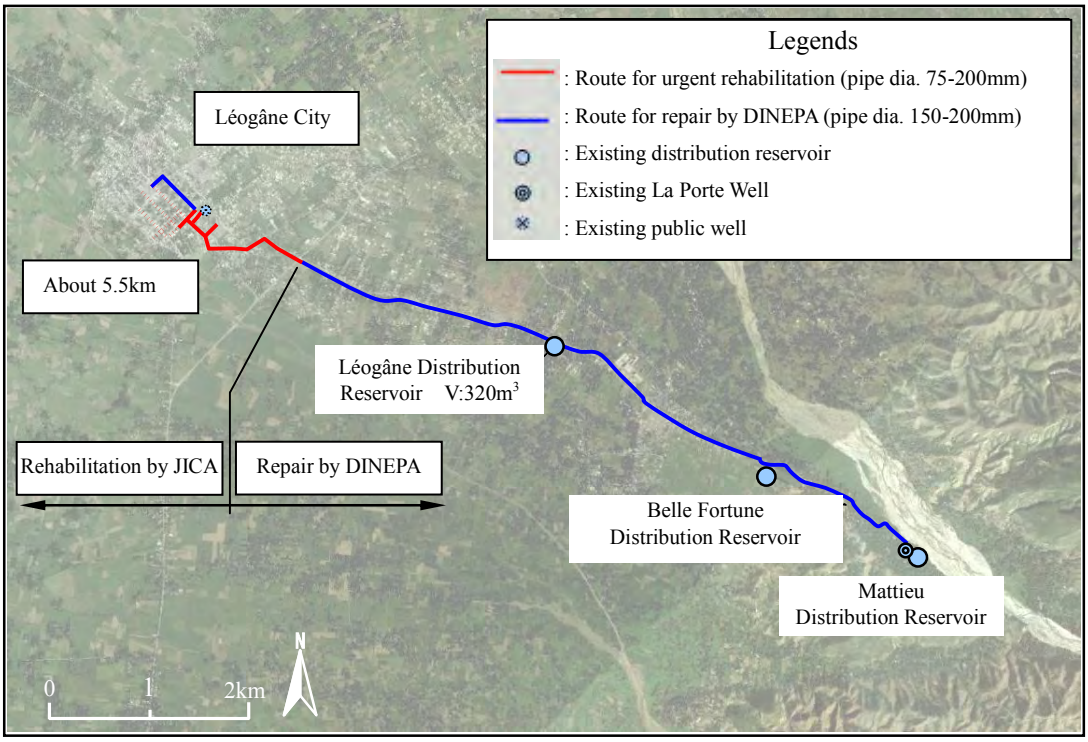

Fig. D3 Scopes of Improvement Works concerning Urgent Rehabilitation Projects

6-2 Consideration of the water supply method

As the urgent rehabilitation project is to generate quick project effect and carry out temporary measures for water supply from La Porte Well to the urban district of Léogâne City, the water supply method have been determined from the following viewpoints. (See Fig.D4.)

- To make works easier
- To facilitate operation and maintenance
- To reduce negative impact of works on the residents
- To shorten the period for material procurement
- To reduce initial cost
- To reduce operation cost

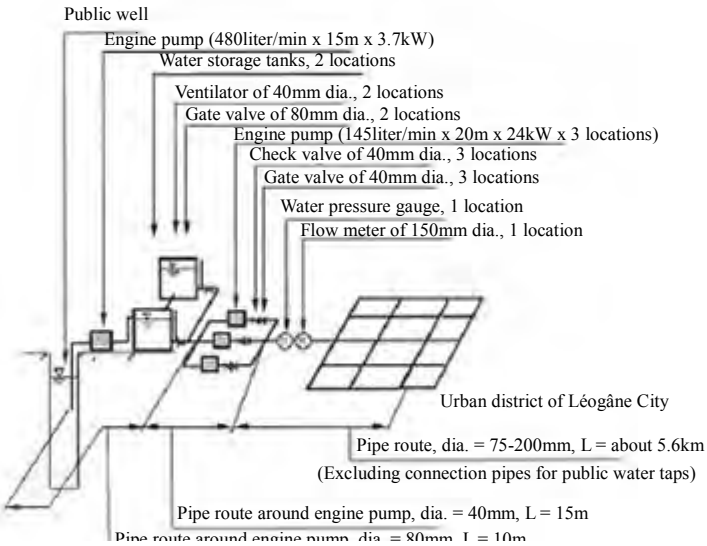

Fig. D4 Water Supply Method

6-3 Criteria for the locations of public water taps

To select the locations for public water taps, we have set the installation criteria as shown in Table D2 and gained approval from DINEPA. The criteria were defined based on the reasons shown in the same table. Fig. D6 shows the 14 locations of public taps selected according to the criteria of Table D2. Table D3

shows the reasons for the selection of these locations.

Table D2 Criteria for Locations of Public Water Taps and Reasons

Installation criteria	Reason
A. Location where a plastic water storage tank has been installed	◊ Save the Children, a NGO, installed the tanks to improve people's convenience after the earthquake.
B. Location of existing public taps	◊ The locations of existing public taps are considered convenient for the residents.
C. Area with many schools, health centers etc.	◊ Important public facilities
D. Area with no shallow well with a hand pump	◊ It is considered that such areas do not have enough water sources.
E. Area with an evacuee camp	◊ There is no water source around the camp.

(Data from JICA research team)

Table D3 Criteria for Locations of Public Water Taps

Public water tap (P.T.) No.	Selection criteria	Public water tap (P.T.) No.	Selection criteria
1.	E	8.	B
2.	D	9.	D
3.	A	10.	C
4.	C	11.	B
5.	A	12.	C
6.	A	13.	D
7.	A	14.	C

(Data from JICA research team)

DINEPA had a plan for future water facility development with the target year set at 2030, for which they planned to start a feasibility study. As installation of public taps that anybody can freely use might cause operation and maintenance issues, they had a policy to not develop public taps. Therefore, instead of 14 locations in publicly-owned land, installation of public taps in 6 locations on the premises of public schools has been decided. Finally, it has been decided to install public taps in 12 locations, including 6 locations for additional extension works, on school premises as shown in Table D4. We made the final decision concerning the locations of public taps through additional extension works after checking the installation space of the public taps on school property and convenience for the users based on the request from DINEPA and schools.

Table D4 Schools where Public Water Taps will be Installed

No.	School	Address	No. of students (as of Oct 2010)
P.T.1	École Nationale de Filles	Rue Saint Yves	325
P.T.2	École Nationale Mixte de Léogâne	Grand Rue	438
P.T.3&4	École Louis Bornó	Face Place Anacaona	800
P.T.5	College Coeur de Marie Sainte Rose de Lima	Montée Rue Saint Croix	645
(P.T.6)	Joyeux Soleil Kindergarden	Grand Rue	330
P.T.7	Lycée Anacaona	Route Nationale # 2	2,500
(P.T.8)	Institute Sainte Marie	Rue d'Enfer et Rue la Croix	150
(P.T.9)	École Enfants de Myriame	Rue d'Enfer	100
(P.T.10)	Centre d'Etudes Montaigne	rue la Croix	263
(P.T.11)	Petit Mignon	Rue d'Enfer	700
(P.T.12)	École Surein Eveillard	Rue d'Enfer	750

Note: Public taps in brackets were added for extension works.

6-4 Points to consider for spec determination based on the future water demand

Having a future concept for 2030, DINEPA started a feasibility study in major cities of the country in March 2010 and is now conducting the study in places including Léogâne. We have considered whether the functions of the facilities to be improved through this urgent rehabilitation projects can still be used in 2030 and determined the specifications so that the capacity of distribution pipes etc. can handle the pumping discharge from La Porte Well and the water demand in 2030. We considered specifications in the following procedures.

A. Confirmation of the pumping capacity of La Porte Well
B. Hydraulic analysis based on the pumping discharge of La Porte Well
C. Water demand forecast for 2030
D. Hydraulic analysis with the water demand forecast for 2030
E. Evaluation of the validity of the hydraulic analysis of B, based on the result of the analysis of D

As seen in Fig. D5, the planned pipe diameters of QIP will still be good in 2030.

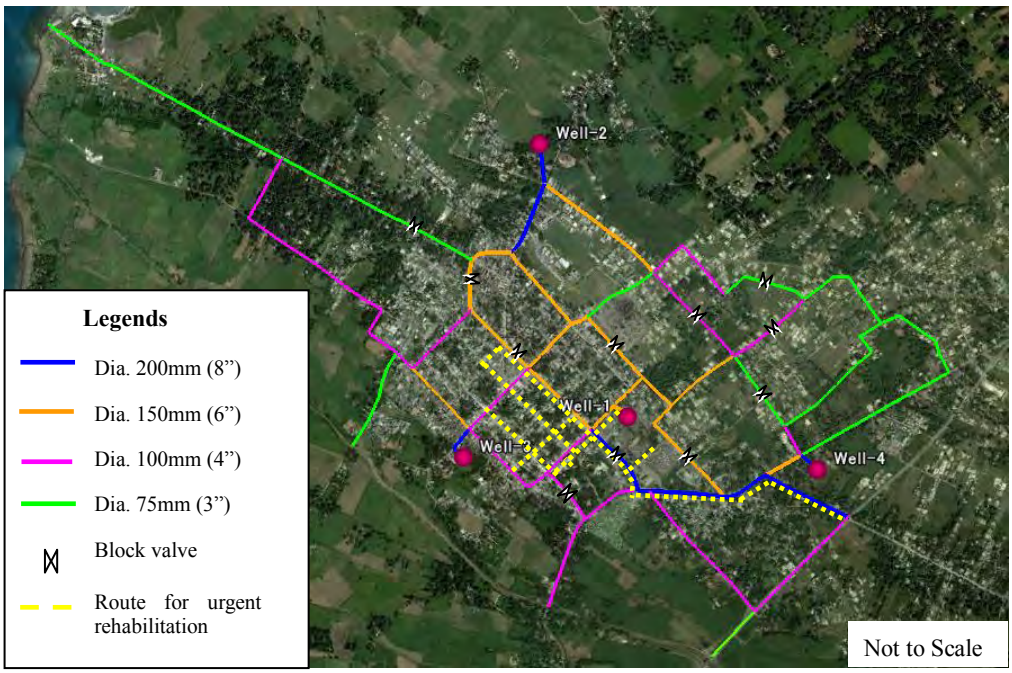

Fig. D5 Planned Pipe Diameters in the Pipe Line Plan of QIP for 2030

6-5 Outline of the water facilities to be developed in the urgent rehabilitation project

Table D5 shows the outline of the water supply facilities. Fig.D6 shows the locations of water facilities to be developed in the urgent rehabilitation project.

Table D5 Outline of Water Supply Facilities of the Urgent Rehabilitation Project

Item	Contents
1. Details of water facility development	1) Development of distribution pipe routes: Approx. 5.6km x PVC40-200mm, approx. 9m x GS 100mm 2) Installation of 4 engine pumps (1 main engine pump and 3 sub engine pumps) 3) Installation of water storage tanks: 2 tanks (an existing tank to be used for one of them) 4) Installation of public water taps: 12 locations (repair work in one of these locations) 5) Laying of water supply pipes to each house (including corporation stops with saddle and 5 meters long distribution pipe): 173 locations
	[Ancillary works] Teardown and restoration of interlocking block paving Teardown and restoration of concrete paving
2. Water source	[Public well in urban district of Léogâne city*1] Capacity: approx. 480L/min *1 To be used during the urgent rehabilitation project period for the water supply to the urban district of Léogâne City

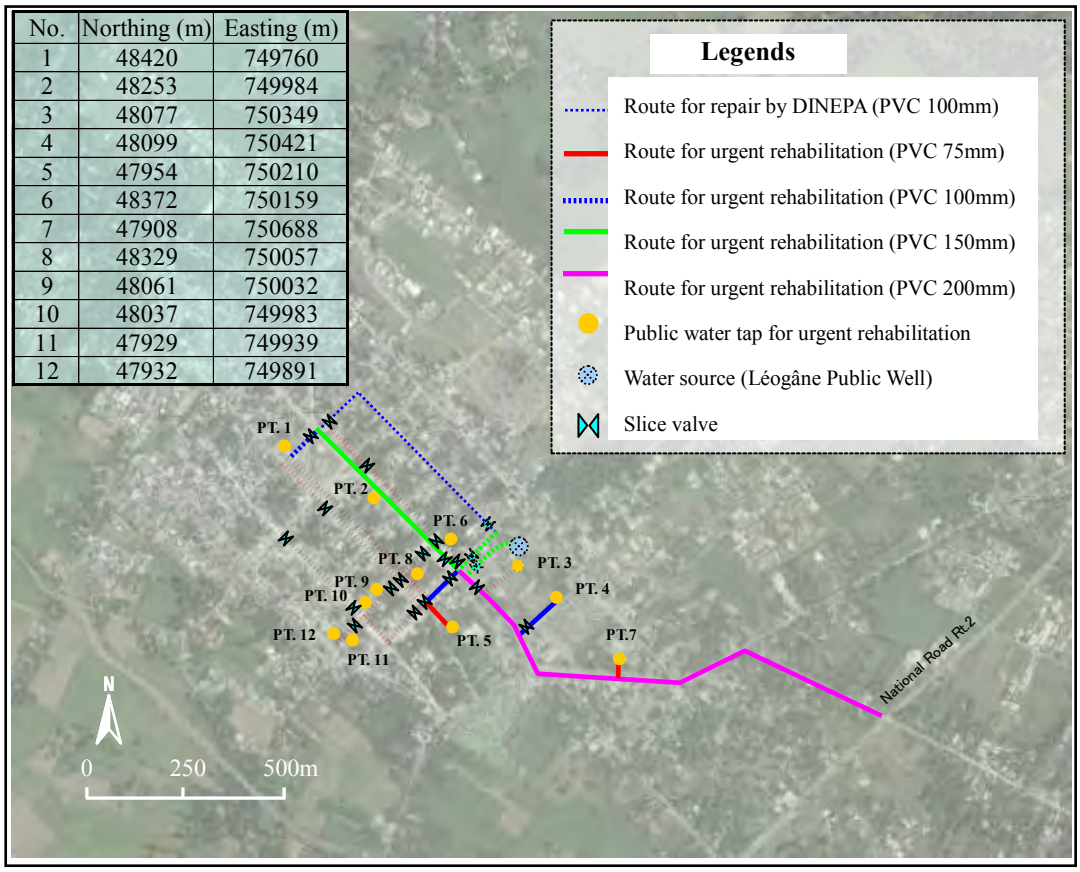

Fig. D6 Locations of Underground Water Supply Facilities in Léogâne City

6-6 Basic policy of operation and maintenance

(1) Basic policy of operation and maintenance

As most of the components of this rehabilitation project are improvement works of water supply facilities (with some exceptional works of common water tap construction) for future water supply to each house with permanent facilities, we have created technical and financial manuals and guidelines and provided various supports and guidance concerning operation processes, registration and connection procedures etc., as described in the next section. It is deemed appropriate that support was provided for the establishment of an operation and maintenance system based on water supply to each house, because SNEP (National Service for Drinking Water) has had a paid service of water supply to each house in Léogâne and as much as 90% of the respondents of the baseline survey are willing to use and pay for water supply to their house.

(2) Contents and outputs of technical supports concerning operation and maintenance

We provided guidance concerning operation and maintenance of the water supply facilities to be constructed through the urgent rehabilitation project to a total of seven people including a regular member of DINEPA Léogâne of Léogâne CTE and some candidates for future staff. However, OJT was not carried out as the facilities and equipment were neither completed nor operated at that time. Instead, we provided training using manuals. Despite this, the personnel, including former staff of SNEP Léogâne, were considered to have sufficient ability to conduct technical operation and maintenance for the water facilities to be constructed through the urgent rehabilitation project. The contents and outputs of the supports are as described below.

Contents and Outputs of Technical Cooperation concerning Operation and Maintenance

Contents of support	- Development of operation and maintenance manual - Operation and maintenance training of DINEPA staff with the above-stated manual - Support to hold an explanation meeting for residents concerning the use of public water service, preparation of meeting materials and kits
Output	- Operation and maintenance manual (See the reference material of the main report) - Various training of a total of 7 people including a staff member of DINEPA and candidates for future staff (e.g., organizational structure, rate collection processes, account opening, accounting forms, registration and connection procedures, ledger management, PR, emergency response, water supply flow, facilities and equipment, operation processes, meter reading, disinfection by chlorine, monitoring and recording) - Explanatory meeting for residents concerning the use of public water supply system (about 70 participants)

As of August 2011, CTE is processing contract with beneficiaries and restarting water supply service for those who have signed the contract.

7. Contents of the rehabilitation works

7-1 Results of works

Urgent water supply rehabilitation works, including some additional extension works, were completed at the end of May 2011. The results are as shown in Table D6.

Table D6 Results of Works

Item	Spec	Initial work	Additional work	Total
Starting date		Oct 16	Mar 1	-
Completion date		Apr 27	May 27	-
Contructor		SOHECO	G4 construction	-
Construction of water pipes	PVC φ200mm	1,337.8m	0m	1,337.8m
	PVC φ150mm	830.3m	0m	830.3m
	PVC Φ100mm	437.6m	0m	437.6m
	PVC φ75mm	232.2m	2,485m	2,717.2m
	PVC φ50mm	50m	0m	50m
	PVC φ40mm	23m	210m	233m
	GS φ100mm	9m	0m	9m
	Total	2,919,9m	2,695m	5,614.9m
Installation of engine pumps	28m x 1,1100L/min for pumping	1 unit	-	1 unit
	32m x 600L/min for distribution	3 units	-	3 units
Installation of water storage tanks	700 Gal	1 unit	-	1 unit
	2,200 Gal		1 unit (Used existing tank)	1 unit
Installation of public water taps	A total of 4 taps on both sides	6 locations	5 locations	11 locations
Repair of public water taps		0 location	1 location	1 location
Connection of a distribution pipe to each house		73 locations	100 locations	173 locations
Proportion of the amount of orders to the whole employment cost of Léogâne residents		0.16%	2.87%	

7-2 Construction abilities of local contractors

The local contractor made progress at one point, laying several hundred meters of simple-shaped straight water pipes in a day. However, construction works often had to stop because equipment was often poorly maintained. The contractor failed to understand the schedule and procure materials in a planned manner. Such attitude of the contractor eventually delayed the construction works. Moreover, the quality of the works was sometimes unacceptable. For example, the ground surface sank several days after a backfill work.

In this situation, construction by the local contractor had to be supervised on a daily basis by the research team for quality and schedule management.

7-3 Results of employment of local residents

As seen in Table D7, there was a distinctive difference between the initial works (by SOHECO) and additional extension works (by G4 Construction). It was probably because of the prior experience of construction in the area and difference of the employment and wage systems such as incentives.

As the construction came toward the end, the number of local residents employed became fewer and fewer for both, finally reaching zero at the time of the installation of interlocking blocks, for which local labor force was expected to be used most. It was probably because they had to meet the schedule and there was no time to employ local residents.

Table D7 Results of Employment of Local Residents

	SOHECO	G4 Construction
Proportion of cost for employment of local residents to the total order amount	0.16%	2.87%
No. of local residents employed per day	0.58	7.59

Public water tap at primary school

Public water tap at primary school

Water storage tank

Engine pumps for water distribution

Photos at the Time of Completion (May 2011)

8. Hygiene education activities

Cholera has started to spread in Haiti in October 2010 and there have been many cases (248,000 by February 2011, the Ministry of Health), including many deaths (4,600 by February 2011, the Ministry of Health). Cholera is transmitted via the oral route, and poor sanitation and lack of education and knowledge have caused such situation.

With activities and supports from the Ministry of Health, NGOs and the international society including UNICEF to fight against cholera and improve hygienic status and hygienic behaviors, the number of cases have dropped but it has not completely ended yet.

Sanitary conditions have improved with 12 public water taps installed on school premises, as part of the restoration works of water supply facilities in Léogâne City center. (There are about 7,500 teachers and students in the schools.) In addition, for further improvement of hygiene status, hygiene education activities were carried out from April to June in 2011, mainly at the schools with public common water taps. Experience, knowhow and teaching materials of JEN, a Japanese NGO, were used for the activities. At school, hygiene education was provided from teachers to students, from teachers to other teachers, from students to other students, and from students to families. Such education is also expected in the community. This seems to have had large effects to improve hygiene and to prevent and reduce oral infection. Ways and possibilities of expansion of hygiene education were confirmed.

Major activities are as follows.

- ◊ Survey and assessment
- ◊ Selection of schools and teachers
- ◊ Preparation of materials and training for hygiene education
- ◊ Education to promote better hygiene (6 schools)
- ◊ Hygiene promotion program for students (including hygiene education video, songs and dances)
- ◊ Monitoring of teachers
- ◊ Hygiene competition (game) for students
- ◊ Hygiene promotion program for communities
- ◊ Monitoring, evaluation and report

Result

Hygiene education was provided to 7,180 students through 113 teachers and 27 students who had received hygiene education earlier and were requested to become communicators and trainers. Hygiene education was also provided to the residents in surrounding camps. A total 1,241 camp residents attended town meetings by June 20 2011, learning hygienic knowledge through games and quiz.

Effect

The results of questionnaires and quiz have confirmed that participants have acquired correct knowledge through the education. Especially, it has been confirmed that they have properly digested and understood what they already knew but did not really understand the mechanism of. For example, now they understand what diseases and pollution would be brought by uncovered food or outdoor urination

and what they should do to avoid it.

Conclusion

It has been confirmed that appropriate behavior can be led to if people fully understand the reasons instead of being forced to learn knowledge. Both adults and children understand better in a fun learning environment. We found it effective to provide hygiene education in a way in tune with the local culture, i.e., with a DJ, songs and dances.

Future improvements

The interpretation of the word "hygiene" in Haiti is different from that in advanced countries. Hygienic behaviors at the level of individuals and household can be understood and carried out, but when it comes to trash disposal, proper use of a toilet or environmental conservation, people are not so much concerned and do not show improvement in their behaviors. Regarding such matters, the government needs to carry out policies concerning waste disposal and pollution so that people will gradually understand the consequence of their actions and change.

Children practicing washing hands

Children dancing in the assembly