Green and Integrated Wastewater Management San Fernando, La Union – Pre-feasibility Study

Final Report

April 2016

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Green and Integrated Wastewater Management San Fernando, La Union – Pre-feasibility Study

A report submitted by ICF Consulting Services

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Executive summary

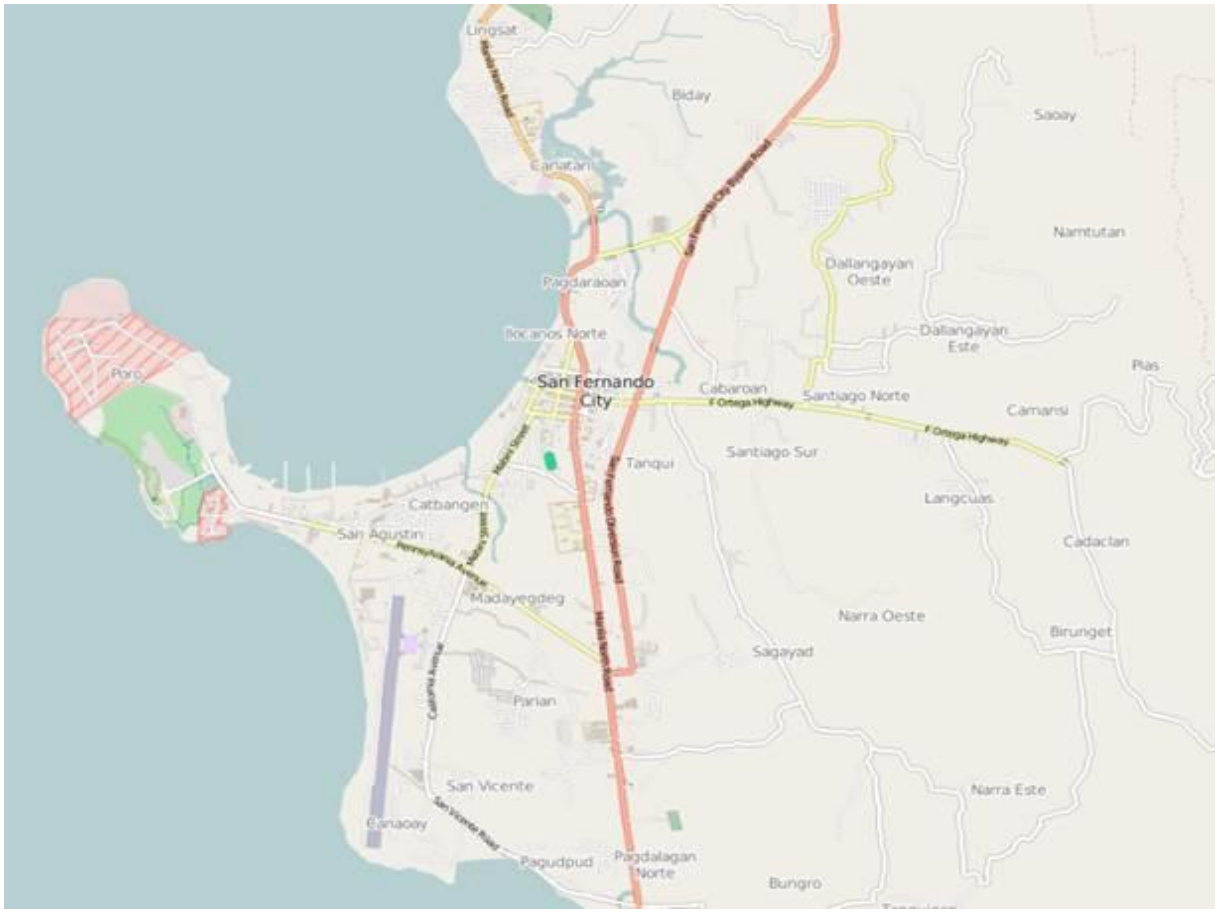
ES1 Background

1. The Cities Development Initiative for Asia (CDIA) provides assistance to medium-sized cities to bridge the gap between their development plans and implementation of corresponding infrastructure investments. CDIA uses a demand driven approach to support the identification and development of urban investment projects which emphasize environmental sustainability, pro-poor development, good governance, and climate-change resilience. The City Government of San Fernando, La Union submitted an application for CDIA support in the preparation of pre-feasibility studies in the areas of Integrated Wastewater Management and Flood Control in April 2014. Integrated wastewater management is considered to be high priority by the San Fernando City Government, which sees an urgent need for infrastructure investment and technical assistance in this sector.

ES2 Issues and Challenges

2. San Fernando, La Union is a component city and the provincial capital of La Union, one of four provinces in the Ilocos Region: Region 1. San Fernando fulfils an important role in providing commercial, health, educational and administrative services for the Region. The topography of the city is a combination of coastal plain (where urban development is concentrated) and the foothills of the Cordillera Mountain Range to the east. The city has an estimated 2015 population of about 125,000.
3. Wastewater management in the city is predominantly through the use of septic tanks discharging to groundwater or surface drainage, There is an underutilised septic sludge treatment facility and also a number of small decentralised wastewater treatment systems which are not fully functional. The groundwater is heavily fecally contaminated, and is extensively used for (generally) non-potable domestic purposes. The penetration of domestic water supply connections is only about 25% in the urban area.
4. Flooding occurs frequently, with around 35% of the urban population regularly experience flooding of their residences. Climate-change impact assessments for the city predict an increase in the frequency and intensity of rainfall which is likely to exacerbate flooding and rain-induced landslides. Climate-change is also likely to increase storm surge, coastal and stream erosion, which will in turn contribute to further flooding and inundation by the sea.
5. The Comprehensive Land Use Plan (CLUP) and associated Comprehensive Development Plans (CDPs) for the city are supposed to provide a development framework. However, while the current CLUP is out of date, the city has been unable to agree on the new CLUP which should guide development over the period 2014 to 2024. This has been caused by a combination of: (i) a lack of agreement among city departments on local development issues and priorities; and (ii) delays caused by a backlog of documents for review and ratification by the Housing and Land Use Regulatory Board. As a result, there is currently no development framework in place.
6. The wastewater management and storm-water drainage sectors are characterized by fragmented, and in some cases overlapping responsibilities which prevent optimal oversight and management of the sectors, and compromise the effectiveness of service provision. The Metro San Fernando Water District (MSFWD) and the relevant departments of City Government – particularly the City Environment and Natural Resources Office (CENRO) – are mandated to play crucial roles in water supply and the management of wastewater. Currently, MSFWD has no role in wastewater management, and CENRO lacks the technical resources to develop and operate wastewater management infrastructure. In the storm water drainage and flood control sector, responsibility is shared between national agencies (notably DENR for watershed management and DPWH for major drainage) and the city. Figure ES1 shows the location and a map of San Fernando City, La Union.

Figure ES1 Location and a map of San Fernando City.



ES3 Opportunities

7. The rationale for the project is underpinned by the San Fernando's Vision 2020 which sees San Fernando as the centre for healthy living and wellbeing in Region 1 by year 2020. Achieving this objective will demand significant investment in both drainage and wastewater management in the short-term and beyond.
8. At the community and household levels, investment in infrastructure such as flood protection and improved sanitation facilities are perceived as important interventions in bringing about significant quality-of-life benefits to households, and particularly to women and children. Information obtained from the social survey conducted under the project identified priorities as: (i) improvement in sanitation, and providing improved access to wastewater facilities and services; and (ii) an urgent need to address the city's flooding problems, through the introduction of durable and sustainable solutions.
9. San Fernando has been a leader among cities in the Philippines in introducing innovative sanitation and wastewater management facilities. Prior investments in the sector include the septic sludge treatment facility, decentralised wastewater treatment facilities at the market and slaughterhouse, communal eco-tanks, and household-level eco-san toilets. These have experienced a variable degree of success, but have provided a platform and experience on which future sector plans and projects can build.
10. The city runs a surplus budget, and already levies and collects an environmental charge designed to cover the cost of septic sludge collection and treatment. The fact that these financial conditions are in place provides an opportunity for the city to leverage its investments in the sector.
11. The MSFWD has entered into an arrangement with a private sector operator to operate the water supply and wastewater management systems in San Fernando and to achieve enhanced water supply and wastewater collection and treatment coverage targets. This also presents an opportunity for both management and financial resources to be attracted into the sector in San Fernando.

ES4 Proposed Programs and Projects

12. **Program Impact:** Reduced wastewater pollution and flooding, and a cleaner and safer urban environment in San Fernando

Program Targets:

- **Sanitation and Wastewater management** – 70% coverage by sanitary sewerage and sewage treatment and the remaining 30% by septage treatment by 2035.
- **Stormwater drainage and flood control** – reduction in flooding and flood damage to infrequent and occasional shallow flooding of short duration at critical flood points.
- **Environmental -** Quality standard of coastal waters raised from Class SC to class SB.

Program Outcomes:

- Sound long-term planning framework for wastewater management and drainage improvement established and operational
- Sustainable improved sanitation and wastewater management services for all, and reduced incidence of flooding in San Fernando.
- Increased wastewater and septage collection and treatment coverage in San Fernando.
- Reduced incidence and duration of flooding in San Fernando
- Sanitation and wastewater management services improved and self-financing

13. The proposed sector targets, which the program is designed to achieve, are supported by measurable indicators as follows:

Table ES1 Wastewater Management Sector Targets

Indicator	How Measured	Measured By	2015	2020	2025	2030	2035
Sanitation Coverage	Survey	CENRO	87%	100%	100%	100%	100%
Wastewater collected by DEWATS	By inflows at (DEWATS) WWTPs	CENRO	0	20%	40%	60%	70%
Septage treated	Measured at septage treatment facility	Operator & checked by CENRO	15-25%	60%	100%	100%	100%
Sealed Septic Tank Coverage	By survey & checking	CENRO	52%	80%	100%	100%	100%

Table ES2 Drainage Flood Control and Watershed Management Sector Targets

Indicator	2015	2020	2025	2030	2035
Flooding from Streams and Creeks					
Frequency of flooding	Regular flooding every year during major storms. Major flood under extreme storm events	Flooding reduced to 1 in 10-year flood event (i.e 10% chance of occurring annually)	Flooding reduced to 1 in 20-year flood event (i.e 5% chance of occurring annually)	Flooding reduced to 1 in 20-year flood event (i.e 5% chance of occurring annually)	Flooding reduced to 1 in 25-year flood event (i.e 4% chance of occurring annually)
Flood duration	Up to 1 day	Up to 6 hr	Up to 3 hr	Up to 3 hr	0 –Up to 2 hr
Depth of flooding	1 - 5 m	<1 m	< 1 m	< 0.5 m	< 0.5 m
Flooding from Roadside and Other Drains					
Frequency of flooding	Regular flooding every year during major storms	Flooding reduced to 1 in 2 or 5-year flood event	Flooding reduced to 1 in 10-year flood event	Flooding reduced to 1 in 20-year flood event	Flooding reduced to 1 in 25-year flood event
Flood duration	Up to 3 hr	Up to 2 hr	Up to 2 hr	Up to 1 hr	Up to 1 hr
Depth of flooding	Over 1 m	< 0.5 m	< 0.2 m	< 0.2 m	< 0.1 m
Incidence of Rain-induced Landslides					
Landslide interrupting or disconnecting infrastructure	Baseline of X incidents every year established	Baseline - 10% every year	baseline – 20% every year	Baseline - 50% every year	Baseline – 100% every year
SuDS Measures Introduced					
Retention areas identified and created	No areas identified and none created	2 areas identified and 1 created	3 areas identified and 2 created	5 areas identified and 2 created	8 areas identified and 5 created
Proportion of	Baseline	Baseline	Baseline	Baseline	Baseline

Indicator	2015	2020	2025	2030	2035
green area to paved area	established	proportion maintained	proportion + 2%	proportion + 5%	proportion + 10%

14. The proposed projects are intended to enable achievement of these sector targets. In the short- and medium-term, the project interventions have been subject to full pre-feasibility analysis. Summaries of these project packages are provided in the Project Summary Fiches attached at Annex 2 to this Report.

15. The priority short- and medium-term actions identified in the wastewater management sector are as follows:

    1. Rehabilitation of existing wet market wastewater treatment plant and sewerage system, including system extensions to increase wastewater coverage (Project Summary Fiche 1).
    2. Repair of slaughterhouse wastewater treatment facility (Project Summary Fiche 2).
    3. Refurbishment of Septage Treatment Plant (Project Summary Fiche 3).
    4. Replacement or replacement of communal septic tanks (eco tanks) - identify causes of non-performance and repair or upgrade accordingly (Project Summary Fiche 4).
    5. Install small-bore wastewater collection and DEWATS treatment plant, and aim to maximize connections to replace communal latrines in coastal strip of city (Project Summary Fiche 5).
    6. Septic tank sealing program for households and businesses with unsealed septic tanks, and facilitation of latrine provision in foreshore and rural areas without access (Project Summary Fiche 6).
    7. Preparation of a Wastewater, Drainage and Green Development Master Plan with GIS, to provide the basis for future sector plans and programs (Project Summary Fiche 7).

16. The priority short- and medium-term flood control and drainage activities are to:

    1. Prepare a drainage master plan for the City outlining the development of an overall drainage system for the City, and to guide future developments and prevent drains from being built haphazardly (Project Summary Fiche 7).
    2. Provide improved area drainage in the Sevilla area, which is currently subject to frequent flooding, and construct outfall drainage across north-south North Road and Diversion Roads (Project Summary Fiches 8 and 9).
    3. Remove obstructions and improve cross-drainage structures such as under-sized culverts, etc. particularly across obstructive north-south national road in the areas around the Oasis hotel (Project Summary Fiches 10 and 11).
    4. Carry out priority drainage improvements in the north of the Central Business District in areas affected by storm-water ponding in accordance with the drainage masterplan for the CBD prepared in 2015 (Project Summary Fiche 12).
    5. Support the City's efforts to actively pursue its Integrated Watershed Management Plans and make drainage and flood control investments in accordance with SuDS approaches, particularly in the Carlatan wetland basin and in upland catchments, including reforestation (Project Summary Fiches 13, 14 and 15).
    6. Improve the capacity of the streams (particularly Tangui Biday Creek and Narra-Cabaroan Creek) by dredging, lining the channel banks and providing floodwalls along some reaches of the streams (Project Summary Fiches 16 and 17).
    7. Carry out drainage improvements and slope protection on critical sections of the city road network with inadequate or undersized drainage (Project Summary Fiche 18).

17. The physical investment program will be supported by a range of institutional reform and capacity development actions to support the continued development and implementation of green and integrated wastewater and flood management strategies, programs and projects. Key among these are:

    1. Separation of the: (i) regulatory; and (ii) executing, implementation and management functions within the wastewater management sector. (i.e. the City as regulator, and the Water District as implementer and manager of investment, and as service provider and operator).
    2. City government to reach agreement with the Water District on roles and responsibilities in the wastewater management sector through a memorandum of agreement (MOA) with the Water District setting out a roadmap for sector institutional reform and program execution.
    3. Improved planning and coordination between city government departments, including capacity development at the city level on data needs, data generation, data capture, interpretation and processing, and importance of data in informing investment decisions.
    4. Capacity building and development of GIS capabilities, and in data sharing and integration.
    5. Support to metropolitan-scale planning approaches including supporting the City to understand that metropolitan-level planning can generate economies of scale in water resource management and other areas.
    6. Maintain natural flood areas where possible and control the filling and development of the area in accordance with CLUP and drainage masterplan provisions.
    7. Efforts be made to strengthen the City's and barangays' and communities' abilities in the areas flood preparedness, emergency response, recovery and community awareness in preparation for flood events.

ES5 Program Costs and Financing Plan

18. The total costs of the short- and medium term investment program is estimated as follows:

Table ES3 Proposed Investment Program Outline Cost Estimate

Cost Components (PHP million)	Total	% Total	Short-term	Medium-term
Sanitation & WW Management	430	50%	373	57
Drainage & Flood Control	265	31%	132	133
Total Construction Cost	**695**	**81%**	**505**	**190**
Capacity Building	8	1%	8	-
Project Management Support	151	18%	129	22
Total Project Cost	**854**	**100%**	**642**	**212**

Source: Consultants' Estimates.

19. It is proposed that the program would be financed by a combination of equity and loan financing as shown below:

Table ES4 Proposed Investment Program Outline Financing Plan

Sources of Funds (PHP Million)	Total	% Total	Short-term	Medium-term
Borrowings from MDFO	229	27%	229	-
NSSMP Grant Fund	-	0%	-	-
City Counterpart Fund	325	38%	265	60
DPWH Budget Allocation	186	22%	91	95
Homeowners Contribution	114	13%	57	57
Total Project Cost	**854**	**100%**	**642**	**212**

Source: Consultants' estimates.

ES6 Program Viability

20. The financial and economic analysis demonstrate that the proposed short- and medium-term program is both financially and economically viable. The analysis suggest that the base case FIRR is 4.7% and the EIRR 32% for the wastewater component and 26% for the drainage and flood control component. However, the FIRR in particular is not robust in the event of increased costs or delayed benefits. In terms of affordability, the project is affordable provided that an element of lifeline pricing is adopted for those households in the lower affordability quartile.

21. As a whole, the project package is considered to generate strong environmental and social benefits, provide both the Environmental Management Plan and Social and Gender Action Plan are executed in parallel with the investment program. It is not anticipated that there will be any significant land acquisition or resettlement requirements for the short-and medium-term program, although a financial provision has been made for this.

22. Social benefits of the program will particularly be felt by women, children and the elderly. Children and the elderly are considered the most vulnerable to waterborne diseases, the incidence of which will be reduced through improved sanitation and wastewater management, and a reduction in flooding. Women, who generally care for sick children and elderly relatives, will benefit from increased retained earnings which would otherwise be lost in time taken away from work or business to look after sick family members. Additional financial benefits will result from reduced expenditure on medicines. Furthermore, poor households are disproportionately impacted by flooding, the reduction in which will reduce the costs of flood damage, labour days lost, and business losses, and consequently contribute to poverty reduction.

23. Community engagement will be enhanced by the proposed program, particularly through involvement of communities in neighbourhood-level SuDS initiatives. The separation of responsibilities between the city (as regulator) and water district (as service provider) in the water and wastewater management sector will improve governance in the sector, and consequently the quality and effectiveness of service delivery. The improved mechanisms for inter-departmental coordination within the city Government, and intensified dialogue and joint planning with the metropolitan (CELUMPA) area will also improve the effectiveness urban planning and governance.

24. Training was carried out during the pre-feasibility study (PFS) to: (i) contribute to enhancing the understanding by city stakeholders of sector issues and the potential solutions which the project proposes; and (ii) clarifying the role that city government departments can play in supporting subsequent stages in the project cycle. This training took the form of regular on-the-job engagement between the PFS team and city government staff and formal information exchange

through presentations. Focus areas included: (i) green and sustainable urban development – international experience and local applications; and (ii) sustainable urban drainage solutions.

ES7 Next Steps

25. The key next steps to ensure that the program continues to move forward are:

- Continuing dissemination of the project to stakeholders and dialogue between CDIA the City Government and MSFWD.
- Reaching of an agreement on sector responsibilities and roadmap and signing of an MoA between the city government and water district
- Identification and allocation of funding sources, and finalisation of financing plan
- Identification and securing of additional (loan and grant) finance

1 Introduction

1.1 Purpose and Scope of the Pre-Feasibility Study

1. The purpose of the Cities Development Initiative for Asia (CDIA)-supported Green and Integrated Wastewater Management (GIWM) study is to provide the City Government of San Fernando La Union with sufficient information and justifications to make informed decisions on the most appropriate options for: (i) delivering sustainable access to improved and affordable sanitation and wastewater management for all the population; and (ii) reducing the costs and impacts of flooding caused by extreme weather events. The study recommends and provides outline resource requirements for a strategy to be followed over the next 20 years to ensure the long-term sustainability of sanitation, wastewater management and storm-water drainage services in San Fernando city. It also assists the city government to prioritize works, and to develop more detailed investment plans in sanitation, wastewater management and storm-water drainage over the next two five-year periods – 2016 to 2020 and 2021 to 2025 – including pre-feasibility analysis and due diligence. The GIWM will also promote San Fernando as a model of excellence in sanitation and wastewater management services that can be duplicated in other coastal urban centres in the country.

2. The objectives of the Study are to improve the environment and public health of the City of San Fernando La Union by: (i) improving sanitation infrastructure and capacity in urban management, (ii) reducing the incidence of flooding through improved storm-water drainage; (iii) improving surface and groundwater quality, and (iv) promoting private sector participation in the provision of urban services. The study objectives have been supported through capacity development of the responsible agencies and staff at the city level.

3. The study involves the accomplishment of three work stages over the nine month project duration[1] up to Final Report (FR) stage:

   i. Analysis and diagnostic of the current status of sanitation, wastewater management and storm-water drainage in the city, and identification of key sector issues. In San Fernando this includes on-plot facilities, the existing small decentralised collection and treatment systems and septage management arrangements (reported in the Interim Report).

   ii. Based on this review, and on discussion with key stakeholders, development of a strategy for progressive improvement of sanitation, wastewater management and storm-water drainage over the period 2016 to 2035, and an associated outline investment program (reported in the Interim Report).

   iii. Pre-Feasibility study of a program of: (a) prioritized urban sanitation and wastewater management infrastructure improvement; and (b) storm-water drainage improvements and flood control measures. The investment program is developed for short-term (2016 to 2020) and medium-term (2021 to 2025) time horizons.

1.2 Structure of the Report

4. This report forms the final output of the GIWM for San Fernando City. It is a stand-alone report presented in two volumes – a main text, and a volume of appendices. This Main Text volume provides an executive summary and short report which covers all aspects of the work in San Fernando. Detailed analysis and project proposals are included in the volume of appendices.

1 Project duration extended due to the additional time required to allow the cities to provide substantive comments on the Interim Report.

5. This Main Text report summarises: (i) the project rationale, which highlights development challenges facing the city, and presents the current performance in the sanitation, wastewater management, drainage and flood control sectors; (ii) current and planned committed and funded activities in these sectors; (iii) the city's strategic goals and objectives for the sectors; (iv) the proposed sector roadmaps and investment programs to achieve these goals; (v) Investment Program outline costs, financing plan, and implementation arrangements; (vii) priority immediate (short- and medium-term) project proposals and their pre-feasibility analysis; (viii) priority project environmental and social due diligence and safeguards; and (ix) an outline of Project benefits, impacts assumption and risks.

6. The Appendices provide: (i) the project design and monitoring framework; (ii) a summary of current city plans and growth prospects; (iii) an analysis of city vulnerability and resilience to hazards; (iii) a city environmental profile; (iv) a diagnostic of existing sanitation, wastewater management, drainage and flood control systems; (vi) the survey findings for San Fernando City; (vii) an analysis of septage treatment options; (viii) detailed project proposals; (ix) financial and economic pre-feasibility analysis; (x) preliminary environmental and social evaluations of the project; (xi) a dissemination and communication plan; and (xii) initial development impact assessment (IDIA) forms.

1.3 Guiding Approach and Methodology

7. The approach and methodology which has been adopted in guiding development of the strategies and investment programs for wastewater management and storm water drainage improvements in San Fernando is as set out below.

8. **Incorporating a comprehensive "Green Cities" and climate-change resilient approach into the strategies, investment program and project designs.** The strategies, programs and projects have been developed within a framework which recognizes this emerging approach to integrated urban development and environmental planning. This enables the city to better respond to rapid urbanization and its associated challenges— the degrading of environmental quality; inefficient resource consumption; inequitable growth; and increased risks from climate-change and natural disasters—which progressively compromise liveability. In particular, the advice of the Housing and Land Use Regulatory Board (HLURB) on incorporating Climate and Disaster Risk Assessment techniques into urban planning, and work recently carried out[2] on vulnerability and resilience analysis in San Fernando, has been used to guide the selection and prioritisation of elements of the program.

9. **Adopting a consultative and inclusive program prioritisation and design process to ensure ownership of the project outputs.** The sector development strategies, roadmaps and proposed program components have been developed based on both a diagnostic of current sector issues and weaknesses, and on extensive discussions with the primary project stakeholders. This has included city officials (and particularly those included in the Project Technical Working Group), other key stakeholders (through focus group discussions) and the public (through focus group discussions and the household surveys). Through adopting this approach, the proposed investment program enjoys strong stakeholder support. This should ensure that the city government and beneficiary communities develop a strong sense of ownership of the assets created under the program.

10. **Balancing innovation and proven technical approaches.** San Fernando has been exposed to innovative wastewater management approaches. Pilot wastewater management systems have been introduced for market and slaughterhouse wastewater treatment,

2 Climate Change, Vulnerability Assessment, and Adaptation Scenarios and Strategies for San Fernando: International Council for Local Environmental Initiatives – Local Governments for Sustainability Southeast Asia Secretariat, Manila, 2014

septage treatment, and community and on-plot sanitation systems[3]. The approach supports innovation where it offers more efficient solutions and thus better value for money. However, it is only where there is strong evidence that these innovative approaches are proven under conditions prevailing in San Fernando, and offer long-term sustainable solutions, that they have been proposed. The proposed solutions build on local knowledge and experience of what has, and has not, worked before, and an analysis of why it has, or has not, been successful.

11. **Adopting a holistic approach – consideration of the sectors which will have an impact on the effectiveness and success of a program of wastewater management and drainage improvements.** The wastewater management and storm water drainage and flood control sectors are strongly interrelated with other urban development sectors, particularly, urban planning, water supply and hygiene (for wastewater management) and watershed management and solid water management (for drainage and flood control). While interventions in these related sectors are not necessarily included in the proposed program, these sectors are considered in program formulation and project design. Where decisions or actions are required in these related sectors to ensure the success of program interventions, these are highlighted and the required actions are identified.

12. **Strengthening institutional capacity for development, and implementing mechanisms to achieve and sustain results**. Institutional development and the achievement of results from infrastructure investment go hand in hand. The soundness of the concerned national agencies and city government and other local institutions to develop and implement policies, and manage program resources is crucial to development effectiveness of the proposed interventions. Our analysis points to the lack of institutional capacity in the city as a key constraint to effective planning, implementation, and management of urban wastewater management and drainage activities. This lack of capacity at the city level risks compromising the achievement of strategic targets and must be addressed appropriately. Consequently, the program includes capacity development and institutional strengthening proposals. These will ensure the proposed programs can be efficiently and effectively implemented, and sustainably operated and maintained.

13. **Promoting and supporting Project sustainability**. The long-term sustainability of the proposed programs and projects is supported by the application of the following principles in program and project preparation: (i) promoting government ownership; (ii) linking interventions to achieving clear and measurable better service delivery results; (iii) ensuring that technical solutions are fully understood and supported; (iv) supporting selective, well structured, and well-sequenced learning; and (v) encouraging mutual learning among stakeholders.

14. **Fostering the economic sustainability of project investments.** Green Cities go beyond environmental sustainability. They are also about improving quality of life and creating business opportunities throughout the local economy. This has been kept in mind during program and project identification, with identified projects seeking both to address deficiencies and maximize support for the economic development of San Fernando. The infrastructure, environmental and capacity improvements are designed to facilitate priority development in the employment and residential development spheres. San Fernando is likely to drive economic growth within its sub-region, and improved urban environmental infrastructure and services are instrumental in facilitating broad local economic growth. The proposed programme enhances the economic and livelihood development prospects for the city. The economy will benefit as a consequence of better urban sanitation, wastewater

3 The “Eco tank” – effectively an above ground communal septic tank, but not functioning well in the two sites where it is installed, and the eco-san “dry” toilet, installed in one community, and generally working well.

management and drainage systems which improve public health, reduce business costs, and match state-of the-art green development standards.

15. **Identifying potentials for private sector participation.** There is currently only very limited involvement of the private sector in the provision of sanitation, wastewater management and storm water drainage services in the city. In identifying delivery and operational modalities for the programs and projects, the possibilities for private sector participation have been considered, particularly in funding and operating wastewater management facilities, and the establishment of public-private partnerships for wastewater and drainage development projects. This is particularly true of the wastewater management sector where partnerships between the city, water district and private sector are already in early stages of development. The proposals are referenced against recent experience of the Philippines in working with the private sector in developing and implementing public-private partnership in the wastewater management and drainage sectors.

16. **Improving horizontal and vertical coordination and consideration of metropolitan approaches**. There are generally poor levels of collaboration between the Water District which is responsible for drinking water production and supply in the city, and the city government which is currently responsible for sanitation and wastewater management. In the drainage and flood control sector, coordination between DPWH and the city is generally poor. In San Fernando the geographical jurisdictions differ between water district and the city. Water supply and wastewater management are inextricably linked – wastewater currently pollutes the groundwater that is used untreated for the majority of domestic supplies. In addition, wastewater is no respecter of local government jurisdictions. Long-term solutions to these issues lie in: (i) better coordination between the agencies involved in the water cycle (short-term); and (ii) (longer-term) the adoption of a metropolitan approach to wastewater and drainage issues – particularly in this case where the city (and contiguous municipalities) are conurbated along the coastal belt, and share a common water supply.

2 Rationale: Sector Performance, Challenges and Opportunities

2.1 Urbanization Trends and Challenges

2.1.1 Urban Form, Dynamics and Planning Issues

2.1.1.1 Role and Population Aspects

17. The city of San Fernando, La Union is a component city and the provincial capital of La Union, one of four provinces in the Ilocos Region: Region 1. As provincial capital, it fulfils an important role providing commercial, health, education and administrative services for the area. As a coastal city, San Fernando is vulnerable to the impacts of climate change and coastal processes along its shoreline. The topography of the city is a combination of coastal plain (where development is concentrated) and the foothills of the Cordillera Mountain Range to the east. San Fernando had a population of 114,963 in 2010, and the city has estimated the 2015 population to be 124,888 rising to 144,963 in 2024, adopting a growth rate of approximately 1.6%[4].

18. The Illocos Regional Plan (2011 – 2016) provides an overview of the economic, social and physical status of the region and sets out the corresponding vision and objectives. This provides a development framework for Local Government Units (LGUs) to develop their Comprehensive Land Use Plan (CLUP). Agriculture is highlighted as the principal economic driver for Ilocos, along with the need to develop a service industry. Following the 2009 global economic downturn and a series of severe weather events, the agricultural sector has shown a sharp decline[5]. The Regional Plan notes the vulnerability of the agricultural sector to both climatic shocks and global markets.

2.1.1.2 Economic and Physical Aspects

19. Agriculture and associated industry has historically been the main economic driver for the city of San Fernando. However, the economic makeup of the city is changing as a result of conversion of agricultural lands for development. Land conversion is identified by the City as an issue in its draft CLUP and it notes the need to have a more proactive policy to address the issue. The draft CLUP also notes that despite the policy intent of the Regional Plan and previous plans for San Fernando which have emphasised the importance of agriculture and agro-industry, the city has not seen significant growth in this area. Investors and locators in this sector have remained few.

20. Consequently, the draft CLUP is reorienting its policy thrust toward supporting trade and commercial and urban services development. Trade and commerce in San Fernando demonstrated 5.91% growth for the period of 2011 – 2015 corresponding with an increase in overall business permit registrations. This is a positive growth rate that provides a sound justification for the city looking to support this sector.

21. The city acknowledges the relationship it has with its surrounding municipalities and that there is benefit in adopting more integrated planning. The city is part of the Metro La Union Development Coordinating Council (MLUDCC) but this is yet to become a fully effective mechanism for cross-boundary cooperation. In the previous CLUP (2000-2010) MLUDCC is referenced in the context of constructing a circumferential road and in the role it can play to strengthen San Fernando's role as a service provider to neighbouring municipalities.

4 The City of San Fernando advised that the growth rate adopted is the average of the growth rates from 2000, 2007 and 2010. The figure or 1.6% is also consistent with the TA 7122 (Water Supply Extension TA) which projects this rate for the 2008 – 2025 period.

5 See chapter 1 Ilocos Regional Plan 2011-2016

2.1.2 Environmental Baseline and Intensifying Environmental Challenges

22. The pace of climate change is generally accepted to have significantly increased over the past few decades as a result of the increasing rate of greenhouse gas emissions. Climate change results is altered patterns of rainfall and increased occurrence of extreme weather events. These are likely to lead to higher intensity and more concentrated rainfall in San Fernando, resulting in flooding and rain-induced landslides.

23. The effects of climate change are particularly pronounced in the Philippines which is hit by about twenty typhoons each year. Low- lying areas experience recurrent flooding even with short-duration rainstorms, while those at higher elevations are under constant threat of rain-induced landslides. Much of the more intensively developed area of San Fernando lies along the coastal belt, and is consequently at risk from storm surges which exacerbate the flood risk. Communities that are affected have adjusted their lifestyles and are beginning to adapt, but more needs to be done to improve the resilience of communities to these more frequently occurring extreme events.

Flooding in the City of San Fernando during Tropical Storm Egay in July 2015

24. To address the impacts associated with climate change, cities need to implement adaptive management strategies for water management, flood protection and drainage improvement. It is in this context that the Green and Integrated Wastewater Management Project for the City of San Fernando is developing strategies to address the problems of wastewater management, flooding and poor drainage. The approach and design of the proposed program and projects considers the impact of climate change on both structural and non-structural interventions.

25. Further environmental challenges are faced as a result of rapidly growing urban populations, which place increasing stress on land and on the provision of vital environmental services such as sanitation, drainage, and wastewater and solid waste management. Increased development means an increase in impermeable areas, which in turn contributes to additional storm run-off and consequently increased flooding. In San Fernando, the filling of land for development[6] reduces flood storage potential and interrupts natural drainage courses.

2.2 Climate-change Vulnerability

2.2.1 Trends and Threats

26. Adopting the projections of PAGASA's PRECIS modeling under a medium-range emission scenario, the climate projections for San Fernando City are presented in Tables 2-1 and 2-2 below. The model predicts that the City will experience higher temperatures during the summer season, and increased rainfall during the rainy season (3rd quarter of the year).

6 It is understood that permission for the filling of land can be issued by the Barangay council, and that there is no need for any form of environmental impact assessment which would consider mitigation of potentially negative impacts.

Increased rainfall and extreme weather events may induce flooding, storm surges and rainfall-induced landslides.

27. From the climate projections for La Union, seasonal temperature will increase by 0.9 to 1.1oC by 2020 and 1.6 to 2.1oC by 2050. Seasonal rainfall will change by between -0.4% and 43.1% in 2020 and by a wider range of –24.6% to 72.5% by 2050. The rainfall predictions will mean overly dry months in the summer, and extremely wet conditions during the southwest monsoon.

Table 2.1 Climate Projections in 2020 and 2050 for La Union Province - Medium Range Scenario (PAGASA, 2011)

Parameter	Baseline (1971-2000)				Projected in 2020 (2006-2035)				Projected in 2050 (2036-2065)			
	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Temperature, ºC	20.5	22.9	22.8	22.2	21.4	24.0	23.5	23.2	22.5	25.0	24.2	24.0
	Predicted Change, ºC				0.9	1.1	0.7	1.0	2.0	2.1	1.6	1.8
Rainfall, mm	14.7	395.6	1852.3	837.8	14.6	413.4	2650.6	1089.1	14.5	298.3	3195.2	1164.5
	Predicted Change, %				-0.4	4.5	43.1	30.0	-1.1	-24.6	72.5	39.0

Table 2.2 Frequency of Extreme Events in 2020 and 2050 for La Union Province- Medium-Range Emission Scenario (PAGASA, 2011)

Parameter	Number of Days with Tmax > 35oC			Number of Dry Days			Number of Days with Rainfall > 300mm		
	Observed 1917-2000	2020	2050	Observed 1917-2000	2020	2050	Observed 1917-2000	2020	2050
La Union, using Dagupan Station	1280	2265	3728	8303	6443	6419	2	13	20

28. A warmer and wetter climate can be a cause for increases in vector-borne and water-borne diseases. Higher temperatures may results in water shortages that can decrease the production of rice and other crops. Hot surface water temperature can cause coral bleaching and reduce fish supplies while increased rainfall and extreme weather events may induce flooding, erosion, storm surges and rain-induced landslides. Sea-level rise will cause coastal erosion and a loss of land and property.

2.2.2 Urban Vulnerabilities and Impact

29. Based on the Climate Change assessment carried out for the City under the ICLEI project[7], the major impacts of climate change in the City are likely to be increased flooding, rain-induced landslide and drought. The projected increase in the frequency and intensity of rainfall and typhoons will mean the City facing increased climate-related hazards of storm

7 Climate Change and Vulnerability Assessment of San Fernando City, ICLEI, November 2013

surge, coastal and stream erosion, floods, strong (and potentially damaging) winds and rainfall-induced landslides. Approximately 60% of rainfall falling on the City is caused by the passage of tropical cyclones.

30. Higher rainfall intensity coupled with high tides and storm surges, particularly during typhoon events, may trigger widespread flooding in San Fernando City, especially in the central and western parts which are low-lying, and in the pond areas to the northwest of the city. As a result of the impact of current siltation rates and encroachment, rivers and creeks already overtop their banks during heavy rains, with floods generally ranging from 30 to 50 centimeters in depth and receding within 2 hours.

31. ICLEI's Vulnerability Assessment Report predicts that the negative impact of increased flooding on the agriculture and fisheries sectors will be significant, largely through damage to agricultural products, increase in parasites and diseases harmful to fish, higher costs of goods and inputs, and reduced income of farmers and fisher-folk. Floods are also likely to negatively affect the river systems of the City, causing siltation and destruction of aquatic biodiversity.

32. Due to its rugged relief and steep slopes in some areas, San Fernando is also susceptible to rain-induced landslides. Strong winds (151-200 kilometers per hour) which accompany typhoons cause damage to lightweight structures within the City, and pose a threat to rice and corn crops, electrical power cables, trees and communication services.

33. The City is also considered vulnerable to drought, which may result in a decrease in water supply and depletion of water resources, leading to water stress, decreases in crop and livestock production, and thus loss of income. Incomes of the fisher-folk may also be negatively impacting as a result of bleaching of corals and fish kills caused by drought.

34. Coastal and stream erosion are also identified as potential hazards which may be induced by climate-change factors. The entire 19-kilometer coastline of the City is vulnerable to coastal erosion from storm surges and strong typhoons and to reduced supply of sediments during extreme dry spells. Coastal erosion may also be brought about by sea-level rise which may cause shoreline retreat landward, land cover changes, human sea-defense activities (including mining, construction of seawalls and riprap protection) and destruction of coral reefs, mangroves and sand dunes.

35. The City must prepare for the increased incidence of floods, coastal erosion, saltwater intrusion and changes to coastal ecosystems. With the cumulative and gradual effect of storm surges and accelerated coastal erosion, the coastal resources of the City are at risk. Improved adaptive capacity to climate change impacts needs to be introduced through structural (flood control dikes, storm surge barriers and embankments), non-structural (capacity development and strengthening of environmental policies), and green (planting, creation of flood retention basins etc.) measures.

36. A more detailed analysis on urban resilience specifically related to wastewater management and drainage systems has carried out for San Fernando City. This highlights the importance of the mainstreaming of climate-change mitigation and adaptation actions and disaster resilience into urban planning and project identification and design. The proposed framework and a list of resilience strategies has been drafted and are presented in Appendix C. These, the ACCCRN[8] Workbook Manual, and the guide on urban system climate

8 Building Urban Climate Change Resilience: A Toolkit for Local Governments. ICLEI Asian Cities Climate Change Resilient Network (ACCCRN) Program. (1st Edition December 2014)

sensitivity prescribed by the DG-CLIMA of the European Union (COWI 2012)[9], have been used in the identification and design of potential programs and projects, in discussion with the San Fernando City Environment and Natural Resource Office (CENRO) and other stakeholders.

2.3 The Planning Framework

2.3.1 Philippine Planning Framework

37. The planning process in the Philippines is led by the National Economic and Development Authority (NEDA) which is tasked with coordinating and formulating policies, plans and programs to efficiently set the broad parameters for national and sub-national (area-wide, regional and local) development. At the local level, support to Local Government Unit's (LGUs) is provided by the Department of Interior and Local Government (DILG)

38. The framework to enable development that considers green, sustainable and resilient practices through the planning process is in place, and there is an awareness of environmental issues and the impacts that a changing climate will have on the City. What is lacking is a coordinated approach to address cross-sectoral and cross-boundary issues. Although a potential metropolitan-level planning structure has been identified for San Fernando through the Metro La Union Development Coordinating Council[10] (MLUDCC) and the Central La Union Metro Planning Authority (CELUMPA) this arrangement has yet to be developed to the point of being effective.

39. The draft San Fernando Comprehensive Land Use Plan (CLUP) sets out the vision for the city to (currently) 2024, and the enabling policies for this vision to be realised. However, San Fernando has limited capacity and resources to prepare all the required plans and effectively integrate, program and implement the actions necessary to comply with the new disaster risk management and climate change adaptation and mitigation legislative requirements[11]. Figure 2.1 below sets out the planning framework highlighting the many inputs and influences which bear on local government in the planning process.

2.3.2 Strategic Planning for San Fernando

40. San Fernando faces a range of development challenges. Planning needs to address current deficiencies in city function and infrastructure provision as well as identify actions that can assist in improving the environmental condition, and respond to a changing climate. This requires that an integrated development approach be adopted. Green and integrated development means providing necessary urban services whilst simultaneously seizing opportunities to provide an improved natural environment and a better general living environment. To achieve this, a multi-sectoral approach is required that works across strategic and detailed phases of planning – both spatially and through prioritised investment planning.

41. Green and resilient development needs to follow a set of guiding principles that encourage and support more sustainable development outcomes. These principles have been developed into a suite of tools that can be applied across the different development stages of a program or project cycle. The common thread across all stages is that each 'step' includes an assessment of the types of changes or impacts that may occur over time due to

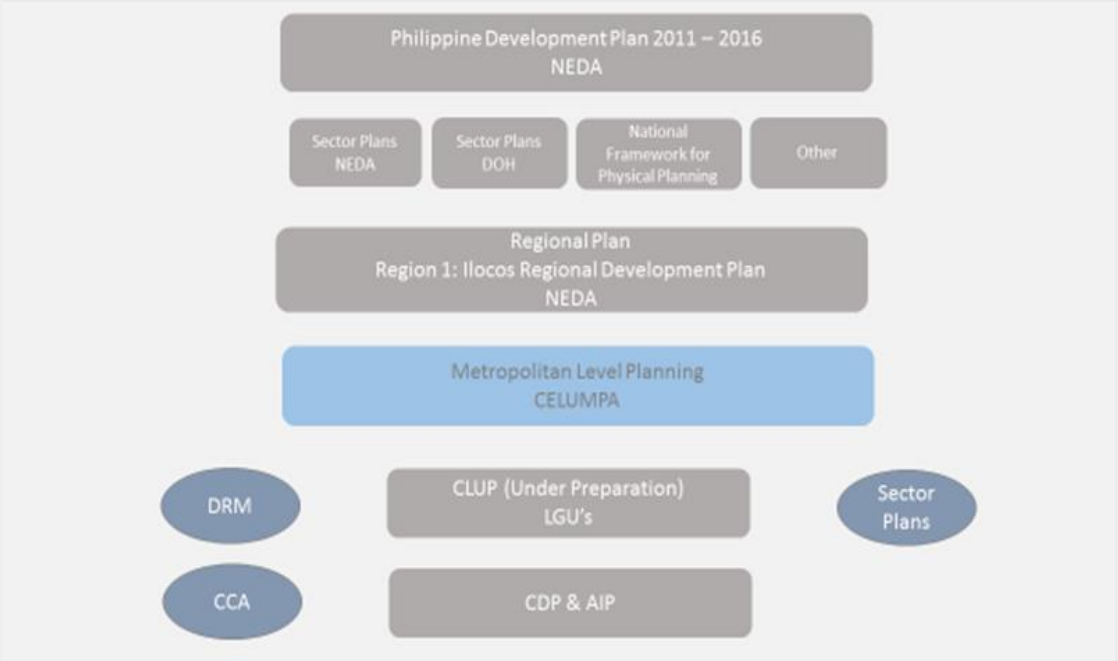
9 Guidelines for Project Managers: Making vulnerable investments climate resilient. Report to the European Commission DG CLIMA by Acclimatise and COWI, September 2012.

10 The main function of the Metro La Union Development Coordinating Council (MLUDCC) is to strengthen the comparative advantage of every LGU within the Metro La Union Area through cooperation, and supporting complementarity of priority programs and projects.

11 National Disaster Risk Reduction and Management Act, 2010 (RA 10121) and Climate Change Act, 2009 (RA 9729)

a changing climate, and identifies actions that are multi-functional: delivering a core of service to users, as well as the enhancing environment or quality-of-life outcomes. The process is outlined in Appendix H.

Figure 2.1 Overall Urban Planning Framework for San Fernando



42. The options developed under this project and ultimately the interventions selected, need to be situated within the existing panning framework of the Comprehensive Land Use Plan (CLUP) and be incorporated into the Comprehensive Development Plans (CDPs). Land use planning should provide a policy mechanism that enables diverse, and often conflicting, objectives to be integrated and addressed in a development framework– this process and its output, is referred to as 'integrated land use planning'. Through its development and implementation detailed land use planning:

- Identifies appropriate area(s)/location(s) for specific land uses;
- Determines what risks are associated with specific land uses in specific locations;
- Determines and identifies sensitive or important societal or environmental features; and
- Details the minimum requirements or expectations of particular land use types.

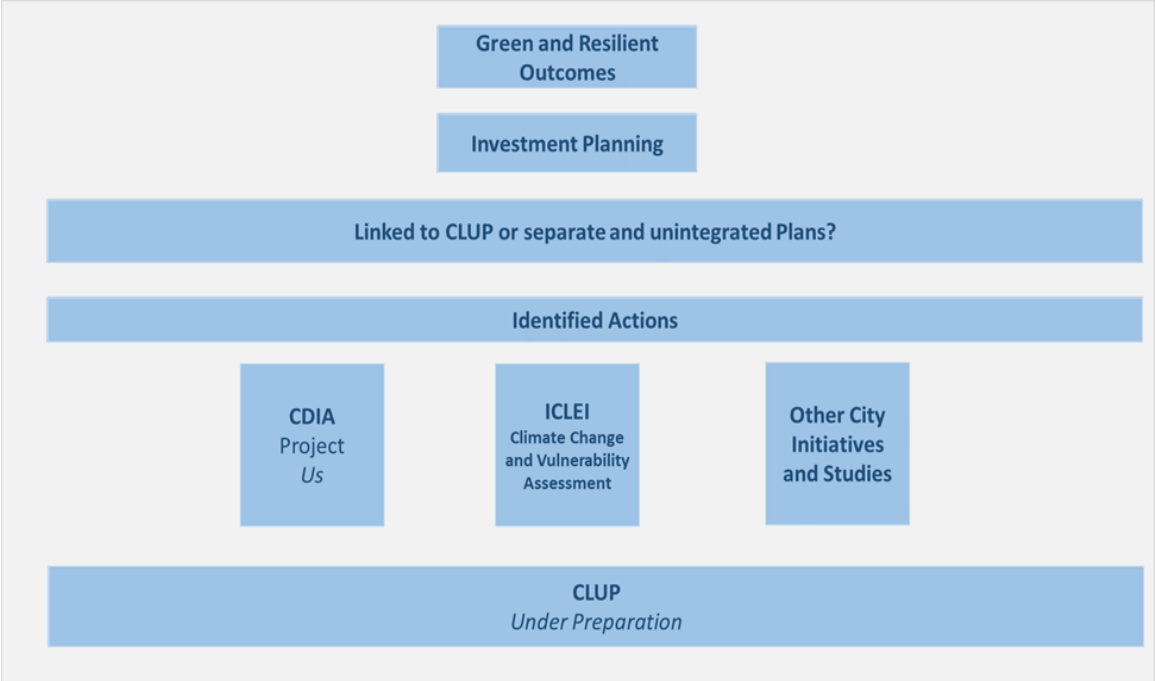
2.3.3 Current Status of CLUP

43. San Fernando, La Union City Planning and Development Office (CPDO), is currently preparing the CLUP for the city with a target date for finalisation which has now run over into 2016. This project must work within and support the objective and vision set out in the current draft of the CLUP. The task is made more challenging by sector-based, and issue-based plans which are often prepared in parallel, creating duplication and incoherence. Figure 2.2 below presents this challenge and its impact in threatening the achievement of green and sustainable outcomes in San Fernando.

44. There is an apparent disconnect between the preparation of planning policy, its implementation and enforcement, and the realities on the ground. Although the planning framework exists, the capacity of San Fernando City to effectively guide development is limited. As a result, development is driven by either the infrastructure e.g. roads

development, or speculation and availability of land, highlighting poor sector integration and a non-responsive planning policy. The impacts of this are poorly planned city centres and surrounding areas, increased environmental degradation through poorly sited development; alteration and obstruction of drainage paths and in turn greater vulnerability to flooding and rain-induced landslides, and damage to property and persons.

Figure 2.2 Planning Challenges in Developing the CLUP



45. While the draft CLUP includes provisions that highlight areas affected by certain issues – flooding, rain induced landslides etc., there is a not a comprehensive assessment or map that identifies land that is unsuitable for development, or where land back-filling (adopted extensively in San Fernando) will generate problems. These is no identification of areas at high risk for multiple hazards and/or areas that require remediation works, or in the case of settled areas, potential relocation. Furthermore, the city currently lacks the capacity to capture, manage and generate data based on real-time events. The city is largely reliant on national government agencies to collect, maintain and prepare updated maps reflecting localised issues.

46. The integration of project programing and corresponding investment planning is also limited. The breadth of identified actions within the CLUP of the city coupled with the range of other sector-level objectives that are not institutionally integrated, e.g the current separation of water supply and sewerage, leads to disconnects at the spatial, sectoral and investment levels, and greatly inhibits the city's ability to: (i) redress current service deficiencies; and (ii) effectively plan for future development and growth.

2.4 Sector Performance and Issues

2.4.1 Sanitation and Wastewater Management

47. In San Fernando, the approach to wastewater management in the past has been for households to use individual septic tanks. There is no residential sewerage in the city, apart from community-level shallow sewer systems which serve two small communities, with wastewater discharged to eco-tanks (effectively above ground communal septic tanks). The remained of households rely on sealed or "bottomless" septic tanks for treatment and

disposal of toilet wastes. The exception is a fisherman's village area where households are served by dry eco-san toilets. There is also a septic sludge treatment facility, and small DEWATS treatment plants treat wastewater from the market and slaughterhouse. Details of the current system, and a summary of previous work carried out in the sector us provided at Appendix E.

48. The Strategic Sanitation Plan of the City of San Fernando (SSP-CSF) 2006-2015[12] articulates the City's comprehensive proposals and initiatives for the sanitation sector. The SSP-CSF provides an analysis of the present level of sanitation services and the problems confronting effective service delivery in the sanitation sector. It defines strategic measures to address these problems, and identifies service provision and development options which the City may initiate or continue pursuing with its constituents and development partners. The plan period was to 2015, and Table 2.3 shows the progress made against the 2015 targets set out in the SSP-CSF document.

Table 2.3 Review of San Fernando's Strategic Sanitation Plan

Facilities and Equipment	Status	Comments
Sanitary Landfill	Constructed with World Bank loan	Operational
Materials Recovery Facilities	Integrated with Landfill	
Garbage Collection Vehicles	Provided under World Bank loan	
Wastewater Treatment Plant for City Market and Slaughter House	Constructed by city	City market treatment operational but underutilized. Slaughterhouse treatment is not operational.
City Level Septage Treatment Facility	Constructed by city	Underutilized
Improvement of Drainage System	Done in some areas	Still major flooding issues
Establishment of Water and Food Laboratory	Built	In operation
Construction of Ecosan Toilets	Built in Fisherman's Village	Used by beneficiaries
Watershed and Spring Development; construction of wells and ferro-cement water tanks	Carried out by MSFWD	

49. A major focus of the strategic sanitation plan was community-level development, improved coordination among agencies and advocacy for sanitation. The impacts of these activities are difficult to assess, but the fact that the eco-san toilets in the Fisherman's village are still being used indicates a degree of success, particularly in community involvement. However, the functioning issues with the slaughterhouse treatment and septage treatment facility point to the need for improving management and monitoring, and/or improving operational arrangements.

50. The City Health Office of San Fernando classifies the types of sanitation facilities present in the city: (i) flush type; (ii) water-sealed type; (iii) sanitary pit; (iv) open pit; (v) public toilet; (vi) communal toilet; (vii) those sharing toilets, and (viii) those without toilets. Almost 90 per cent of the 24,700 households in San Fernando City have either water-sealed type or flush type

12 Prepared with external funding support and adopting a participatory strategic planning process

toilet facilities. However, there are still some ten per cent of households in poor coastal and remote upland barangays to the east who use unsanitary open pits or are without toilets.

51. Three coastal barangays have communal toilets in which households share the same toilet facility with others within their purok (as little as 10 to more than 30 households). These communal toilets, which have one room for males and another for females, are of the water-sealed type and have concrete walls with roofs. Public toilets in the city located in public places like markets and bus stations also use the water-sealed type.

52. In the absence of a sewerage system, even large establishments and institutions in the city make use of septic tanks to treat and dispose of their wastewater. A few communal septic tanks (the eco-tanks) have been constructed with external assistance, but these are currently not functioning. An initial assessment shows that this is probably due to a combination of poor design through applying a too complex and expensive technology, plus the relatively high maintenance costs and responsibilities not being sustainable for system users.

53. It is estimated by the City that around half of the city's households use water sealed septic tanks but many of these only provide partial treatment. This means that a large quantity of wastewater flows into the ground and pollutes the water table, which in San Fernando is only a few meters deep and is used extensively for non-drinking domestic and cooking purposes.

54. To treat liquid wastes from some of San Fernando City's commercial activities, the market area sewage is treated by a small sequencing batch reactor (SBR) plant that is manually operated as the automatic switch has ceased to function, and appears to operating under very low flows and organic loading. The City's slaughterhouse also has a treatment plant for its liquid waste that is functioning. But is reported as requiring substantial rehabilitation, possibly due to the high concentrations of animal waste being treated.

55. The septic sludge treatment facility has a capacity of 30 m^3/day, but appears underutilized. It cost P 7.2 million to build and was funded by grant money from the USAID and from donations provided by other government agencies and socio-civic organizations. It is designed to have a discharge that meets the DENR DAO 35 Class C Standards.

56. San Fernando City's Government passed an ordinance requiring households to de-sludge every five years and appointed private desludging contractors, paid by the City Government, to collect septic sludge from individual homes. To fund this, an additional annual real estate tax of P 600 per building was imposed and this aims to cover both septic sludge collection and treatment. However, the septic tank emptying service is not keeping pace with demand.

57. Allowing sludge to accumulate or more than five years in septic tanks reduces their treatment efficiency as the liquid volume and retention time is inadequate to allow treatment. Untreated effluent consequently goes out directly from the septic tank and flows to groundwater or to drainage discharging to water bodies. The public's exposure to untreated effluent along the drainage as well as in the water bodies is a health risk that should be addressed.

58. The impact of ground water pollution in San Fernando is more acute as ground water is used for domestic purposes by around 90 per cent of the population. Water for drinking and cooking purposes is purchased from tankers or as packaged water, but as Figure 2.3 below shows; groundwater is used for both personal washing and laundry purposes. The type of pump used also allows the inflow of polluted and contaminated water down the side of the tubewell, rendering the groundwater unsafe for potable uses. The surface drains, creeks and rivers in San Fernando are also highly polluted and flow directly into the sea, polluting bathing areas and the marine environment.

59. The location of the existing treatment facilities are shown in Figure 2.4.

Figure 2.3 Shallow Hand Pump Water in Use for Domestic Laundry and Washing Children

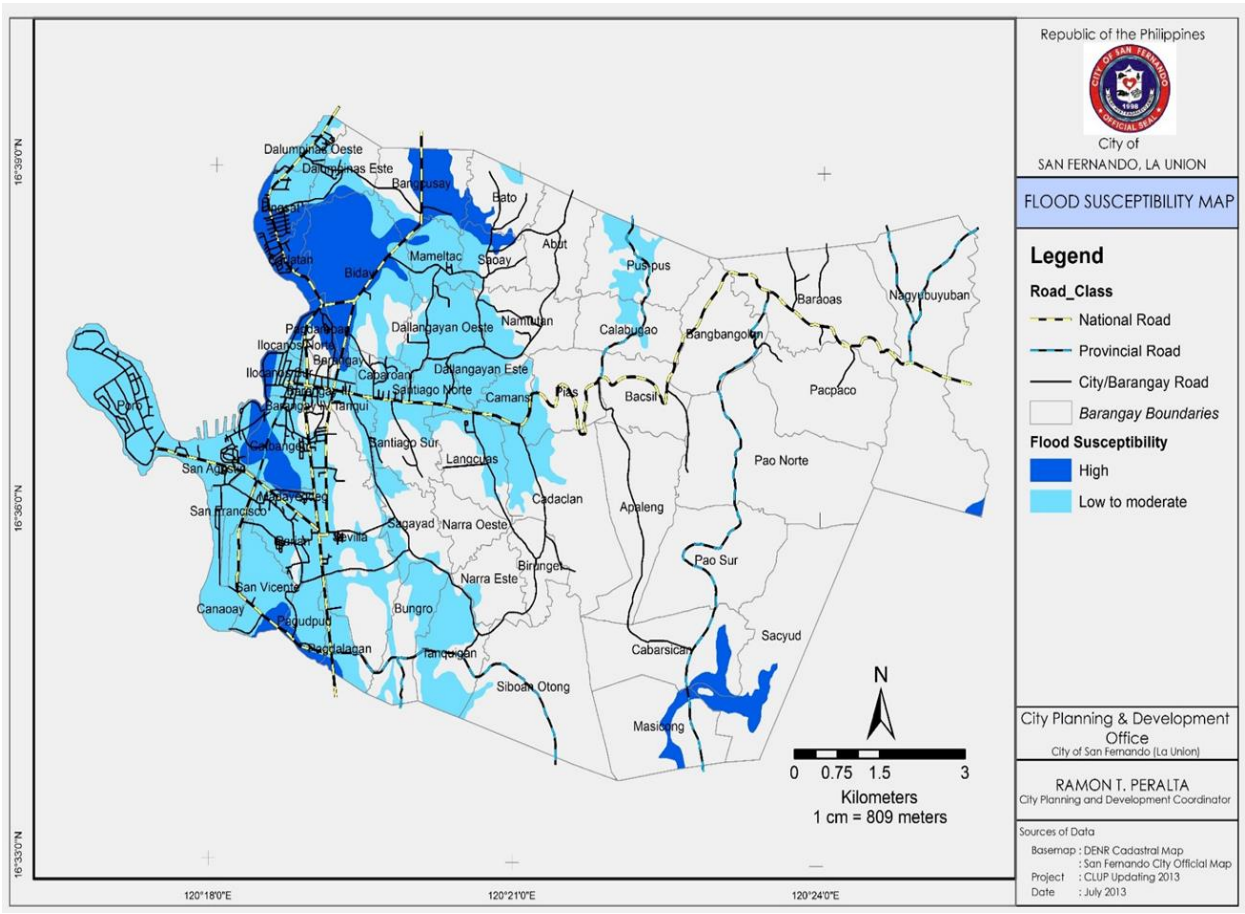
2.4.2 Drainage, Flood Control and Watershed Management

60. In San Fernando, flooding mainly occurs along the rivers and streams which act as collectors for storm-water, in low-lying areas, and along streets having inadequate drainage systems. The streams flowing through the flood-affected areas do not have well-defined channels, and are generally shallow, and thus susceptible to frequent overbank flows resulting in flooding during major storms. In addition, heavy run-off from hillsides during extreme rainfall events inundates areas of the CBD which has inadequate drainage to remove the resulting surface water. The situation is shown in Figure 2.5 below.

61. Several low-lying areas in San Fernando, which used to be natural flood storage areas, have been filled and developed, and natural flow paths obstructed. This is a continuing trend, which will undoubtedly exacerbate flooding problems in the city if action is not taken to regulate filling of low-lying areas. Currently, adequate provision is not made for storm water drainage where filling occurs. Building encroachments have also taken place along some stretches of the streams and thus restricted storm flows. In areas where street flooding occurs, there are either no roadside drains or the existing flow capacities appear inadequate. Drains which discharge to the ocean are affected by tides and these impact on the ability of the drains to discharge during heavy rains when tidal levels are high causing flooding along some streets.

62. A key feature which impacts negatively on the flow of storm-water from the upland eastern portion of the city to points of discharge into lagoons or to creeks and eventually the sea, are the boundaries formed by built-up road sections of the Quezon Avenue (North Road) and Diversion Road. Both these major north-south thoroughfares form a barrier to storm-water flowing from the east. Cross drainage which did exist has been made ineffective by a combination of ribbon development along the roads and backfilling to form development plots – this process is still going on, and the worsening of current conditions can be anticipated without mitigating actions.

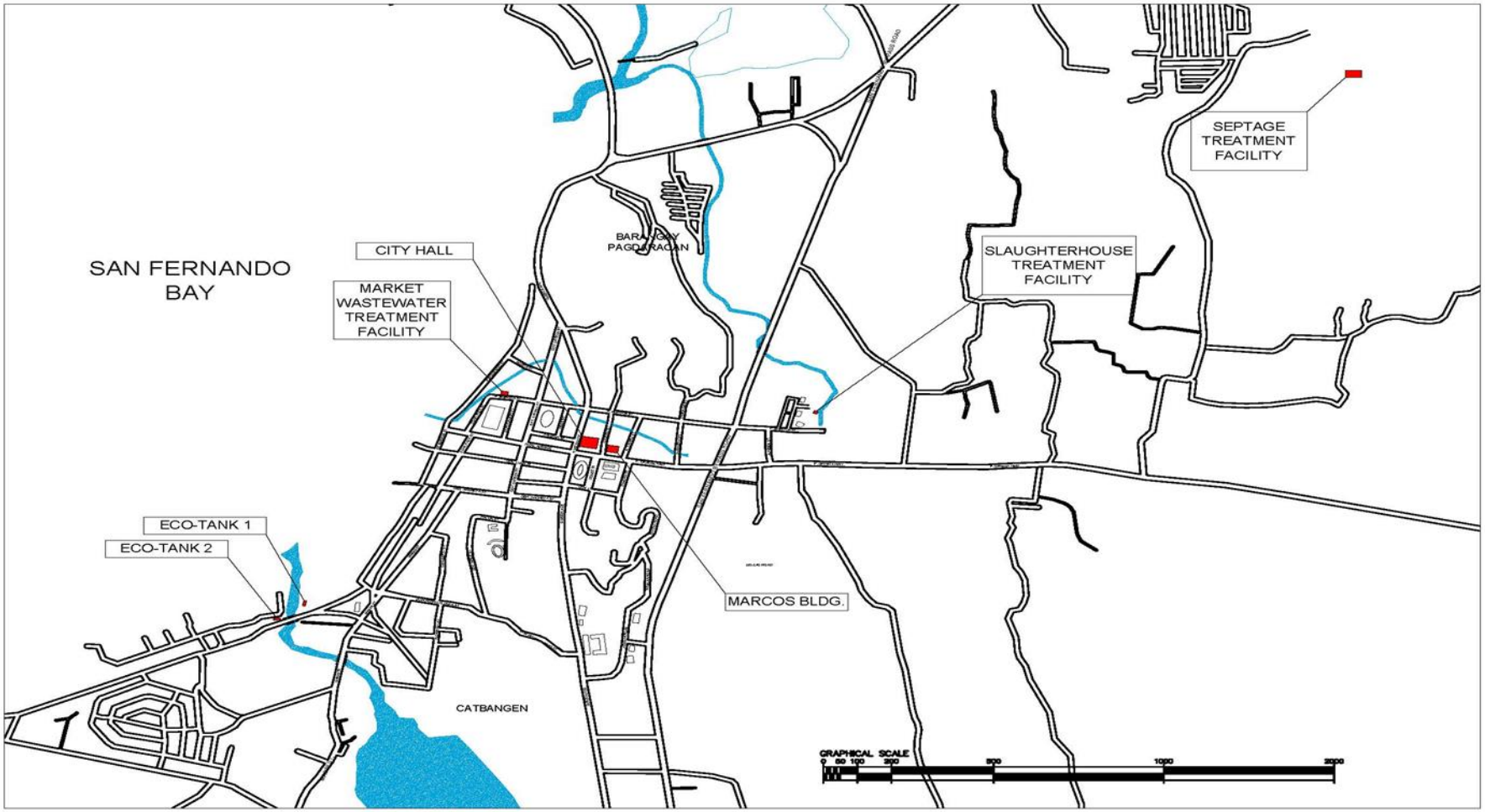
Figure 2.4 Areas Vulnerable To, and Prone To Frequent Flooding



2.5 Institutional Framework: Constraints and Opportunities

63. Both the wastewater management and storm-water drainage sectors are characterized by fragmented, and in some cases overlapping responsibilities which prevent optimal oversight and management of the sectors, and compromise their effectiveness in service provision. The Metro San Fernando Water District (MSFWD) and the relevant departments of City Government – particularly CENRO - play crucial roles in water supply and the management of wastewater, while the City Health Department has jurisdiction over the safeguarding of public health. During the engagement with project stakeholders through the focus group discussions (see section 2.7 below) the point was made that to safeguard public health, there should be an integrated approach to water supply and sanitation provision, supported by all concerned agencies. This should preferably be developed within a framework which adopts a comprehensive public health-driven approach.

Figure 2.5 Existing Sanitation and Treatment Facilities in San Fernando



64. In the water supply and wastewater sector, the two key implementers are the local government units and local water districts. The ideal scenario is for the two implementers to combine their resources (technical and financial) and work closely and harmoniously in the planning, design, development and implementation of critical wastewater infrastructure services that are efficient, effective and yet provided at a cost which is affordable to the end users. Such ideal scenarios however, have not to date occurred in San Fernando. This situation may change in light of the recent resolution of the Sangguniang Panlungsod of San Fernando City which endorsed the 25-year development plan and project of MSFWD[13,14].

65. In the case of stormwater drainage and flood control, the major disconnect is between the DPWH (responsible for most major drainage infrastructure and drains along national roads) and the City Engineers Department (responsible for minor drainage channels and facilities, and drains along city roads). In the absence of a drainage masterplan for the city agreed to by all, even if collaboration were good, there is no basis for a unified approach on the ground. A further disconnect occurs between the land management and drainage spheres. For mitigating measures to be taken to mitigate flood peaks (for instance using SuDS approaches) requires inter-action at the planning, design and execution phases. This means close collaboration between the planning department, CENRO, CEO and DPHW. Without closer collaboration between these institutions, effective action in watershed management as an integral aspect of urban drainage and flood control is unlikely to occur.

66. At the community level, the impact is more evident in the water supply and sanitation sectors. Information from the household survey and focus group discussions indicated the frustration of community residents in having to deal with different agencies for water supply and liquid waste collection. Participants disclosed that they feel that dealing with two agencies separately constitutes an unnecessary investment in time spent and cost, and that a streamlined institutional arrangement would be beneficial. It was also felt by respondents that the involvement of private companies in the funding and operation of services would be more efficient, particularly in providing investments for infrastructure, operations and maintenance.

2.6 Financial Framework: Constraints and Opportunities

67. Responsibility for the financing and operation of sanitation and wastewater collection and treatment currently rests with the City Government. In the case of the city government of San Fernando, the operation of the wastewater management facilities is incorporated into the daily activities of CENRO. Storm-water drainage is a shared responsibility between the DPWH and the City Government.

68. Despite their revenue-generating character and potential, the wastewater management facilities of the city government of San Fernando are not classified as local economic enterprises. Hence, the operating cost and revenue of the wastewater facilities are not ring-fenced, nor are they separately accounted for in the city's financial books of accounts. Financial assessment in terms of cost recovery is therefore not possible. Nevertheless, partial cost recovery is still accomplished given that fixed users fees are imposed and collected periodically. The city government currently imposes an annual wastewater management fee on all property owners as part of the real property tax assessment. The

13 Resolution Number 15-171 dated 25th August 2015 which resolved to endorse the proposed twenty five (25) year development project of the Metro San Fernando water District.

14 This is discussed more fully in the section on Institutional Reform in section 4.6 below.

annual fee ranges from a low of PHP600 for residential properties to a high of PHP 2,000 for industrial properties.

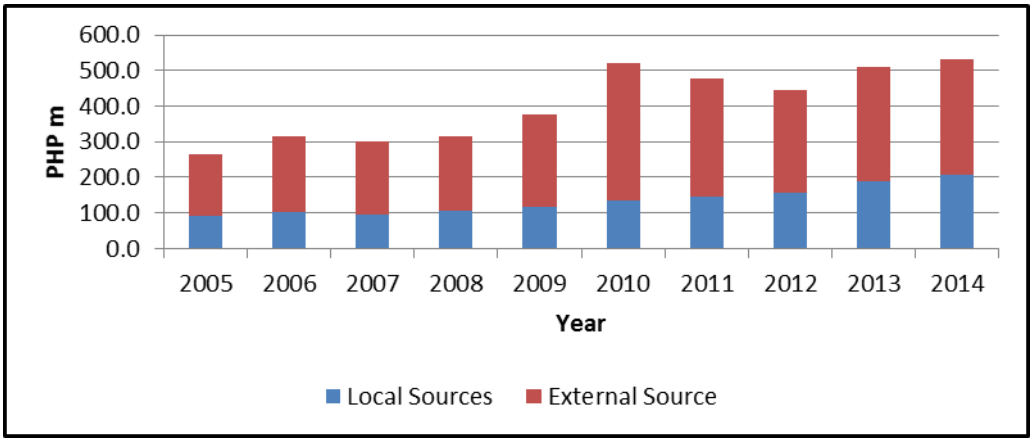
2.6.1 Financial Evaluation of the City Government of San Fernando

69. The financial evaluation of the city government of San Fernando covers the period from 2005 to 2014 and as of June 2015. Financial data for this period are taken from the annual audit reports of the Commission on Audit.

2.6.1.1 Operating Income

70. Total income of the city government of San Fernando, La Union has been on an upwards trend since 2005 as shown in Figure 2.6. Total income increased from PHP264.3 million in 2005 to PH P532.1 million in 2014. This represents an annual average growth rate of 9.0% over a 10-year period. Total income posted by the city government in the first quarter of 2015 amounted to PHP 330.0 million – more than 60% of the total realized in the entire year of 2014.

Figure 2.6 Total Income / Current Operating Income, 2005-2014



Source: Bureau of Local Government Finance (BLGF)

71. The share of incomes from external sources as a proportion of the total has expanded from 46.4% in 2005 to 52.1% in 2014. Average internal revenues allotment (IRA) dependency of the city stood at a relatively low average of 35.7% of total revenues over the 10-year period. Growth in externally generated incomes grew at a faster rate of 8.2%, compared to the 5.0% annual average increase for locally sourced revenues.

72. From 2010 to 2014, the growth in current operating income accelerated to 8.4% in nominal terms and 4.6% in real terms (see Table 2.4). The growth registered by the city government was higher than the 5.4% benchmark -- the sum of the average inflation rate of 3.7% and the population growth rate of 1.7%, indicating that current operating incomes have been growing at 2.9% per capita per annum in real terms. Internally sourced incomes have grown at a slightly faster rate of 13.9%, compared with the 4.1% increase in external sources of income.

73. Over the past five years, locally sourced incomes contributed an average of 33.7% of total current operating income. The major contributor to tax revenues was business taxes with an average share of 17.7% over a five-year period. The contribution of real property taxes was significantly lower at 9.0%. In the case of non-tax revenues, the leading contributor was the receipts from economic enterprises including market and slaughterhouse operations.

Table 2.4 Breakdown of Total Current Operating Income, 2010-2014 (PHP m)

Item	2010	2011	2012	2013	2014	Ave. Growth (%)	
						Nominal	Real
Local Sources	135.8	147.0	158.0	188.1	206.7	11.8%	8.1%
Tax Revenues	85.8	89.7	92.7	126.0	141.1	13.9%	10.1%
Real Property Tax	41.6	42.6	41.8	45.4	51.8	12.0%	8.3%
Tax on Business	39.0	40.9	45.1	73.4	82.2	17.2%	13.4%
Other Taxes	5.2	6.2	5.9	7.2	7.2	9.8%	6.0%
Non-Tax Revenues	50.0	57.4	65.3	62.1	65.6	9.2%	5.4%
Regulatory Fees	13.0	16.5	14.3	14.0	15.5	9.4%	5.7%
Service / User Charges	10.9	12.9	19.0	15.5	13.9	11.2%	7.4%
Income from Eco. Enterprises	23.6	24.3	25.9	29.4	33.1	7.6%	3.9%
Other Receipts	2.5	3.7	6.1	3.3	3.1	152.2%	148.5%
External Sources	384.1	330.1	286.0	321.1	325.4	6.9%	3.2%
Internal Revenue Allotment	280.6	301.1	261.0	274.0	308.0	4.1%	0.4%
Others	103.5	29.1	25.0	47.1	17.4	1,061.4%	1,057.6%
Total Current Operating Income	519.9	477.1	444.0	509.1	532.1	8.4%	4.6%

Source: City Treasurer's Office (CTO)

74. IRA contributed the majority of external sources of total current operating income, with an average share of 57.4%. Due to the sustained growth in locally sources incomes, the IRA dependency of the city government declined to 57.9% in 2014 from 63.1% in 2011.

2.6.1.2 Operating Expenditures

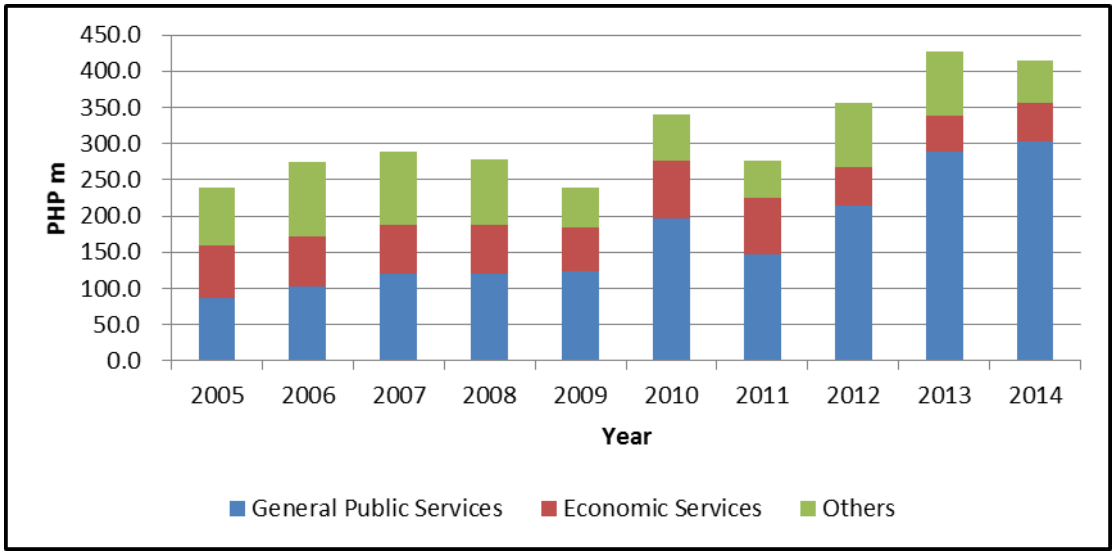
75. As shown in Figure 2.7, total expenditures of the city government have also steadily increased over the past 10 years – from PHP239.5 million in 2005 to PHP414.0 million in 2014, representing an average growth rate of 7.9%. In the first two quarters of 2015, total expenditures amounted to PHP204.2 million or 49.3% of the total registered for the entire year of 2015. General public expenditures[15] accounted for more than 63% of total operating expenditures, see Table 2.5. Spending on economic services was a distant second with an average share of 17.2%[16].

76. There is a noticeable recent increase in capital outlays of the city government. From only PHP 19.0 million in 2010, capital expenditures have expanded to PHP 97.3 million in 2014, and in the first two quarters of 2015, capital expenditure stood at PHP 94.9 million, close to 89% of last year's projected total. Average annual capital expenditures in the past five years amounted to only PHP36.1 million.

15 According to the BLGF's Statement of Receipts and Expenditures Manual, spending on general public services refer to expenditures for services that are indispensable to the existence of an organized local government.

16 Economic services cover expenditures for activities directed at the promotion, enhancement and attainment of the desired economic growth.

Figure 2.7 Total Expenditures / Operating Expenditures



Source: BLGF

Table 2.5 Breakdown of Total Expenditures, 2010-2014 (PHP m)

Item	2010	2011	2012	2013	2014	Ave. Growth (%)	
						Nominal	Real
Current Operating Expenditures	340.7	276.4	355.7	426.5	414.0	13.8%	10.1%
General Public Services	197.4	147.1	214.9	288.6	303.6	24.1%	20.4%
Education, Culture and Sports/ Manpower Development	8.5	8.5	6.1	12.3	8.5	10.7%	7.0%
Health, Nutrition and Population Control	22.8	30.0	31.1	29.4	32.6	11.7%	8.0%
Labor and Employment	0.0	0.0	0.0	0.0	0.0	---	---
Housing and Community Development	0.0	0.0	0.0	0.0	0.0	---	---
Social Services and Social Welfare	13.2	12.3	50.7	33.8	9.4	29.0%	25.3%
Economic Services	79.1	78.4	52.9	50.1	51.9	-0.9%	-4.7%
Debt Service (Interest Expense and Other Charges)	19.7	0.0	0.0	12.3	8.1	---	---
Payment of Loan Amortization	0.0	25.3	34.0	22.8	26.0	---	---
Capital Outlay	19.0	25.7	22.9	15.7	97.3	99.5%	95.7%
Total Expenditures	359.7	327.4	412.6	465.0	537.3	14.9%	11.1%

Source: CTO

2.6.1.3 Net Operating Income (Loss)

77. The city government continues to post surpluses in its financial operations with a high of PHP 200.7 million registered in 2011, as shown in Table 2.6. Over the past five years, the average net operating income from current operations was PHP133.8 million per annum, although growth in operating expenditures has outpaced that of operating incomes in the past five years, at 13.8% against 8.4%. In the first two quarters of 2015, net operating income from current operations reached PHP 125.9 million – slightly higher than last year's total.

Table 2.6 Net Operating Income (Loss), 2010-First Two Quarters of 2015(PHP m)

Item	2010	2011	2012	2013	2014	First Two Qtr 2015
Operating Income	519.9	477.1	444.0	509.1	532.1	330.0
Operating Expenditures	340.7	276.4	355.7	426.5	414.0	204.2
Net Operating Income (Loss)	179.2	200.7	88.3	82.7	118.1	125.9
Non-Income Receipts	0.0	0.0	0.0	0.0	0.0	0.0
Non-Operating Expenditures	19.0	51.0	56.9	38.5	123.3	111.8
Net Increase (Decrease) in Fund	160.2	149.7	31.4	44.1	-5.2	14.1
Fund, Ending Balance	290.8	424.4	441.9	408.6	107.5	422.7
Cash in Bank	291.8	421.2	438.3	404.3	400.8	---
Net Operating Surplus to Total Revenue (%)	34.5%	42.1%	19.9%	16.2%	22.2%	---
Uncommitted Cash Balance to Total Expenditures (%)	85.3%	153.6%	124.2%	95.8%	26.0%	---

Source: CTO and Commission on Audit (COA)

2.6.2 Financial Evaluation of Metro San Fernando Water District[17]

78. Net income of the MSFWD dropped sharply to PHP 4.9 million in 2014 from PHP 10.5 million in the previous year. This was largely attributed to the 4.5% decline in total income coupled with a 4.9% increase in total expenses, as shown in Table 2.7. Expenses incurred by the water district increased across the board, with operating and maintenance expenses and financial expenses increasing by 10.8% and 2.1%, respectively, although personal services expenditure declined by 3.2%. Net income averaged PHP 7.9 million per annum during the 2012-2014 period. Net cash flow from operations expanded to PHP 11.5 million in 2014 from PHP 6.8 million in 2012.

Table 2.7 Summary of Income Statement, 2012-2014 (PHP m)

Items	2012	2013	2014
Total Income	65.5	65.1	62.2
Personal Services	20.9	19.2	18.6

17 The financial evaluation conducted on MSFWD covers the years 2010 to 2014 and the first two quarters of 2015. It was accomplished using audited financial statements for the years 2010 to 2014 secured from the Commission on Audit. For 2015, preliminary financial statements covering the first 6 months of the year were provided by MSFWD

Items	2012	2013	2014
Operating and Maintenance Expenses	32.5	29.1	32.2
Financial Expenses	3.8	6.4	6.5
Net Income	8.3	10.5	4.9
Net Cash Flow from Operations	6.8	5.9	11.5

Source: Commission on Audit (COA)

79. Outstanding loan balances of long-term indebtedness to domestic creditors, shown in Table 2.8, totalled PNP 70.0 million as of end December 2014, a slight improvement on last year's total. The largest source of debt financing is the Local Water Utilities Administration (LWUA) Regular Loan at PHP 51.7 million. Loan proceeds from the Land Bank of the Philippines (LBP) totalled PHP17.3 million. In spite of the decline in the total outstanding long-term debt, loan amortization increased to PHP9.1 million in 2014 from PHP6.6 million the previous year.

Table 2.8 Outstanding Loans of MSFWD, 2012-2014 (PHP m)

Items	2012	2013	2014
LWUA Regular Loan	52.95	52.07	51.73
LWUA NLIF	---	0.97	0.97
LBP	9.51	18.98	17.26
TOTAL	62.46	72.03	69.97
Loan Amortization	2.9	6.6	9.1

Source: COA

LWUA = Local Water Utilities Administration; NLIF = Non-LWUA Initiated Funds; LBP = Land Bank of the Philippines

80. MSFWD is currently classified by LWUA as semi-creditworthy, meaning that it can still avail of the limited debt financing available from LWUA. Table 2.9 compares the most recent information on MSFWD with the LWUA criteria. The MSFWD performed well in terms of the current ratio, debt-to-equity and the staff productivity index. It was well within the semi-creditworthy range for debt-service coverage ratio (DSCR), net profit ratio and collection efficiency ratio. However, it fared poorly for the non-revenue water percentage.

Table 2.9 Financing and Operating Indicators, MSFWD

Indicators	2012	2013	2014	End-June 2015
Financial Parameters				
Current Ratio (x)	-115.1	57.3	9.6	---
Debt Service Coverage Ratio (x)	5.8	3.3	1.9	---
Net Profit Ratio (%)	12.6	16.1	7.9	
Debt-to-Equity Ratio	39:61	44:56	51:49	---
Operating Parameters				
Collection Efficiency	91	91	90	87

Indicators	2012	2013	2014	End-June 2015
Ratio (%)				
Non-Revenue Water (%)	56.0	66.5	68.8	54.1
Service Connection / Staff	107	131	122	121

Source: COA and MSFWD

81. Based on MSFWD's most recent earnings before interest, taxes and depreciation (EBITDA), it will be difficult for it to obtain new debt financing from commercial sources without the DSCR falling to the minimum 1.3 times required by most banks. A possible alternative is for the water district to avail of a secured loan wherein in it will pledge some of its fixed assets as collateral for the loan. As of end-December 2014, net book value of property, plant and equipment totalled PHP 142.8 million. Loanable amount can range from 50% to 70% of the market value of the fixed assets.

82. MSFWD can also explore the possibility of viability-gap funding from the city government of San Fernando or other sources. However, this may require considerable moral persuasion since MSFWD only serves 5 out of the 59 barangays of the city. Moreover, it only supplies 27% of total volume of water consumed by the city, and is also responsible for the service in four municipalities which neighbour San Fernando - San Gabriel, Bacnotan, Bauang and San Juan.

83. A further option, which MSFWD has already pursued, is to enter into partnership with the private sector operator through a lease or concession arrangement. MSFWD is already embarking on this route, and this is discussed in greater detail in section 4.6 below.

2.7 Public Perceptions, Priorities and Affordability

84. The San Fernando La Union social baseline household survey provided valuable insights into prospective program beneficiaries' views and needs for improved sanitation and storm-water drainage. The survey results on sanitation and flooding profile the public perception of the current situation in these sectors, and identify sector priorities. The survey results are presented in Appendix G.

2.7.1 Respondents Profile

85. A total of 402 households were surveyed, with respondents stratified by location: (i) coastal, (ii) flood-prone, (iii) flood-prone/coastal, (iv) landslide-prone/upland, and (v) other areas. Total number of respondents from flood-prone and flood-prone/coastal areas is 43%, with about half of those interviewed household heads (51%), and the majority female (61%). The average age of respondents was 48, with 18 the youngest and 85 the oldest. Only adult members with a fair knowledge of the household features and operations were interviewed. Average household size is 4.76 which is slightly higher than the 2010 national average of 4.6 persons. Householders have been living in the same house for as long as 80 years, although average years of residency was 34.5 years. The modal monthly household income was calculated at PHP10, 000, which was also the median figure. Monthly household income ranged from PHP1, 000 to P172, 500, with a mean of PHP14, 478.

2.7.2 Housing: Amenities, Water Sources, Solid and Liquid Waste Management

86. Figures 2.8 to 2.12 summarise the key findings from the household survey in the water supply, sanitation and wastewater sectors.

Figure 2.8 Household Source of Potable Water

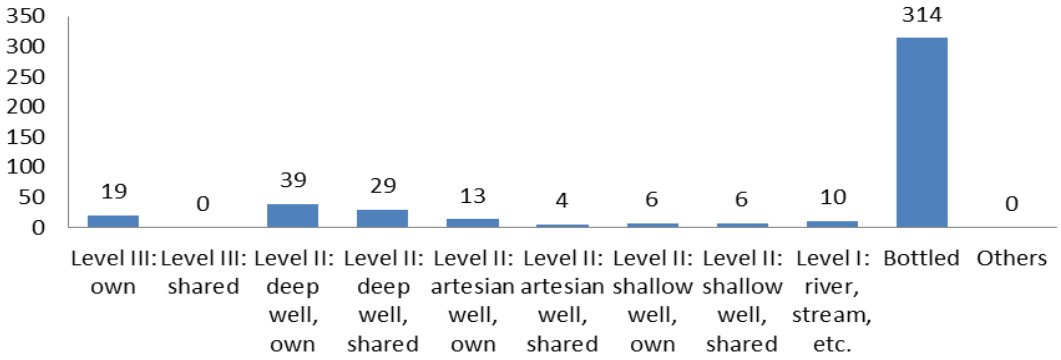


Figure 2.9 Household Sources of Non-potable Water

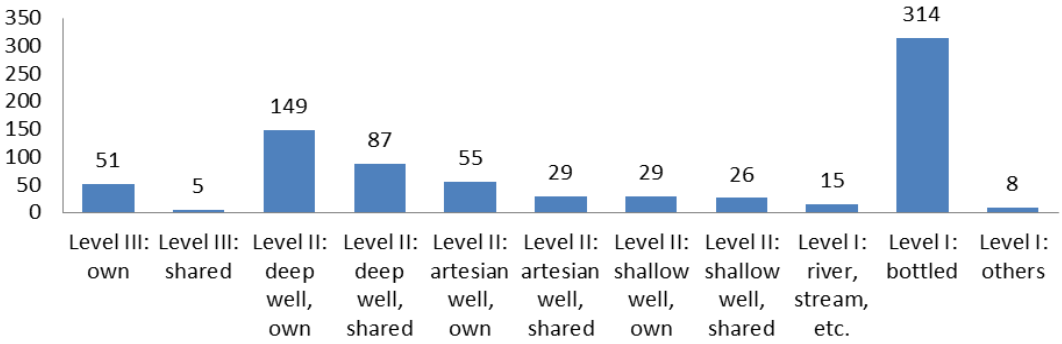


Figure 2.10 Household Sanitation Facilities

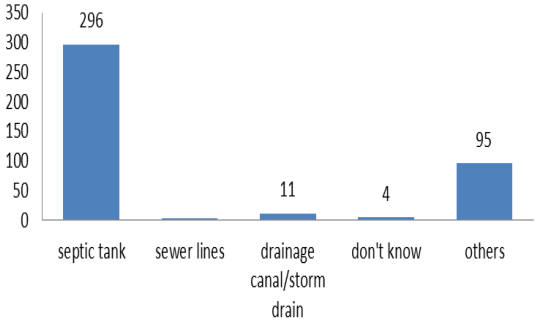


Figure 2.11 Septic Sludge Disposal Methods

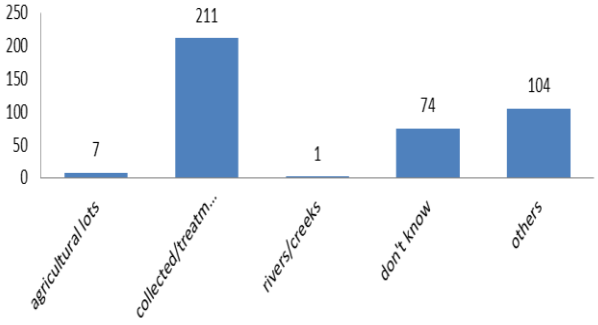
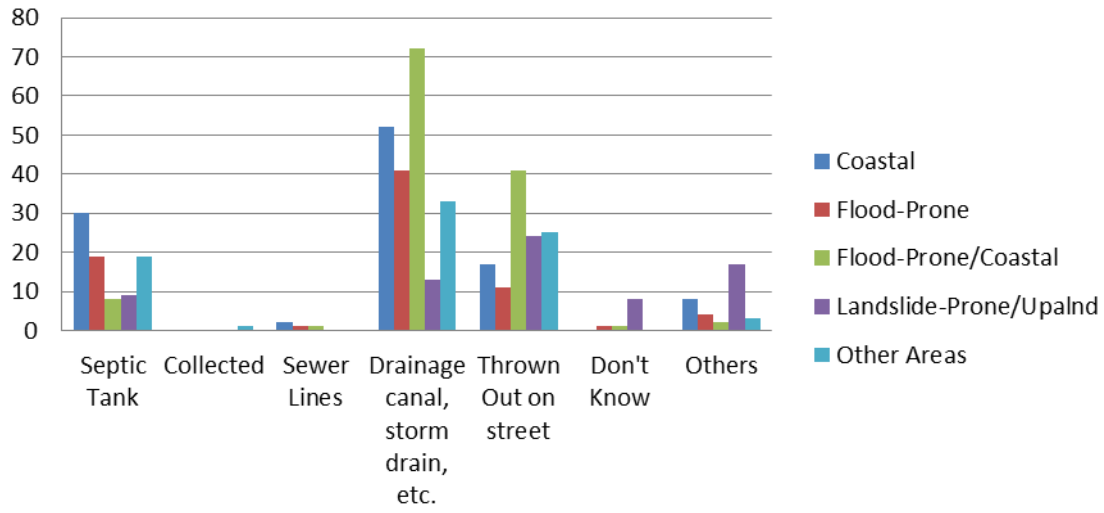


Figure 2.12 Household Sullage Disposal



87. In summary, the majority of households in all strata (71%) use bottled water for drinking and shallow well water for other domestic uses. Only about 15% of respondents have access to household water supply through the Water District. Overall, average household water consumption per day is 447 litres, equivalent to about 94 litres per person per day. The majority of households have their own pour flushed toilets (79%), with most wastewater[18] going to septic tanks (73%). The majority of sullage (non-toilet wastewater) (47%) is disposed of to the storm drainage network, and a further 25% directly onto the streets.

88. For those with septic tanks, 44% said that the tanks are siphoned every 5 years while 40% indicated that their tanks have not been emptied. Of those which have been emptied, 53% of respondents indicated that septic tank sludge is collected and treated in the septic sludge treatment plant, 19% have no idea where it is disposed of, while 26% identified other means of disposal.

2.7.3 Drainage and Impact of Flooding

89. Figures 2.13 to 2.18 summarise the key findings from the household survey on drainage and the impact of flooding. Among households interviewed, 33% said that they have been flooded in the past - most of these, as expected, are in flood-prone areas, although the data shows that flooding no longer occurs only in those areas that are officially categorized as flood-prone by the City. Flooding occurs mostly during heavy rains (63%). Most flooding is of less than 0.5 m depth (65%) and of short duration (< 6 hours) (58%) , but extreme flooding of over 2 meters was experienced in the flood prone areas by 2% of households, and 6% of households experience flood duration of between 1 and 3 days. 40% of flooded households indicated the source of flooding to be overflowing canals and another 40% indicated that the source is upland catchments. Others come from nearby rivers and creeks, and the sea. Of those flooded, 24% indicated that they had incurred property damage, but no loss of life was reported.

18 For the survey taken to mean toilet wastes (excreta plus flushing water)

Figure 2.13 Proportion of Households Flooded

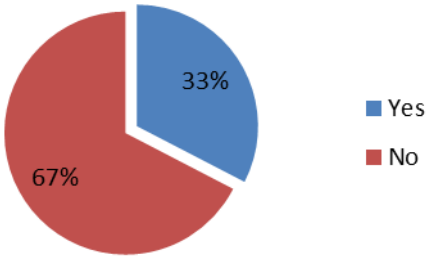
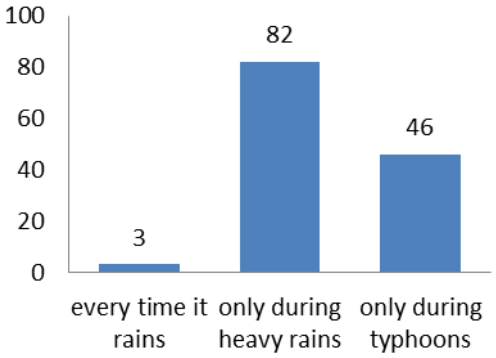


Figure 2.14 Frequency of Flooding



Maximum Depth of Flooding

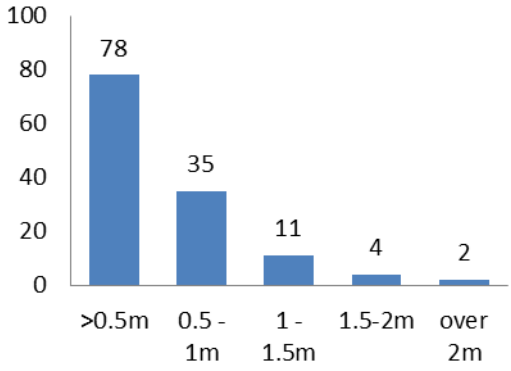
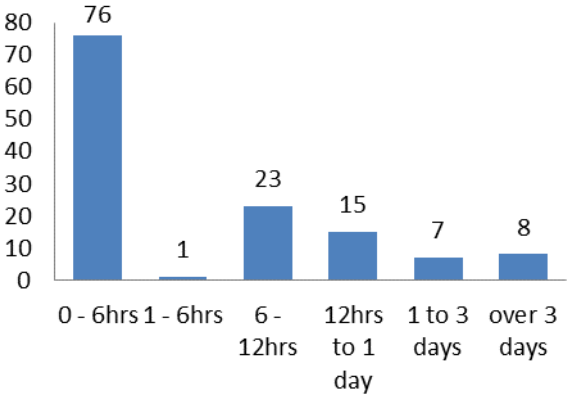
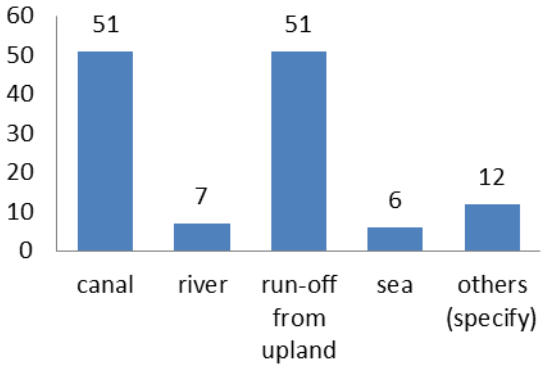


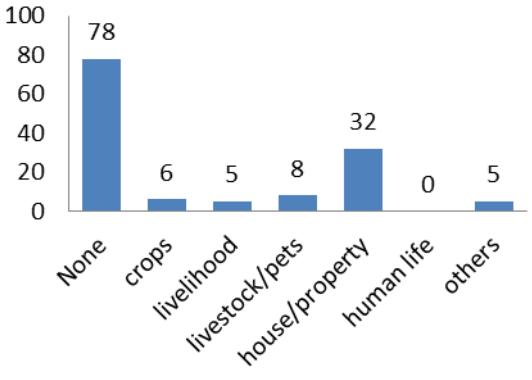
Figure 2.16 Duration of Flooding



Source of Flooding



Economic Losses from Flood



2.7.4 Project Awareness, Perception and Willingness to Pay

90. On the question of willingness to pay for better sanitation and wastewater management services, 45% gave an affirmative response, 50% responded negatively, while 5% were

indifferent. Among those willing to pay, the average additional fee they offered was PHP 139 annually. Willingness to pay more is almost certainly impacted by the fact that the city already charges PHP 600 per year per household for septic tank emptying, while the service does not deliver emptying at the required frequency.

91. Asked to identify the top environmental hazard faced by the city 65% indicated flooding. In distant second place was rain-induced landslides (14%).

2.7.5 Overall Conclusions

92. Pro-poor infrastructure such as flood protection and improved sanitation facilities are perceived as important interventions in bringing about significant benefits to households, and particularly to women and children. Bringing together information obtained from the social survey results, and from the focus group discussions and key interviews indicated: (i) improvement in sanitation, and improved access to wastewater facilities and services contributes to peace of mind among households on the potential ill effects of flooding and illnesses due unsanitary environmental conditions; and (ii) the urgent need to address the city's flooding problems, particularly during heavy rains. Specific recommendations included: (i) introducing durable solutions to resolving frequent flooding in identified flood prone Barangays and proximate areas; (ii) incremental investment in sanitation projects from the City funds and from external sources to cover the entire city's requirements; (iii) the establishment of a better system for collection of sullage from individual septic tanks, particularly from coastal communities and Barangays that are located in the outskirts of the city; and (iv) expand coverage of sanitation facilities in communities that are located in informal settlement areas.

3 Wastewater and Drainage Sector Strategy and Targets

3.1 Program Rationale and Priorities

93. The rationale for the project is underpinned by the 1987 Constitution of the Philippines which embodies the basic right of citizens to a healthy environment. This basic right is translated into the vision of San Fernando as the centre for healthy living and wellbeing in Region 1. As an expression of its commitment to health, wellbeing and the environment, San Fernando has, through its Vision 2020 set itself the task of becoming a regional centre for health and wellness by 2020. This will demand significant investment in both drainage and wastewater management, since at present: (i) there is significant flooding experienced during heavy rains; and (ii) as a result of extensive use of septic tanks and pit latrines for sanitation, the groundwater is heavily polluted. This creates a significant health risk in a city in which most households take their domestic water supply from shallow wells.

94. As is the case with all urban areas in the Philippines, the provision of environmentally acceptable and hygienic sanitation and wastewater management facilities has fallen well short of what a city at the current stage of socio-economic development of San Fernando should expect. Investment in wastewater management facilities has fallen well behind that in water supply, and even though San Fernando has been a leader among cities in the Philippines in introducing innovative sanitation and wastewater management facilities (septage treatment, eco-tanks, DEWATS and ecosan toilets – see Appendix E). However, these have experienced a variable degree of success, and have done little to address the underlying challenge which is posed by inadequate sanitation and wastewater management in the city.

95. There is also currently a great deal of investment being allocated to drainage works as an integral part of national road improvements in the city. However, these investments in storm-water drainage are not being undertaken in accordance with a city drainage masterplan, and are ad-hoc in nature. Neither the recent storm-water nor wastewater management investments have been consistent with an approach where collaborative cross-sector working is designed to achieve a clear sector objective.

96. Government efforts at both the national and local level in addressing the inadequacy of sanitation infrastructure (see Appendix I) are constrained by a weak and fragmented regulatory framework, poor incentives, an inadequate monitoring mechanisms and high costs coupled with weak financial resources. The institutional issue is important as without effective institutions, and a common approach to wastewater and storm-water management among responsible institutions, efforts to address the problems resulting from inadequate wastewater management are likely to fail. In San Fernando this means involving both the MSFWD and surrounding municipalities in the process (through MLUDCC and CELUPMA). The Metropolitan approach informs the investment strategy, and thus needs to be addressed as part of the program. Future water supply proposals will also dictate the volume of future wastewater flows. In San Fernando, the pace and extent of introduction of mains water supply to replace individual shallow wells is critical to the sanitation and wastewater management strategy and investment plan.

97. These constraints have the potential to prevent San Fernando from achieving its overall goal of becoming a centre for health and wellness through environmentally-friendly development. Furthermore, they potentially threaten the economic base of San Fernando which is partly reliant on tourism for its economic wellbeing. Added to this are the threats posed by climate

change. The anticipated changes in San Fernando's climate over the medium to long term are likely to exacerbate problems from rain-induced landslides, flooding and storm surges. The city needs a development strategy which can improve its resilience to these threats.

98. The proposed Green and Integrated Wastewater Management Program and Project for San Fernando is designed to address these issues. It provides the city with a clear strategy, roadmap and investment program to achieve its objectives in the wastewater management and storm-water drainage sectors and do so in a way that enhances its resilience to future climate change impacts.

3.2 Strategic Principles and Planning Approach

3.2.1 Green and Integrated Development

99. At the project level, green and integrated development considers future investment options that deliver benefits to residents that are more than provision of service infrastructure alone. Green development is multi-functional and demonstrates resilient or adaptive capacity. This requires: (i) an understanding that infrastructure is an integral part of the city system; (ii) identifying and implementing a combination of "hard" and "soft" measures; (iii) identifying cross-boundary issues and how to effectively engage across these boundaries; (iv) identifying solutions that can address current deficiencies and also contribute to longer term development objectives; and finally, (iv) empowering local-level leadership and communities to be champions of green and resilient projects.

100. Green and integrated interventions are incremental and iterative, and will take place over multiple time horizons – as is reflected in the approach to the investment program. Furthermore, identified development interventions recognise the transitionary and dynamic nature of cities and their hinterlands. As such, development plans and projects will develop responses that can build upon the successes achieved in earlier stages to contribute to, and enable, more ambitious interventions as capacity is developed and successes are realised.

3.2.2 Approach to Project Formulation

101. The strategies, roadmaps, programs and projects have been identified and developed through a process which follows the general approach to program preparation and design described in Appendix H. The key sources of information, opinion and analysis which have informed this process are:

i. The audit and diagnostic of current performance in the sanitation, wastewater management, storm water drainage and flood control sectors (see Chapter 2 above);

ii. Discussions with sector professionals in the city government and in other national and local agencies responsible for, or connected with, the sanitation, wastewater management, drainage and flood control sectors;

iii. Findings emerging from the presentations and workshops held in San Fernando on: (i) the Strategic goals and objectives for the sector: and (ii) early findings presented in the Inception and Interim Reports;

iv. Views on issues and priorities emerging from focus group discussions and key informant interviews conducted under the project (see Appendix G);

v. Findings from the household socio-economic and attitude survey conducted for over 400 households in San Fernando city (see Appendix G); and

vi. Technical analysis of possible approaches and options, based on local knowledge and global experience, to arrive at the preferred proposed solutions.

3.2.3 Strategic Objectives

102. The strategic objectives and associated benchmark targets to achieve these objectives are based on: (i) high-level vision and mission statements taken from the CLUP, prior studies, and other policy guidance documents of San Fernando; and (ii) the strategic objectives and targets developed during the strategy workshops conducted during July 2015. These strategic goals represent the high-level aim of the project – the end point which the programs and projects should enable the city to reach. Progress along this path – particularly at the end of each investment plan period (2020, 2025, 2030 and 2035) is measured through achievement against benchmarked targets for key sector indicators. This enables success to be measured and corrective actions to be taken if progress falls behind target.

103. Achievement of the strategic objectives requires that action is taken across a range of sectors. These include: institutional reform, legislative and regulatory reform, capacity building, the preparation of plans, studies and research, and physical interventions. A Roadmap has been developed (see Chapter 4 below) which sets out the path to be taken in each sector to achieve the strategic goals and objectives for the program. The Roadmap indicates the nature, timing and responsibility for all major actions required to deliver the program, and achieve the goals.

3.2.4 Guiding Principles

104. For the physical elements of the program, the project components are required to satisfy the following guiding principles and criteria:

i. The technology applied has to be acceptable to the users of the infrastructure, service or system;

ii. The technology applied must be able to be maintained which means that the financial; institutional and human resources for its operation and maintenance must be available, or can be acquired as part of the program;

iii. The infrastructure, service or system proposed must be affordable both to the City, and to its citizens. In particular, levels of service should be able to accommodate the needs and affordability constraints of the poorer sections of society: The program should benefit all sections of society;

iv. The infrastructure, service or system should be flexible in design and should be compatible with, and able to be integrated into, both older existing systems, and future system expansions, which might involve application of technological innovations;

v. The system should offer the least-cost solution to providing the outputs, outcomes and benefits required;

vi. The system should offer net positive environmental and social impacts.

105. While the focus of the program is sanitation, wastewater management, drainage and flood control, the success of investments in these sectors, in many cases, depends upon other

interventions being made in related sectors. For instance, sanitation and wastewater management improvements, and the type of interventions adopted, may depend upon further developments in the water supply sector. The effectiveness of drainage and flood control improvements depend upon the future efficiency and effectiveness of solid waste collection and management systems. The utility and success of all proposed physical interventions depend upon the effectiveness of the city's planning processes. Consequently, the program roadmap has to consider actions required in these related sectors to ensure the success of the proposed program.

106. As highlighted above, neither wastewater nor storm water are constrained by administrative boundaries. San Fernando is located in a coastal area which forms a contiguous urban area with its neighbour municipalities, and some of its watersheds are shared by surrounding municipalities. This means that drainage and wastewater management issues are to a significant extent metropolitan issues. Many of the issues faced by San Fernando are issues faced by neighboring local governments within the metropolitan (MLUDCC and CELUMPA) areas. Despite this, horizontal coordination between LGUs is generally poor, as is the coordination between the local governments and the MSFWD. The program's approach must be to encourage improved co-ordination between LGUs and other agencies involved in these sectors, and in the longer-term to investigate the formation of metropolitan bodies which can address these issues across LGU jurisdictional boundaries.

3.3 Urban Resilience and Climate-change Mitigation

107. Urban climate change resilience (UCCR) includes climate change adaptation, mitigation actions and disaster risk reduction while recognizing the complexity of rapidly growing urban areas and the uncertainty associated with climate change.[19] This approach involves the simultaneous development of sectoral plans and consideration of climate change-induced hazard and risk analysis.

108. UCCR does not call for a separate action planning but instead builds on existing development plans drawn from cross-sectoral needs analysis. Thus the sector plans must be developed to complement each other, building towards achieving the goal of a resilient city. This resilience is achieved by successfully implementing the hard and soft development and mitigation strategies identified for the program[20].

109. The program draws on this approach and on the strategic principles set out in the Urban Climate Change Resilience Synopsis of the ADB, which introduces key concepts of what ADB agrees represents climate change resilience. Significant among these are that approaches to urban program and project identification, pre-feasibility and preparation include:

i. **A combination hard and soft measures**. Capacities, networks and behavior (of individuals, communities and institutions) are as critical as physical systems during

19 Synopsis on Urban Climate Change Resilience, ADB, 2014. The document can be accessed at www.adb.org/publications/urban-climate-change-resilience-synopsis.

20 Guideline for Project Managers: Making vulnerable investments climate resilient, a report prepared for DG-CLIMA of the European Commission, September 2012 by Acclimatise and COWI; and Building Urban Climate Change Resilience: a toolkit for local governments, developed by Asian Cities Climate Change Resilient Network (ICLEI ACCCRN).

disruption. Soft measures which contribute to urban resilience include new regulations, technology and information systems, and social networks.

ii. **Planning beyond city boundaries: engaging different geographic and governance scales**. It is important to understand how systems (economic, physical, ecological, and/or political mechanisms) and drivers beyond the city affect it. This is particularly relevant in considering the inter-connectedness of wider markets and economies, and understanding how best to engage stakeholders at different levels.

iii. **The future is now: addressing today's problems while embedding a long-term vision.** City decision-makers find it difficult to look beyond current challenges, particularly when change is unpredictable. Planning processes should begin by addressing the current needs (including wastewater management and drainage). Building on existing issues and analyzing how climate change might increase these risks is one way to bring future scenarios into current decision-making processes.

iv. **Leadership and local action.** Efforts towards building resilience are most likely to be accelerated and sustained through strong leadership driving commitment and accountability (for example, with support from the Mayor), in combination with active engagement of communities and residents to build awareness and demand.

110. Using the ACCCRN[21] Workbook Manual and the guide on urban system climate sensitivity prescribed by the DG-CLIMA of the European Union (COWI 2012)[22], a number of potential climate resilience interventions have been identified during the discussions with sector stakeholders, and as a result of analysis of results from the household survey and focus group discussions. This has informed the development of specific resilience strategies and targets in the wastewater management, drainage and flood control sectors in San Fernando. The analysis of vulnerabilities, and mitigation opportunities and constrains are presented at Appendix C.

111. Among the prioritized interventions identified to increase resilience are: (i) capacity building of CENRO in terms of improved sewage and drainage management; (ii) optimization of the septage management programs; (iii) improvement of existing drainage systems; (iii) provision of small water impounding dam and lagoon improvement for flood control, and (iii) introduction of sewage collection and treatment. In addition, two major infrastructure vulnerabilities were considered for the resilience of the City of San Fernando: (i) higher rainfall and more intense typhoon translating to more intense flooding, storm surges, coastal erosion and higher storm water flow; and (ii) higher average temperature which would increase the water demand and intensity of drought.

112. Some design considerations to increase climate-change resilience may include the following:

- For sewage treatment systems, adaptation of sewer and drainage systems to higher storm water flow and infiltration brought about by more intense rainfall;
- Adaptation in the design of treatment plant effluent systems and septic tank discharges to provide freeboard above reported flood levels;

21 Building Urban Climate Change Resilience: A Toolkit for Local Governments. ICLEI Asian Cities Climate Change Resilient Network (ACCCRN) Program. (1st Edition December 2014)

22 Guidelines for Project Managers: Making vulnerable investments climate resilient. Report to the European Commission DG CLIMA by Acclimatise and COWI, September 2012.

- Modify and strengthen the design values of the proposed drainage improvement, water retention, and wastewater management interventions to accommodate increasing rainfall intensities including improved instrumentation and provision of back-up power;
- Review design requirements for septic tanks including grease traps in the central business district to prevent overflows;
- Review potential of reuse for sewage effluent including but not limited to DEWATS effluents; and
- Develop the wastewater and drainage master plan, with special reference to higher-intensity rainfall events and flooding, and emphasis on adopting SuDS approaches.

3.4 Projected Water Demand and Wastewater Flows

113. Metro San Fernando Water District (MSFWD) is responsible for providing water supply to San Fernando. MSFWD's jurisdiction covers City of San Fernando and four adjacent municipalities (Bacnotan, Bauang, San Gabriel and San Juan). It provides water supply to 28 of San Fernando's 59 Barangay's. A 2013 study[23] for MSFWD estimates the 2025 water demand for San Fernando as 14,163 m^3/day. Population of 153,000 of which 70,000 (45%) served by water connections. These Barangays accommodate most of the city's urban population of 73,000. However, the SFC estimates that the population of the city's 25 urban barangays as closer to 83,000 in its draft CLUP.

114. At this time the actual numbers are not too important. The main issue is that only around 23% of the population, or one third of the urban population, is currently served by a piped water supply. The water supply coverage is and demands have been estimated by the same 2013 study referred to in the above paragraph. The study recognizes the issue of the current suppressed water demand, due to inadequate supply and also the higher tariffs. However, this study only projects the water demand until 2025 and also suggests that daily per capita water use (lpcd) will fall from 110 to 100 lpcd over this time. This figure is quite low and would reflect an economically declining area, not a growing one. For this study, the MSFWD figures have been used up till 2025, but a higher per capita demand of 120 lpcd has been used for 2035.

115. Wastewater is also generated from households that are not connected to the water supply system. Cleary residential properties that buy water from vendors will generate very little wastewater. However, domestic and non-domestic users who use shallow and deep wells may generate much more. Thus an assumption of 50 lpcd has been taken for this wastewater.

116. From the above estimates, an assessment of wastewater flows per catchment has been made. This assumes around 80 percent of the water provided goes to the sewers. However, considering San Fernando's rainfall, a proportion of this rainfall will infiltrate into the sewers. Thus the flows have been increased by 15 per cent to accommodate this. Unaccounted for water is not included in this projection as the leakage does not reach the sewers. Pilfered water may reach the sewers, but this is only around 10% of flow according to the water district.

23 Final Report Volume 5: Sub-Project Appraisal Report – Metro San Fernando Water District; Water District Development Sector Project (Extension); ADB TA No. 7122-PHI PPTA (Extension); Lahmeyer IDP Consult Inc, May 2013.

Table 3.1 Population and Water Demand Projections (m^3/day)

	2015	2025	2035
Urban Population	83,000	92,000	102,000
Percentage urban	63.8%	60.1%	61.1%
Urban Population Served	28,803	68,820	90,000
Percentage Served	34.7%	74.8%	88.2%
Domestic Consumption (m^3/day)	3,563	6,782	10,800
Non-Domestic Consumption (m^3/day)	369	526	750
Bulk Connection Consumption (m^3/day)	2	3	5
Non-connected urban demand (m^3/day)	2,710	1,159	600
Total Water Demand (m^3/day)	6,644	8,470	12,155

117. The wastewater flows are shown in the table below.

Table 3.2 Wastewater Flow Projections (m^3/day)

	2015	2025	2035
Wastewater generated (m^3/day)	6,100	7,800	11,200
Wastewater Treated (m^3/day)	0	4,000	8,000
	0%	50%	70%

3.5 Wastewater Management Sector Goal, strategy and Targets

118. The main goal of San Fernando interventions is to improve environmental sanitation and thus the quality of the marine environment. This includes not only the coastal seawater, but also the coastal and inland creeks that drain to the sea plus the groundwater, saline, brackish and fresh, in and around the city. Currently, San Fernando Bay is classified as SC by the Environmental Management Bureau. This means that the water is suitable for recreation non-contact purposes such as sailing and fishing (class II). The aim is to improve this to at least SB which is safe for swimming and other human contact with the water.

Table 3.3 Timebound Wastewater Management Indicators

Indicator	How Measured	Measured By	2015	2020	2025	2030	2035
Sanitation Coverage	Survey	CENRO	87%	100%	100%	100%	100%
Wastewater collected by DEWATS	By inflows at (DEWATS) WWTPs	CENRO	0	20%	40%	60%	70%
Septage treated	Measured at septage treatment facility	Operator & checked by CENRO	15-25%?	60%	100%	100%	100%

Sealed Septic Tank Coverage	By survey & checking	CENRO	52%	80%	100%	100%	100%

3.6 Drainage and Flood Control Sector Goal, Strategy and Targets

119. The sector strategy and targets for drainage and flood control are focused around achieving a reduction in the incidence, depth, intensity and duration of flood events in the city. For stream flooding, it is intended to reduce the regular flooding by providing flood immunity up to the 10-year rainfall event. A 2- to 5-year average return period will be provided for the city (more minor) drains. Climate change impacts will be accommodated in the engineering investigations.

120. The flood control and drainage strategic actions are to:

- Improve the capacity of the streams (particularly Tangui Biday Creek and Narra-Cabaroan Creek) by dredging, lining the channel banks and providing floodwalls along some reaches of the streams.
- Provide roadside drainage and improve the existing drainage systems in the city areas affected by storm-water ponding.
- Remove obstructions and improve cross-drainage structures such as under-sized culverts, etc. particularly across obstructive north-south North Road and Diversion Road.
- Provide tidal gates at the outlets of the city drains to minimise tidal impacts.
- Maintain natural flood areas where possible and control the filling and development of the area in accordance with CLUP and drainage masterplan provisions.
- Prepare a drainage master plan for the City outlining the development of an overall drainage system for the City, and to guide future developments and prevent drains from being built haphazardly.
- Support the City's efforts to actively pursue its Integrated Watershed Management Plans and make drainage and flood control investments in accordance with SuDS approaches.
- Efforts be made to strengthen the City's and barangays' and communities' abilities in the areas flood preparedness, emergency response, recovery and community awareness in preparation for flood events.

121. The proposed sector targets need further refinement, but preliminary sector targets are shown in Table 3.4 below.

Table 3.4 Targets for Storm-water Drainage and Flood Control

Indicator	2015	2020	2025	2030	2035
Flooding from Streams and Creeks					
Frequency of flooding	Regular flooding every year during major storms. Major flood under extreme storm events	Flooding reduced to 1 in 10-year flood event (i.e 10% chance of occurring annually)	Flooding reduced to 1 in 20-year flood event (i.e 5% chance of occurring annually)	Flooding reduced to 1 in 20-year flood event (i.e 5% chance of occurring annually)	Flooding reduced to 1 in 25-year flood event (i.e 4% chance of occurring annually)
Flood duration	Up to 1 day	Up to 6 hr	Up to 3 hr	Up to 3 hr	0 –Up to 2 hr
Depth of flooding	1 - 5 m	<1 m	< 1 m	< 0.5 m	< 0.5 m
Flooding from Roadside and Other Drains					
Frequency of flooding	Regular flooding every year during major storms	Flooding reduced to 1 in 2 or 5-year flood event	Flooding reduced to 1 in 10-year flood event	Flooding reduced to 1 in 20-year flood event	Flooding reduced to 1 in 25-year flood event
Flood duration	Up to 3 hr	Up to 2 hr	Up to 2 hr	Up to 1 hr	Up to 1 hr
Depth of flooding	Over 1 m	< 0.5 m	< 0.2 m	< 0.2 m	< 0.1 m
Incidence of Rain-induced Landslides					
Landslide interrupting or disconnecting infrastructure	Baseline of X incidents every year established	Baseline - 10% every year	baseline – 20% every year	Baseline - 50% every year	Baseline – 100% every year
SuDS Measures Introduced					
Retention areas identified and created	No areas identified and none created	2 areas identified and 1 created	3 areas identified and 2 created	5 areas identified and 2 created	8 areas identified and 5 created
Proportion of green area to paved area	Baseline established	Baseline proportion maintained	Baseline proportion + 2%	Baseline proportion + 5%	Baseline proportion + 10%

4 Wastewater and Drainage Sector Investment Programs (Short-Medium- and Long-term)

4.1 The Investment Program

122. The Investment Program is designed to achieve the sector targets set out above. The Design and Monitoring Framework (DMF) for the Investment Program sets out the intended impact, outcomes and outputs of the Investment Program. It also provides a summary of activities and inputs, and is provided at Annex 1 to this Report.

4.1.1 Program Impact

123. Reduced wastewater pollution and flooding, and a cleaner and safer urban environment in San Fernando

4.1.2 Program Targets

124. Sanitation and Wastewater management – 70% coverage by sanitary sewerage and sewage treatment and the remaining 30% by septage treatment by 2035.

125. Stormwater drainage and flood control – reduction in flooding and flood damage to infrequent and occasional shallow flooding of short duration at critical flood points.

126. Quality standard of coastal waters raised from Class SC to class SB.

4.1.3 Program Outcomes

127. Sound long-term planning framework for wastewater management and drainage improvement established and operational

128. Sustainable improved sanitation and wastewater management services for all, and reduced incidence of flooding in San Fernando.

129. Increased wastewater and septage collection and treatment coverage in San Fernando.

130. Reduced incidence and duration of flooding in San Fernando

131. Sanitation and wastewater management services improved and self-financing

4.2 Technical Options Analysis: Framework for Project Selection

4.2.1 Sanitation and Wastewater Management

4.2.1.1 Alignment with Government Policy

132. Options have been developed that align with the national sanitation framework as articulated through sector legislation and regulations. These options also aim to meet the sanitation goals for the project and comply with national guidelines, and particularly the Philippines Sustainable Sanitation Roadmap of April 2010. The main aim of the proposed sanitation interventions in San Fernando is to make significant progress towards universal sanitation coverage and treatment of all wastewater by 2035.

4.2.1.2 Guiding Principles

133. A set of key guiding principles have been applied to: (i) guide the option development and selection criteria; and (ii) allow the selection of the optimal alternative under the specific set of conditions and constraints present in San Fernando. These guiding principles are to an extent generic, but are applicable in guiding the development of options and selection of a preferred approach for wastewater collection and treatment.

Selection

- The system should be technically viable.
- The system should be socially acceptable to all users.
- The technology should be capable of being maintained by the operator.
- Both capital costs (construction) and recurrent costs (operation and maintenance) should be affordable to the operating agency and the users. At a minimum, fees should initially be able to cover operation and maintenance costs.

Prioritization

- The technology should be able to be expanded relatively easily.
- The technology should have some flexibility to accommodate shock loads.

134. (The above two points are particularly important for wastewater treatment systems).

- Aim to use topography as much as possible to minimize costs of collection networks and as far as possible avoid the need for pumping.
- Aim to use existing systems as much as possible.
- Accommodate climate change scenarios by translating the variables and options into practical, tangible, and importantly, cost effective, requirements that can be built into the design.

135. These guiding principles and criteria have been applied to the options developed and have assisted in the selection of the optimal solutions.

4.2.1.3 On-plot Disposal Options

136. While sewered systems are the preferred technology, this is not always possible due to physical or financial constraints. In San Fernando, the absence of a sewer network, and high cost of sewerage installation means that in the short- to medium-term at least, on-plot systems will remain the most widely used technology for domestic sanitation and wastewater disposal. The simplest acceptable on-plot disposal system is the water-sealed pit latrine, although the obvious disadvantage is that when the pit fills up it either has to be emptied, with all the attendant health hazards to the emptier and in disposal of the waste. A double pit latrine where pits are used alternately avoids this problem, although this doubles cost and space requirements. In addition, pits need to allow water to percolate into the soil, which is a public health issue in San Fernando due to extensive shallow well use.

137. The most applied technology for on-site disposal is the septic tank. Septic tanks should be completely sealed with only the supernatant liquid effluent being disposed to the environment, although many septic tanks in San Fernando are not sealed, allowing fecally-contaminated wastewater to percolation to the soil. Provided there is adequate arrangement for effluent disposal, and sludge is periodically removed and treated, septic

tanks provide a satisfactory solution for the short- to medium-term, although are less suitable as densities increase.

138. The Ecosan toilets provide a suitable alternative where water use is low, although the need for excreta collection contributes to a high maintenance cost. These are less suitable where water consumption is high, and these is thus a demand for water sealed systems.

4.2.1.4 Wastewater Carriage and Treatment Options

139. There are two main types of sewerage systems. Separate systems that convey only wastewater and sullage, or combined systems that also carry storm-water. Generally, for tropical areas with high and intensive rainfalls, a separate system is more advantageous and cost-effective, see Table 4.1.[24] The adoption of vacuum systems is also being considered for use in the Philippines, but is rejected for use under the conditions prevailing in San Fernando, at least in the short- to medium-term[25].

Table 4.1 Comparison of Combined and Separate Sewer Systems

Item	Combined System	Separate System
Ensures capture of wastewater	Medium	High
Pipes do not block	Medium	Medium
Prevents wastewater release to environment	Low	High
Capital Cost Affordability	Low	Medium
Operation and maintenance costs	Medium	Medium
Simple Operation	Medium	Medium
Energy costs if pumping required	High	Medium
User affordability	Low	Medium
Institutional simplicity for operation	Low	High

140. There are multiple wastewater treatment options. All of them aim to remove the organic loads, particularly nutrients, before discharge, with a further aim being to minimize pathogens in the final effluent. The two main wastewater systems are centralized and decentralized. Decentralized systems (DEWATS) provide sewerage systems to local areas with small scale localized treatment. Centralized wastewater systems cover a much larger area.

141. DEWATS is a low maintenance technique (or combination of techniques) to treat wastewater effectively for daily flows of 1 to about 1,000 m^3 for small catchments. DEWATS may involve a low maintenance system, or may involve relatively high technology solutions (package plants), possible alternatives are:

24 This comparison assumes that wastewater is carried in the drainage system in the "combined" option and that wastewater treatment is provided.

25 It is understood that the GIZ-supported *Nexus* project is promoting the use of vacuum sewer systems in the Philippines. It is the view of the PFS team that vacuum sewerage is not a suitable technology for adoption in San Fernando for reasons of: (i) greater technical complexity and operational costs than gravity networks; (ii) availability of DEWATS systems which reduce sewer runs and thus restrict sewer depths, even in flat topography; and (iii) the relatively successful operation of the existing gravity system elsewhere in the Philippines over the past 30 years.

- Sedimentation and primary treatment in sedimentation tank (or pond) or in communal septic tank.
- Secondary and tertiary aerobic/ anaerobic treatment in ponds or constructed wetlands.
- Secondary anaerobic treatment in baffled septic tank or baffled reactors.
- Package plants using various more technically complex treatment with higher power and maintenance requirements such as sequencing batch reactors or rotating biological contactors.

4.2.2 Drainage Flood Control and Watershed Management

4.2.2.1 Overall Approach

142. The overall rationale for the flood control measures and drainage improvements is to reduce the incidence of regular flooding and hence minimize any adverse impacts. The traditional approach to drainage and flood management in urban areas has been to dispose of the storm-water as efficiently and as quickly as possible – frequently using concrete drains and channels. Urbanization generates more surface runoff as the pervious surfaces are replaced with impervious surfaces (roofs, paved roads, driveways etc.) and thus less storm-water infiltrates into the ground. Runoff from urban areas also impacts on the quality of receiving streams by carrying pollutants – particularly in areas:

- with high intensity rainfall;
- where there is no, or limited sewerage, and wastewater is discharged to storm drainage; and
- which have exposed loose earth surfaces.

143. These conditions exist in San Fernando, and the efficient and rapid removal of storm-water can simply contribute to faster and more effective pollution of water courses. Other watershed practices (e.g. deforestation and land-filling) also impact on the overall flooding regimes by increasing soil erosion (and thus soil discharge to watercourses) and reducing storm-water retention (where land-filling reduces flood storage areas).

144. There has been a growing move over recent years to develop a more integrated approach to urban drainage and flood control, through linking these “hard” investments to “soft” watershed management practices in a sustainable manner. This involves the adoption of an approach designed to reduce the quantity of storm-water runoff from its source, and includes making use of, or intercepting, the runoff where possible, instead of allowing it to concentrate, and in so doing reducing the risk of flooding and cost of surface water disposal. This approach has the added benefits of: (i) attenuating flood peaks, and thus reducing the size and cost of drainage and flood control facilities; and (ii) increasing aquifer recharge.

145. SuDS designs are intended to reduce the risks of flooding and pollution of receiving waters, while at the same time enhancing the amenity and biodiversity value of the environment, and attenuating system storm flow peaks. They can also contribute to improving water retention in catchments, thus helping to replenish groundwater resources. This is achieved by reducing runoff, increasing water storage capacity and reducing the transport of pollution to the water environment through the following techniques (see details in Appendix X):

- source control such as rainwater harvesting
- site controls, including permeable paving such as pervious concrete

- regional controls, including storm-water detention and storm-water infiltration
- evapo-transpiration (e.g. from parks and green roofs)

146. The project recognizes the value of this approach, but also that there are a number of institutional challenges to its introduction. Consequently there is an effort to introduce these concepts alongside a program of more traditional drainage and flood control interventions. Under the PFS, an attempt has been made to progressively introduce these concepts into urban drainage and flood control planning in San Fernando. However, due to some of the institutional complexities involved, priority projects will focus more on mitigating flooding impacts through the adoption of more traditional drainage and flood control approaches.

4.2.2.2 Options and Prioritization

147. In order to ensure that early focus is directed at critical sector priorities, a simple set of criteria is adopted for the selection and prioritization of project interventions and investments in the drainage, flood control and watershed management sub-sectors. The selection and prioritization of potential project interventions for inclusion are based on the following factors and considerations. Priorities have also been informed through discussion with city governments, potential project beneficiaries and other stakeholders. The results from the household socio-economic survey, which focused on flood impacted barangays, has also been used to determine investment priorities. Other criteria are:

a. severity of flooding and inundation, including an assessment of where potential damage or loss of life, and thus economic impacts, are greatest;

b. socio-economic impacts, particularly relating to vulnerability and the potential negative impact of flooding on the wellbeing of those impacted;

c. economic impacts, physical damage and disruption to economic activities as a consequence of flooding;

d. environmental impact of flooding, and of potential interventions - both positive and negative; and

e. ease of implementation – which may impact upon the timing rather than priority (for instance, if land acquisition or resettlement is required, this impacts upon the preparation time required).

148. For each of the above categories, a scoring system (1-5) as shown in the Table below was awarded based on the perceived level of magnitude (low=1; high=5) of the impacts. The scores were tallied and the interventions ranked and prioritized based on the total score.

Table 4.2 Scoring System

Individual Category Score	
Level	Points
Extreme Impact	5
High Impact	4
Moderate Impact	3
Low Impact	2
Very Low Or Insignificant Impact	1

149. Nuisance flooding during heavy rains occurs along many streets in San Fernando, although it is understood that the impact and risks are minimal and hence are not considered as major drainage issues. However, in areas where there are no roadside drains to collect storm-water runoff, the water runs directly onto the roads and surrounding properties. In such cases, it is worthwhile providing roadside drains.

4.3 Design Standards and Levels of Service

4.3.1 Sanitation and Wastewater Management

150. The design standards adopted follow the Philippines norms, mainly using LWUA and DPWH standards. Service levels have been proposed based on the existing situation and on an assessment of future sector plans and aspirations.

151. This program's design horizon is 20 years until 2035. However, for cost effectiveness the design life of most sanitation infrastructure is longer. For this study, the design life of sewers is taken as 30 years. For wastewater treatment plants, the capacity, and thus size of treatment units can be increased incrementally to avoid high levels of redundancy during early stages of operation.

4.3.2 Drainage, Flood Control and Watershed Management

152. For the technical design of the flood control and drainage structures, the DPWH design criteria have been followed and adjusted for climate change predictions. This is further explained below.

a. **Streams and creeks**: For main streams requiring flood control works in the city, a 1 in 10-year average return period flood event is adopted. In general, DPWH adopts a 1 in 30-year return period for major streams. However since the streams flowing through the city are relatively minor, and serve a relatively small catchment, a 1 in 10-year average return period flood event is considered reasonable.

b. **For the city drains:** an average return period of 2-years (minor drains) and 5-years (major drains) is adopted.

c. To account for climate change impacts, the rainfall depths were increased by 12% (in line with regional climate-change predictions, and as used for Manila in the absence of data for the city).

d. The construction of the flood control works will follow the construction standards and criteria applied by DPWH, thus it is proposed to concrete-line the channels.

e. For the roadside drains, it is proposed to have covered drains in the city areas.

4.3.3 Climate Change Resilience Consideration

153. A review of design and material standards with regard to climate change resilience was carried out. Generally the impacts of climate change specifically on sanitation and sewerage systems will be well within the existing design and operational parameters of the systems. More sporadic, yet intense rainfall will impact on drainage designs, but the intention is that some of these impacts will be offset through the adoption of SuDS approaches to storm water management in the medium-term.

154. Table 4.3 provides a summary of the existing national standards for wastewater and proposed standards where these may change. In particular, some existing standards need to be modified to accommodate climate change impacts and ensure resilience. The main climate change impacts on sewerage are in more intensive rainfall increasing the rate of infiltration into sewers, plus greater protection of structures and trenches to avoid damage from floods or landslides caused by extreme climate events.

Table 4.3 Service Levels – Summary of Standards and Proposed Modifications

Service Level	Existing Standard	Proposed Standard (including climate change)
Sewers		
Preferred sewer materials	Concrete Pipes for 150 to 250mm; Reinforced concrete pipes for 250 to 1000mm and those crossing the road. PVC Series 1000 for 100 & PVC SDR 35 for bigger pipes PE Pipes SDR 11 & 24	HDPE, GRP (fiber glass), PVC
Infiltration factor	0.20 to 28 cu. M /ha/day MWSS STD. = 17 cu m /ha/d	
Depths	Pipe diameter + 0.90 min. cover up to 5.00 m Provide lifting stations to eliminate deep trench	0.5 meters to 5 meters Deeper – investigate trenchless technology.
Velocity	Min = 0.60 m/s Max 2.40 m/s	Minimum 0.6 m/s
Sewer jointing	Solvent cement for PVC pipes Concrete collar for concrete pipes Or as per manufacturers specs	Flexible
Manhole spacing	At junction and change of pipe size, spacing is 50 to 100 metres	At junctions and change of sewer diameter, maximum spacing 30 meters.
Septic Tanks		
Retention times	24 hours	Minimum 2 days
Cleansing times	3 to 5 years	Minimum 5 years
Effluent Standards from Wastewater Treatment Plants		
To Rivers	BoD_5 30 mg/l SS 50 mg/l	Include fecal bacterial indicator and nutrient standards
To Lakes	BoD_5 50 mg/l SS 70 mg/l	Include fecal bacterial indicator and nutrient standards
To Sea	BoD_5 100 mg/l SS 150 mg/l	Include fecal bacterial indicator and nutrient standards

4.4 Sanitation and Wastewater Management Investment Program and Projects

4.4.1 Evaluation of Technical Options & Preferred Approach

155. In San Fernando the main technical options are in three broad areas:

i. Continue with individual septic tanks.
ii. Introduce DEWATS – DEWATS are decentralized wastewater treatment systems, typically serving from 10 to 200 properties. In San Fernando a big advantage of this type of system is that it can minimize pumping.
iii. Construct a centralized sewerage systems.

156. These options are not mutually exclusive and a combination of all three or any two could be used. A comparison of the systems against key parameters is given in the table below.

Table 4.4 Comparison of Wastewater Systems

Criteria	Centralized System	DEWATS	Individual Septic Tanks
Effluent quality	Maximum	Good	Medium
Environmental Impact	Low	Low	High
Construction	Treatment technically complex and sewer construction causes temporary disruption	Treatment simple, sewers can cause disruption	Simple
Operation	Varies with technology type, but can be complex, particularly if land use is to be minimized	Relatively simple	Simple – but septage needs treatment
Upgrading and expansion	Should be considered during planning	Possible, but needs careful sewer design.	Needs either a centralized wastewater system or DEWATS
Capital costs	Very high	High	Medium
Operational costs	High in SF as pumping most likely needed.	Medium	Very low only septage treatment required

4.4.2 Component Description, Cost and Phasing

157. The program components proposed for San Fernando are described in the sections below. The project locations and details are presented in Appendix J and at Annex 2 to this Report which provides summary project descriptions.

4.4.3 Wastewater (and Storm Water Drainage) Master Plan

158. The wastewater aspects of this master plan aims to guide and monitor wastewater investment in San Fernando over the next 20 years to ensure that the strategy can be implemented. This plan will contain a combination of phased interventions that will aim to address policy, institutional, physical and management constraints. The plan will develop and detail the wastewater requirements for the 20 year period up to 2035.

159. The plan should be integrated with the storm water drainage plan as there are many overlaps between these sectors, such as in planning and management of the systems, while coordination in design, implementation and operation is also important. Critically, any wastewater master plan must be linked to the water supply plan of that area and be able to respond to the expansion of the water supply. So the involvement of MSFWD will be required in the development of the plan.

160. The plan will also contain a much more robust inventory of wastewater components in the city. GIS is the best means to accomplish this. This GIS should be updated to include all relevant wastewater information that will allow more efficient planning and management of the system. This should also include customer information including septic tank emptying and particularly new buildings. A GIS is an information system and information systems are only useful if the information is relevant. Thus, a GIS has to be constantly updated to reflect new connections, sewers, septic tanks, etc. Plus the GIS should also be integrated with financial data and other sectoral municipality GIS. Given the demand for GIS experts, it may be difficult for a regional local government to retain them. As such the option of contracting out the GIS should be investigated.

161. The Master Plan should also ensure sustainability of the system and equity concerns. These are on various fronts. Financial sustainability needs to consider the affordability to both the local governments as well as those being served by the system, particularly the poor. Other sustainability concerns relate to climate change and environmental impact. These are discussed more in Section below.

162. Within the plan, its key components are described below. Although these components are integral parts of the plan, for the purpose of this study, these components are taken as individual programs and are part of the sanitation investment program proposed for San Fernando.

4.4.4 Wastewater and Septage Management Program

163. The aim of this program is to maximize the capture and treatment of wastewater, particularly effluent from septic tanks.

164. The first priority in this program is ensuring that all the previously constructed facilities, such as the market wastewater treatment plant, the slaughterhouse wastewater treatment plant, the existing communal septic tanks, and particularly the septage treatment plant, all need to be made operable.

165. As well as looking at the treatment processes, the number of users and connections should also be reviewed with an aim of increasing the amount of connections and thus treatment.

166. New areas for DEWATS will also be identified. Priority should be given to areas where pollution of the groundwater affects the creeks and rivers or the sea.

167. Importantly, any technologies used for communal decentralized wastewater treatment should be able to be operated and maintained by San Fernando City and be affordable to the users and the City.

168. The septage program should be enhanced to ensure that all septage generated in San Fernando is treated. The facility could also be used to treat septage from adjacent areas,

such as Bauang and San Juan. This would require some financing agreement between the City and either the other local bodies or with the septage haulers themselves.

169. It has not yet been possible to review the draft central business district (CBD) plan. However, the option of constructing a centralized wastewater system will be assessed. Main issues are:

- Given San Fernando's flat terrain and that sewers need to slope at a reasonably steep gradient to avoid solids settling in them, pumping will be required;
- Land for treatment will also need to be identified. To minimize costs, flat land near the shore would be best. However this may not be available. The land towards the north and San Juan is quite constrained as the hills are close to the sea. The land to the south of the city center, towards Poro Point may be better as there are fish ponds already there and land may be available for a wastewater treatment plant. Care will also need to be taken in the final discharge of the treated effluent to minimize any pollution.
- Importantly, the water supply connection program will be critical in the viability of any centralized wastewater system. A sewerage system can only function where there is an adequate water supply with over 90 per cent of properties having piped water connections.

170. The other option, of course, for the city center is to construct DEWATS. This will also be assessed.

171. All these options have cost implications and a cost recovery program will need to be designed that ensures, a very minimum, that operation and maintenance costs can be covered.

4.4.5 Sanitation Program

172. This program aims to reduce fecal contamination of the groundwater by ensuring that:

- All households have sanitary water sealed latrine.
- All septic tanks are sealed with only the supernatant liquid effluent escaping.

173. It is envisaged that the Sanitation Program will only be required over the short to medium term.

174. The families without sanitary latrines reside in mainly rural parts of the City or on the foreshore of San Fernando Bay. Both these areas will be assisted in developing a full sanitation program where everyone has access to a sanitary latrine. As mentioned in the main report, the preferred option will be for each household to have its own latrines and this will be the main aim. However, this might not always be possible and some shared latrines, particularly in the foreshore area where access and tides make individual sanitary latrines difficult to construct or operate.

175. As art of the Master Plan an assessment of septic tanks will be carried out. This will identify tanks that are sealed and those which are unsealed. A program will be developed to assist these without sealed septic tanks to seal them or construct new ones. This will be expensive, as a septic tank can cost around upwards of P 20,000 depending on its size. As

such, as financing program will have to be designed. This can be combined with the other financing plans for the DEWATS to ensure equity and affordability concerns are addressed.

176. The work should also be prioritized with unsealed septic tanks in the low-lying parts of the town being a priority for sealing.

177. The sanitation program will also include an advocacy component for protecting groundwater and water supply connections. This will be linked to the many ongoing initiatives currently being implemented by CENRO with an aim to ensure that all residents appreciate the need to protect the ground (and surface) water in the City. It will also include encouraging residents to obtain piped water connections.

4.4.6 Phasing

178. It is proposed that these programs will be implemented over a period of 20 years and will need to be phased. Thus the wastewater components will comprise:

Short- and Medium-term

- Production of Master Plan – this will include:
  - An updated inventory of the existing wastewater system with location, type, size and condition of each pipe, manhole and other wastewater assets.
  - A 100 per cent customer inventory broken down into residential, commercial, industrial, institutional customers with details of their wastewater disposal, whether by septic tank, decentralized systems, individual septic tank, or other means.
  - This will all be contained in a GIS.
  - The plan will also develop the detailed phased expansion of the wastewater systems including the decentralized systems, septage management, and treatment and connection programs. This is particularly critical to ensure that all sewer rehabilitation and extension is programmed to dovetail with roads and drainage works.
  - Compare options for BBD – centralized or decentralized treatment.
- Ensure all existing wastewater treatment facilities function.
  - Rehabilitation or replacement of communal septic tanks with DEWATS technologies.
  - Expansion of decentralized systems.
  - Facilitate provision of sanitary latrines to all residents of San Fernando.
  - Commence with program to seal septic tanks.

Long-term

- Continue with expansion of DEWATS to outlying parts of the city.
- If class SA water is wanted in San Fernando Bay, then a centralized wastewater treatment plant and full sewerage system in the CBD will be required.

4.4.7 Implementation and Procurement Arrangements

179. The main agency responsible for implementation will be San Fernando City. The City Engineering Office (CEO) will take overall responsibility for construction of both the

sewerage systems and treatment facilities, while both the CEO and CENRO will be jointly responsible for preparing the Master Plan, in liaison with the MSFWD and DPWH. CENRO will also take the lead role in monitoring the implementation of the master plan, and in advocacy for improving the standard of on-plot sanitation (septic tank sealing) and increasing the number of wastewater connections.

180. However, for the wastewater treatment facilities, including the rehabilitation works on the septic sludge treatment plant, special implementation arrangements will need to be worked out between the City and the MSFWD. In areas of wastewater management, even by its own assessment, the city government does not have the technical capacity to implement this work by administration, whereas MSFWD is deemed to have the technical capacity through the operational umbrella of the Local Water Utilities Administration which is an attached agency of the DPWH. The arrangement delineating the respective roles of the city and MSFWD in project execution would need to be agreed as part of the MoU/MoA between the city and water district (see below).

181. It is proposed that institutional reforms are implemented to bring the arrangements for wastewater management for the city more in line with the institutional remits of the City and MSFWD. Currently the city collects a household charge which is supposed to cover the cost of septic tank emptying. However the service provided is currently no commensurate with the payments made. In addition, as ratified by the Sangguniang Panlungsod, MSFW is planning significant expansion of water connections in the city through its private sector partner, and extension of the wastewater management system should parallel that of the water supply system. Thus, the design, implementation and management arrangements require close liaison and cooperation between San Fernando City and MSFWD.

182. It is proposed that responsibilities for wastewater management and operation are progressively moved from the city to the MSFWD, with the city adopting a regulatory role. This is covered in the Institutional Development section below.

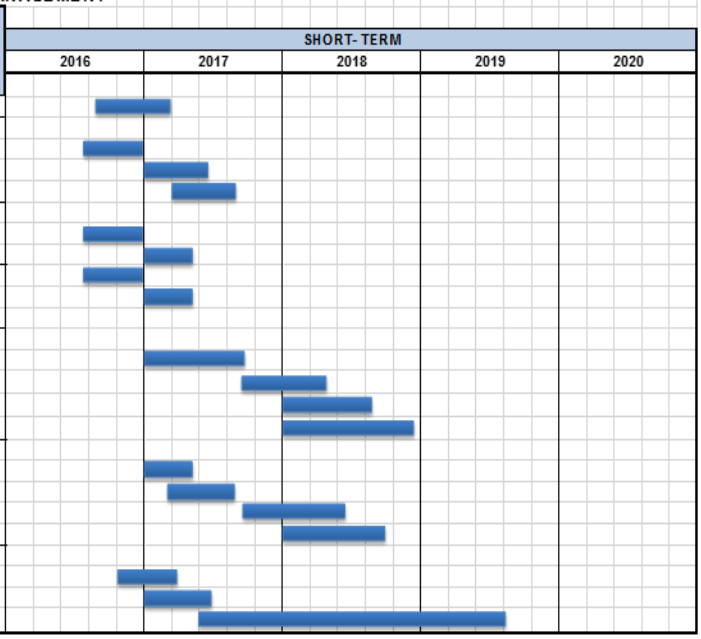
4.4.8 Program Implementation Schedule

183. The proposed implementation schedule for the short-term wastewater management program is shown at Figure 4.1.

Figure 4.1 Implementation Schedule for Short-term Wastewater Management Program

IMPLEMENTATION SCHEDULE FOR SAN FERNANDO WASTEWATER MANAGEMENT

No.	DESCRIPTION
A.	**Masterplan Preparation**
B.	**Rehabilitation of Public Market Sewerage**
	Detailed Design, Estimation and Pocurement
	Repair of SBR
	Realignment and Replacement of Sewers
C.	**Rehabilitation of Slaughter House Sewers**
	Detailed Design, Estimation and Pocurement
	Repair of SBR
D.	**Rehabilitation of Septage Treatment Facility**
	Detailed Design, Estimation and Pocurement
	Repair of SBR
E.	**Replacement of ecosan tank at Fishermen's Village (Both)**
	Detailed Design, Estimation and Pocurement
	Replacement of North Tank
	Replacement of South Tank
	Realignment and Replacement of Sewers
F.	**New Dewats at 2 additional coastal locations**
	Feasibility Study
	Detailed Design, Estimation and Pocurement
	Construction of Dewats
	Construction of Sewers
G.	**Sanitation Program**
	Identification from Masterplan
	Provision of Sanitary Latrines
	Septic Tank Sealing



4.5 Drainage, Flood Control & Watershed Management Investment Program & Projects

4.5.1 Evaluation of Technical Options & Preferred Approach

184. The drainage, flood control and watershed management program takes a two pronged approach. In the short term, the emphasis is on: (i) providing continuing support for the current programs of DPWH and the city government in improving the primary, secondary and tertiary drainage network; and (ii) supporting specific interventions to tackle existing short-term flooding problems – particularly relating to areas which suffer regular severe to moderate flooding.

185. In the longer term, the program will support: (i) the progressive strengthening of watershed management approaches to flood mitigation by protecting the hillsides and thus reducing the incidence of rain-induced landslides, and attenuating flood peaks; and (ii) progressively introducing the application of SuDS approaches to flood control, identifying projects which can contribute to enhancing infiltration or offer temporary surface water impoundment to attenuate flood peaks. As part of this approach, mechanisms need to be supported which will strengthen the hand of the city in ensuring that land and building developers are made aware of SuDS approaches to design, and that these are incorporated into their development plans prior to approval by the City.

4.5.2 Component Description, Cost and Phasing

186. The project coverage is focused on the western half of the City as: (i) this is where the majority of the population resides; and (ii) this is the coastal plain area where storm water discharges, and which consequently suffers most from flooding. The investment program proposed in this area focuses investments in the short- to medium-term phases of the

program. The eastern half of the City is largely rural, and addressing issues in this hilly terrain is considered to be a long-term proposition. Details and locations of the proposed interventions can be found in Appendix K.

4.5.2.1 River Channel Improvement for Flood Control and Drainage

187. Flood control and drainage works are continuing programs of the DPWH and CEO. The expansion of existing programs into additional areas is recommended and the following have been determined to represent a priority program which addresses key system deficiencies. This program covers many of the areas shown in Figure 2.4 above which, are the areas which both most frequently experience flooding at present, and are most vulnerable to flooding in the future. The details of each sub-project are shown in the Project Summary sheets at Annex 2 to this Report.

188. Tanqui –Biday Creek (from Biday Bridge (at Pagdaroan-Biday Road) to Diversion Road Bridge (800 m) thereon to Camansi Bridge (Ortega Highway) – a length of 3,000 m). This could be considered as an extension of the on-going Narra–Cabaroan Creek Improvement (2015 DPWH Project at a cost of P13 million)

- Creek Section from Biday Bridge to Diversion Road Bridge (800m):
  - Dredging
  - Stream alignment improvement
- Flood Wall (concrete / riprap bank protection or revetment)
- Extension upstream Camansi Bridge of the Narra-Cabaroan Creek Improvement

189. Storm Water Drainage for Brgy Sevilla at east of Diversion Road: Brgys Sevilla Norte & Central) (Catchment No. 2)

- Diversion Road Cross Drain and Canal Outfall
  - Pipe Culvert crossing the Diversion Road nearby the Elementary School;
  - Outlet Canal or Culvert towards Quezon Ave.
  - Quezon Ave. Roadside drainage improvement
- Madayegdeg Drainage Improvement: Sevilla Centro
  - New Lined Canal / Improvement

190. No-Name Creek at Brgy Pagdalagan & Brgy Pagudpud

- Oasis Area Canal Improvement
  - Canal Junction Alignment Streamline (Oasis Restaurant Area)
  - South Canal (along Quezon Avenue) Improvement to take the additional storm water flow;
- Extension of Oasis to Purok Bataan
  - Existing Oasis Canal Extension and Riprapping
  - Removal of Obstruction Upstream Pagudpud Bridge

4.5.2.2 *CBD Stormwater Drainage Improvement*

- Quezon Avenue Side Canal (Madayegdeg Monument, DMMMSU, Others)
  - Widening / Improvement of Constricted Sections
  - Improvement of Outfalls
- Mabini Street Storm water Drain
  - New Roadside canal with cover
- Ancheta Street
  - Street Side Drain Improvement

4.5.2.3 *Carlatan Lagoon Improvement*

- Tidal Barrier/Control Gates at Mouth of Lagoon (Carlatan Bridge)
- Lagoon Ring Dike and road similar to existing road dike from Diversion Road to Quezon Ave.
- Small Water Impounding Dikes

4.5.2.4 *Watershed Management Projects*

191. The recent study to prepare an "Integrated Water Resources Management Program" for San Fernando provides a comprehensive range of watershed management projects. Particular project areas identified in the Study which could complement the drainage and flood control program are listed below. These indicate the type of flood mitigation measures proposed for priority implementation under the IWRMP which could have significant beneficial impact on the flood prone areas in this Study:

- Carlatan or Northwest Lagoon in Barangay Carlatan
  - Mangrove Management
  - Fishponds or Aqua Culture
- Narra – Cabaroan Creek Watershed
  - Reforestation
  - Small Water Impounding Reservoir
- Calabugao-Pao-Masicong Creeks Watershed
  - Reforestation
  - Small Water Impounding Reservoir

4.5.3 Phasing

192. Exact phasing for the proposed investment program has yet to be detailed. However an outline implementation schedule for the program over the next 20 years, which identifies priority project for inclusion in the short-term and medium-term (2016-2020 and 2021-2025 respectively) is provided at Figure 4.2 below.

4.5.4 Implementation and procurement Arrangements

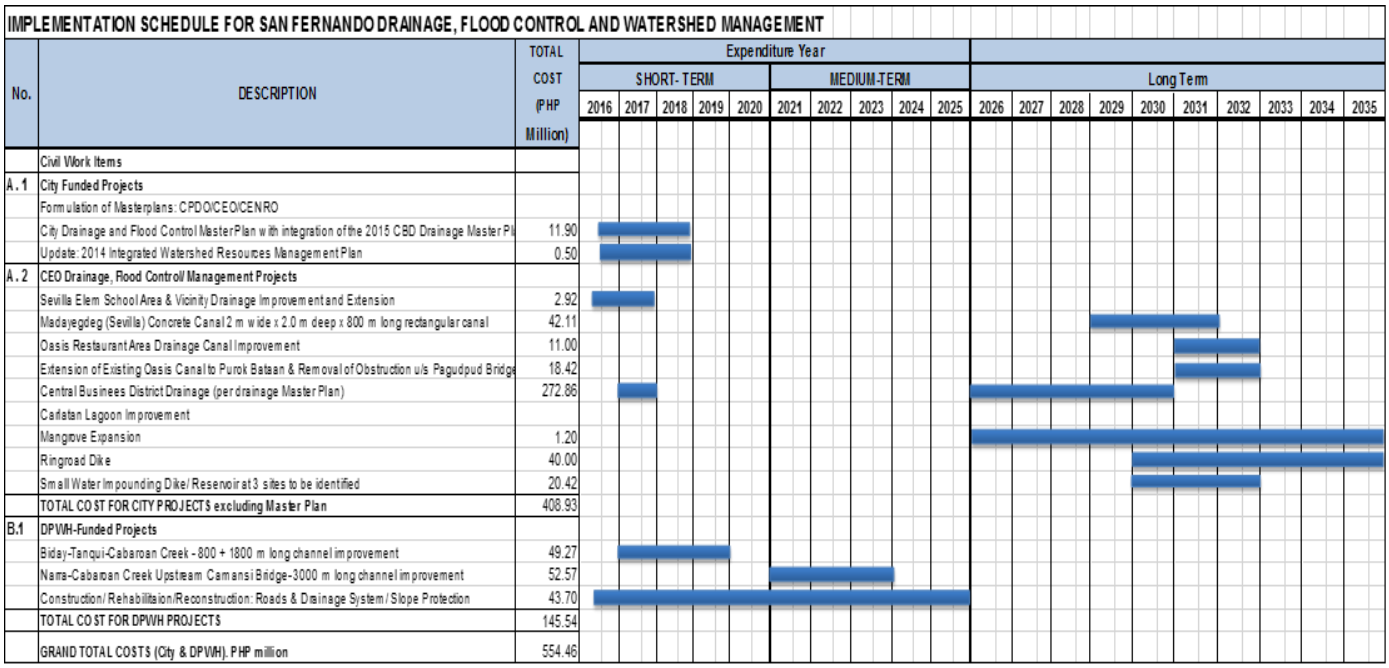
193. Arrangements for the implementation of the flood control, drainage and watershed management projects are expected to be as follows:

- The Department of Public Works through its district offices with responsibility for San Fernando city will implement the flood control projects such as the creek dredging and bank protection, and the storm water drainage associated with the national roads.
- The City Engineers Office (CEO) will implement the storm water drainage works for the city roads, including those in the CBD, and the outlet canals and their outfalls, and small water impounding dikes. The CEO will also take primary responsibility for implementing any works associated with drainage creeks which are too small to fall under DPWH responsibility.
- The City Environment and City Environment and Natural Resources Office (CENRO) is responsible for the identification and implementation of watershed management projects, such as the rehabilitation of natural environments, reforestation, mangrove planting, erosion control, etc. Projects identified which adopt a SuDS approach and involve watershed management actions will be implemented jointly with CEO. In this regard the CEO may implement small water impounding projects as an integral part of projects which impact on watershed management.

4.5.5 Program Implementation Schedule

194. Figure 4.2 shows the implementation schedule for the proposed drainage, flood control and watershed management projects over the short-, medium- and long-term along with the base cost estimates in PHP million.

Figure 4.2 Drainage and Flood Control Works Implementation Schedule



IMPLEMENTATION SCHEDULE FOR SAN FERNANDO DRAINAGE, FLOOD CONTROL AND WATERSHED MANAGEMENT

No.	DESCRIPTION	TOTAL COST (PHP Million)	Expenditure Year																			
			SHORT- TERM					MEDIUM-TERM					Long Term									
			2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
	Civil Work Items																					
A. 1	City Funded Projects																					
	Formulation of Masterplans: CPDO/CEO/CENRO																					
	City Drainage and Flood Control Master Plan with integration of the 2015 CBD Drainage Master Pl	11.90																				
	Update: 2014 Integrated Watershed Resources Management Plan	0.50																				
A. 2	CEO Drainage, Flood Control/ Management Projects																					
	Sevilla Elem School Area & Vicinity Drainage Improvement and Extension	2.92																				
	Madayegdeg (Sevilla) Concrete Canal 2 m wide x 2.0 m deep x 800 m long rectangular canal	42.11																				
	Oasis Restaurant Area Drainage Canal Improvement	11.00																				
	Extension of Existing Oasis Canal to Purok Bataan & Removal of Obstruction u/s Pagudpud Bridge	18.42																				
	Central Businees District Drainage (per drainage Master Plan)	272.86																				
	Carlatan Lagoon Improvement																					
	Mangrove Expansion	1.20																				
	Ringroad Dike	40.00																				
	Small Water Impounding Dike/ Reservoir at 3 sites to be identified	20.42																				
	TOTAL COST FOR CITY PROJECTS excluding Master Plan	408.93																				
B.1	DPWH-Funded Projects																					
	Biday-Tanqui-Cabaroan Creek - 800 + 1800 m long channel improvement	49.27																				
	Narra-Cabaroan Creek Upstream Camansi Bridge-3000 m long channel improvement	52.57																				
	Construction/ Rehabilitaion/Reconstruction: Roads & Drainage System / Slope Protection	43.70																				
	TOTAL COST FOR DPWH PROJECTS	145.54																				
	GRAND TOTAL COSTS (City & DPWH). PHP million	554.46																				

4.6 Supporting Investments (Planning, Institutional Reform and Capacity Building)

4.6.1 The way forward – Sector Institutional Principles

195. For the planned improvement and expansion of the physical facilities for the sub-sector to be effective and sustainable, a parallel program for institutional reform and capacity building is proposed. The current institutional framework is fragmented, and poorly aligned to the achievement of sector objectives. Reform for the sub-sector needs to be guided by a set of principles and related actions, and the following are proposed for consideration (Further details are provided at Appendix M):

i. Separation of conflicting functions within the city government: (i) regulatory; and (ii) executing, implementation and management functions (e.g. city as regulator, implementer/manager, and service provider).

ii. Water supply and wastewater are closely linked through the water cycle, and the ideal institutional set up is for a single agency to handle service provision in both water supply and wastewater management sectors.

iii. Drainage and wastewater management are also linked, and drainage is also closely linked to city physical environment, planning and land development.

iv. For water supply and wastewater management, ring-fencing of both revenues and costs, provides a solid and factual basis for decision makers to pursue and achieve full cost recovery.

v. This, and a pipeline of good quality projects, creates an environment to attract private sector involvement, particularly to contribute management expertise and investment capital.

vi. A water cycle approach and metropolitan approaches exploit economies of scale, and increase efficiency and effectiveness which can help address some of San Fernando's environmental challenges.

vii. The institutional framework needs to support better information exchange between planners and executing and implementing agencies.

viii. DPWH can contract some drainage and flood control works to the City Engineers Office to resolve infrastructure coordination and sequencing problems.

ix. Methods for preparation and implementation of the CLUP need to change if preparation and approval times are to be shortened, and the CLUP become a more effective planning tool.

196. As strongly advocated by Government through DPWH's Program Operations Manual for the NSSMP, the city government and the water district need to pursue and cultivate a relationship of close collaboration and cooperation in the water and wastewater management sector.

4.6.2 The Institutional Reform Agenda

197. Working together, the city government and water district can co-brand the strategic direction for a water resources and wastewater management framework which can be supported through the GIWWM Program., The Program provides an opportunity to re-align sector policy and relationships to better support these two agencies in efficiently using their combined resources to deliver better sector outcomes within a revised and enhanced service delivery arrangement. This framework should form the basis for mechanisms and protocols to support execution of an integrated water resource and wastewater management strategy and program. This process will require the involvement of all stakeholders, including policy makers (City Council), investors such as the national government and private sector companies, water district managers and users such as households and business establishments. This framework can be developed and supported through the preparation and execution of the proposed Wastewater Management, Drainage and Green Development Masterplan.

198. In the short-term (2020), the institutional reform proposed for the wastewater management sub-sector is as follows:

i. City government to follow up on its support for the MSFWD's water supply and wastewater management plan by reaching agreement on roles and responsibilities in the wastewater management sector. Through a memorandum of agreement (MOA) set out a roadmap for sector institutional reform to include specific actions around the billing and collection of the existing environmental management charge levied by the city. Under this arrangement, the city might continue to levy the billing and collection of the environmental charge with some being passed to MSFWD for septic sludge and wastewater treatment operations. Eventually this charge should be replaced or supplemented by a wastewater management fee to be added to the water bill of MSFWD customers.

ii. City government implements ring-fencing of the financial assets and liabilities, revenues and costs of the current wastewater management system, including septic sludge collection and treatment.

iii. City government finances and implements the improvement and expansion works for wastewater and septic sludge management and treatment facilities, and transitions the operational part of CENRO's wastewater activities to become part of the MSFWD.

iv. City Government and MSFWD agree a mutually acceptable plan for the eventual transfer of the operation and maintenance of the septage and wastewater facilities to the latter and sign a MoU to that effect[26].

199. In the **medium term (2025),** the city government and the water district execute the MoU to progressively transfer operational responsibility for wastewater management to the latter and determine the ownership of capital assets.

200. In the **long term (2030),** the WD takes full responsibility for the city's water supply and wastewater management system[27] and the city government concentrates on its role as the regulator of the system and addressing environmental concerns.

4.6.3 Supporting and Executing Better Planning

201. There are a number of issues which need to be addressed to improve the planning process, some of which also impact on the financial and economic performance of the city, and thus support the project objectives:

i. The Tax Code is outdated: the last revision was 1991, and the base map was last updated in 1991. There is an urgent need for an updated cadastre to support both the planning process and improve the revenue base of the City through updated records that can be linked to property ownership, asset management etc.

ii. A new requirement from National Government is for City budgets to include 'climate tagging'. This means that within the budget to 'tag' those budget lines that will contribute to climate mitigation or adaptation measures. This needs to be supported by more resources and enhancing the capability of city staff.

iii. The CPDO which is responsible for preparing the CLUP is not fully staffed in such a way as to optimise the value of the CLUP. The technical competencies of staff need to be improved to better match departmental needs which include economists, environmental planners and increased GIS capacity.

202. The following planning actions are considered necessary to support the objectives of the program. Some of these relate to broader considerations which may be beyond the scope of the program to influence, but are considered integral to the success of the program.

203. By 2020 the City should achieve:

i. An updated city base map, and a programme that will enable the City to regularly update this map and identify a database system that is manageable (in line with human and financial capacity).

26 Issues to be agreed include the valuation and payment of property, plant and equipment to be transferred to the Water District, revenue sharing and expansion of the sanitation facilities.

27 This may include transfer of assets or an agreement for MSFWD to lease the assets from the city as part of a management arrangement

ii. **Metropolitan scale planning**. Introducing the project to MLUDCC and CELUPMA, and supporting the City to understand that: (i) metropolitan-level planning is more than just roads and tourism; and (ii) economies of scale can be realised through greater cooperation in water resource management. Develop a concrete mechanism for the City to actively participate with the neighbouring municipalities in CELUPMA. This could include the establishment of a technical working group with reps from CENRO, CPDO, CEO, MSFWD etc. and identify a funding source that can contribute to the management of CELUPMA through a governing council and associated activities (Region 1 RDC also has a role in facilitating this process).

204. By 2025 the following activities should be completed and milestones reached:

i. GIS capacity building program designed and implemented

ii. Knowledge and data sharing platform developed that supports information management related to the natural and built environment in the city to support better planning decisions.

iii. Linked to GIS, develop multi-hazard mapping. This can be developed concurrently with the provision of appropriate technical training to enable the City to achieve it.

205. By 2030 the following activities should be completed and milestones reached:

i. Have recruited an economist within CPDO and developed economic planning capability that links to the CLUP and the overall development objective of the City.

ii. GIS – have integrated GIS capability into the function of CEPMO and CPDO and Budget office to have accurate data on existing situation so as to enable better decision making.

4.6.4 Capacity Building Requirements

206. Capacity development at the city level in data needs, data generation, data capture, interpretation and processing, and importance of data in informing investment decisions.

207. Capacity building and development of GIS capabilities, and in data sharing and integration. Coordinated approach for each city office to support buy-in to the benefits that more accurate data can have, and the role of the city in collecting and using it.

208. Economic planning: What is really driving the growth of the economy and what infrastructure does the city need to achieve this? Analysis of the development potential of the “growth nodes”, and linkage to green and resilient elements of the plan, and supporting impact assessments on development scenarios or choices.

209. Sustainable Urban Drainage System (SuDS) approaches: what is possible, how to identify and implement sustainable urban drainage interventions; collaboration mechanisms between CPDO, CENRO, CEO and other concerned departments.

210. Governance in the water and wastewater sector: The new role of CENRO as regulator of the water supply and wastewater management, and training in its enhanced functions in the sector for the city staff concerned.

4.6.5 Initial Training Activities

211. Preliminary training activities were carried out during the PFS to start the process of familiarising city government staff with the reforms required to support the program. Training was intended to: (i) contribute to enhancing the understanding by city stakeholders of sector issues and the potential solutions which the project proposes; and (ii) clarify the role that city government departments can play in supporting subsequent stages in the project cycle.

212. The training took the form of regular on-the-job engagement between the PFS team and city government staff and formal information exchange through presentations. The subjects for formal training activities were based on topics requested by the project Steering Committee and Working Group. Focus areas included: (i) promoting green and sustainable urban development – lessons from international good practice; and (iii) sustainable urban drainage solutions and their application.

4.6.6 Implementation and Procurement Arrangements

213. The proposed institutional reform and capacity building activities will be carried out by a combination of activities which are internal to the City Government and other stakeholders (Government of the Philippines Departments, MSFWD etc.) and those which will need to be supported through technical assistance from external sources. There is already a huge amount of technical assistance and guidance available from Government departments (such as DILG) and through multilateral and bi-lateral donor agencies. A first step will be to investigate whether there are existing sources for some of the capacity development activities required.

214. Other key activities will be an integral part of the reform agenda. The critical requirement for this to move forward will be political commitment. However, assistance may need to be sought during the process to ensure that arrangements reached are both within the law, and to the benefit of the population of San Fernando.

215. Some aspects of capacity development, particularly those relating to information collection and improving GIS capability, can be linked to specific elements of the proposed project. The proposed wastewater management, drainage and green development masterplan will afford the opportunity for capacity to be built around database creation and GIS applications.

4.7 Public Dissemination and Communication Plan

4.7.1 Stakeholders' Dissemination Preparation

216. An outline disclosure and stakeholder consultation plan has been prepared and developed by the team in collaboration with the city's counterpart project staff. The purpose is to inform various stakeholders, both in the city government and in the wider constituency, and particularly the Barangay leaders and residents of the study area, about the project and the anticipated project benefits. As the project moves from the pre-feasibility to feasibility, design and implementation phases, public meetings, focus group discussions, and key information interviews are among the tools which should be used in informing and eliciting views and participation from beneficiaries and interest groups. The Dissemination and Communication Plan is provided at Appendix S.

4.7.2 Investment Plan Dissemination

217. Key recipients to be provided with information about the PFS investment plan and program are the city, regional and national government institutions, other concerned agencies (particularly MSFWD) international and domestic financial institutions, private sector enterprises with an interest in the sector and currently engaged in this type of business, and other potential donors and lenders.

218. The dissemination plan incorporates the investment road map for the short, medium and long term investment periods for the project, with a focus on the short-term interventions. It also presents an outline of financial and economic feasibility of the individual investments, indications of beneficiary interest and willingness to pay etc.

219. The purpose of this dissemination exercise is to explain the program objectives and components, to seek stakeholder support, and identify potential roles for the beneficiaries in program execution. It also serves to roll out messages related to the program which enjoy public interest and offer public benefit. In terms of content, the communication includes options to vary content based on the audience, and includes elements such as the proposed project features, indicating project goals, impact on community health, sanitation and hygiene, output and outcome, program costs, financing options and institutional arrangements that are appropriate for the intended audience.

220. Proposed communication means will be through project briefings, update reporting, meetings and presentations at conferences. Also media information campaigns through TV and radio would be implemented. Information will also be disseminated through printed project briefs, brochures summarizing key elements of the project etc. For specific project components with a high chance of attracting private sector finance, prospectuses could be prepared.

4.7.3 Community Engagement during Project Stages

221. The community engagement strategy includes the dissemination of basic ideas and practices which need to be promoted and properly communicated to the target communities in order to ensure that: (i) demand for the project is stimulated; (ii) project facilities are properly used; and (iii) full benefits are realised from project investments. The green and integrated wastewater management project is designed to be implementable and appropriate within the institutional and social constraints of San Fernando City. It is an approach to wastewater and storm-water management where the target audience of the campaign – the beneficiaries – need to carry out certain responsibilities within their command of responsibility. This is particularly true in the short-term where: (i) household water supply connections are set to dramatically increase; and (ii) sanitation will remain largely on-plot and thus the responsibility of the householder. Engagement must begin with ideas on how the message can be crafted to ensure that it can catch the attention of, and get the message across to, the target audience.

222. An example of the ideas which the campaign can convey is through messages such as: (i) increased disease incidence from contamination of groundwater and surface water is rising; (ii) untreated sewage or wastewater contaminates the water that we use and has caused water-borne diseases; (iii) inappropriate wastewater disposal also causes foul odour and attracts disease vectors; (iv) there is a need to prevent water contamination from untreated sewage or wastewater; (v) consequently septic tanks must be properly designed and maintained (have to be water-tight, multi-chambered and accessible for periodic desludging). The message needs to continue that the city of San Fernando is determined to address

untreated wastewater through the project, setting out the actions to be taken by the city and the individual to support this strategy.

223. In the drainage and flood control sector, messages can focus on: (i) the concept of SuDS, and the potential role for the community is supporting this approach, and (ii) this linkage between increased flood risk and the factors which can potentially increase these risks – such as back-filling of low-lying land, poor solid waste disposal practices, drainage encroachments, and increases in impermeable areas.

4.7.4 Community Engagement Strategy per Project Stage

224. Wastewater management is a complex message to promote because it has many associated ideas. Because of this, there is a need to introduce the social relevance of this project gradually and in a phased manner so that each idea and practice will be properly understood, absorbed and retained in the target audiences' minds. For instance, the levying of increased user fees can only be marketed if the service is effectively provided, or the common facility is properly maintained through the use of user's fees, and beneficiaries see the benefit of the improved service or new facility. The wastewater management improvements in particular will eventually need to be paid for by beneficiaries. Good public information and engagement can help this process gain acceptance.

225. The community engagement strategy will be carried out in phases: Under Phase 1 – (2016-2020) community engagement will focus on the awareness raising stage, the educational stage, and the continuing education and action promotion stage. For Phase 2 (2021-2025) community engagement activities should be able to be scaled back, if the activities under Phase 1 have been successful, but focus may need to be more on tariff issues. Where the project is implemented in different areas, community representatives from the area which has benefitted can be used to propagate messages in new project areas. These stages will require varied investment and can be implemented in sequence. They may be repeated at any given phase as necessary, or brought back if there is further need after the initial programs are completed.

4.8 Program Roadmap

226. The proposed GIWWMP involves the execution of sequenced activities within a range of sectors which go beyond the relatively narrow confines of those of wastewater and storm water management. The interlinkage between the project activities identified above is important, as without the related and supporting activities, the core of the program, which is the improvements to wastewater management, drainage flood control and watershed management cannot be successfully executed.

227. This interlinkage of activities and the sequencing of interventions is demonstrated in Figure 4.3, a diagram of the Strategic Framework, and Figure 4.4, the Program Roadmap. The Strategic Framework demonstrates how the projects are led by a set of sector policies and guided by a sector Masterplan, and underpinned by community and institutional support, and financial resources. The Roadmap sets the project activities out in more detail and in a sequenced arrangement which also demonstrates how one project links to others in the Program.

Figure 4.3 Program Strategic Framework

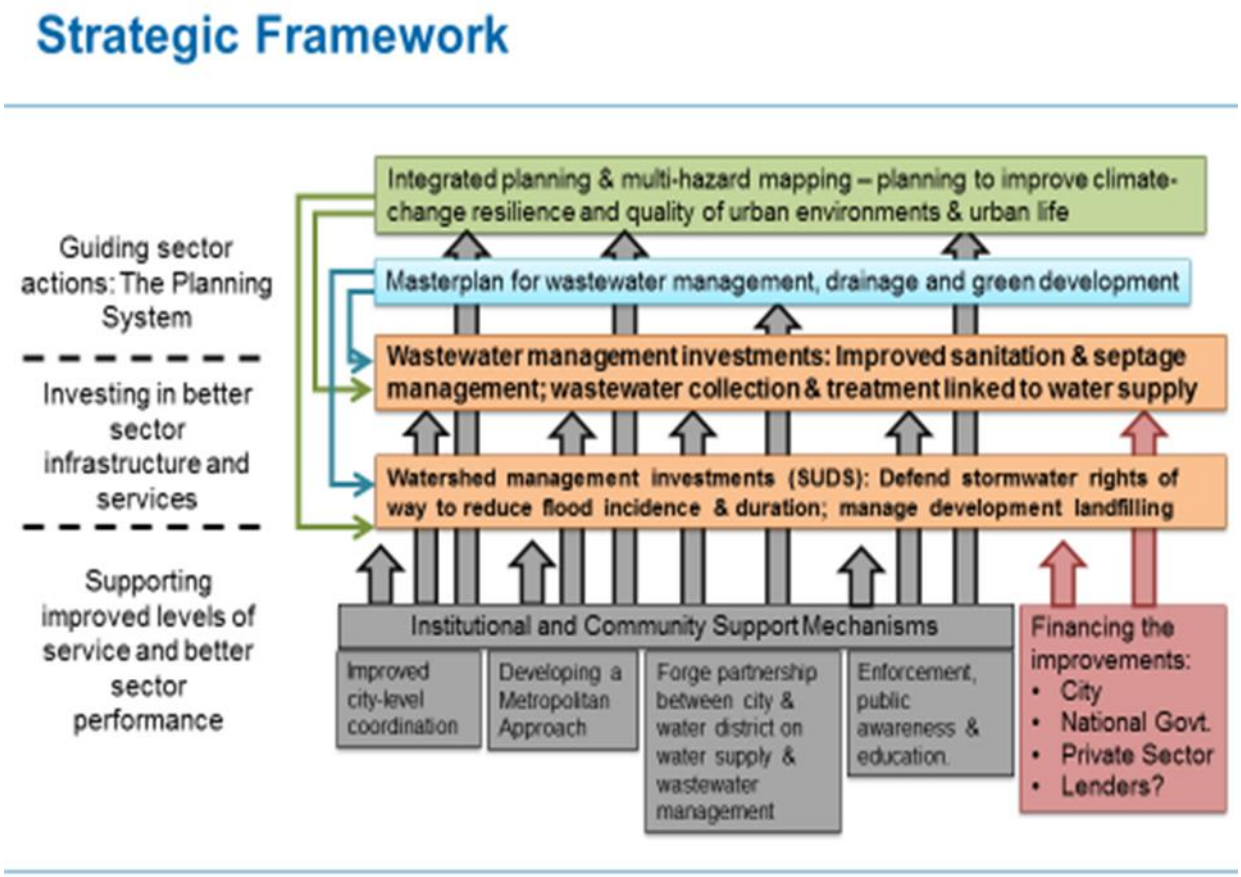
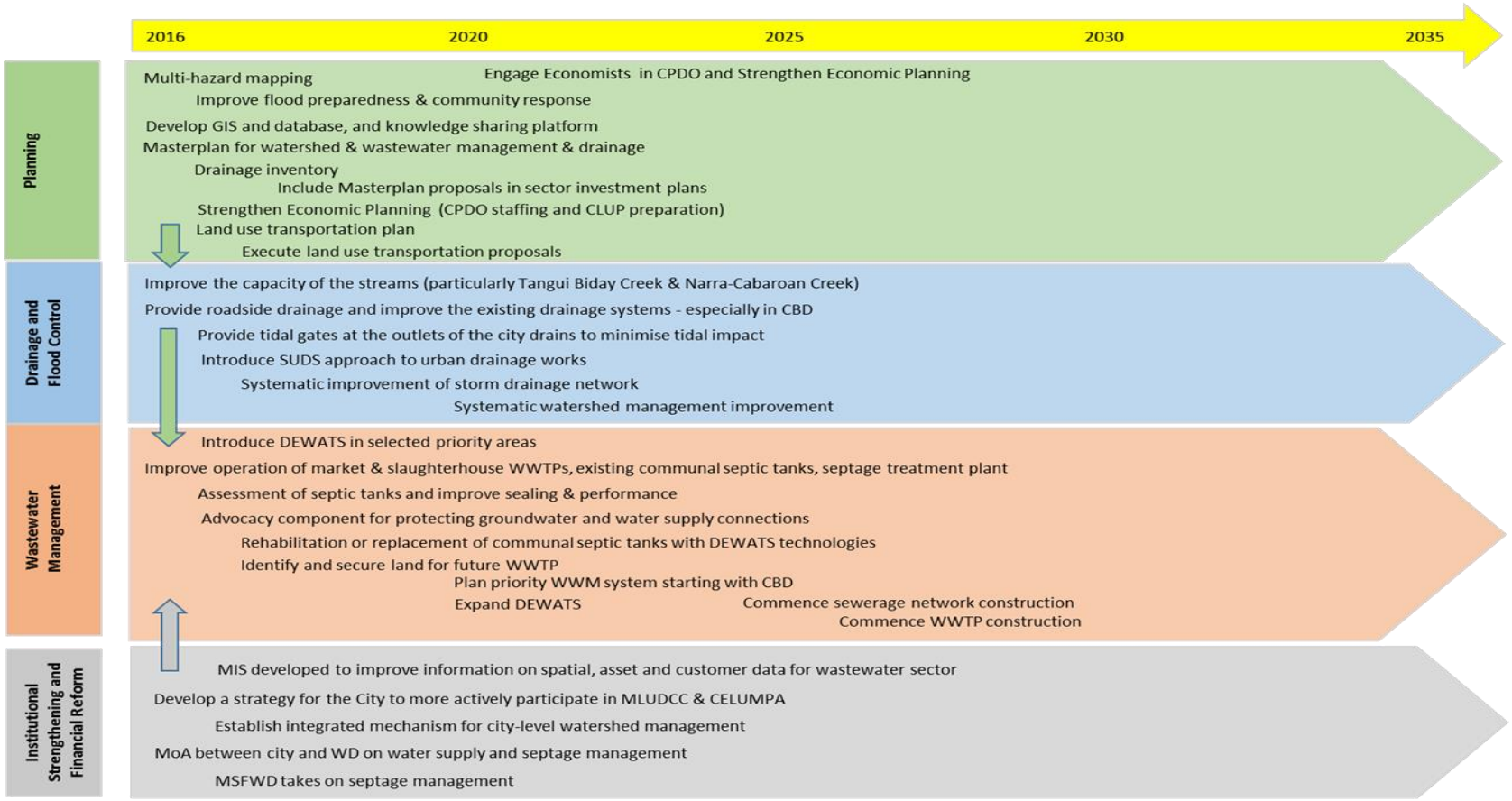


Figure 4.4 Project Roadmap



5 Priority Program Pre-Feasibility Analysis

5.1 Technical Analysis and Feasibility (Selection of Technical Approach)

228. The technical approaches adopted in the preparation of the investment program and in the identification and design of the project components are outlined in sections 4.2 to 4.6 above and in Appendices J and K. The approach to drainage and flood control projects is further elaborated in Appendix Y on SuDS interventions. For most project components there are few, if any, options in terms of the technical approach adopted, and where there are choices, a least-cost approach has been taken which is compatible with the performance requirement for the infrastructure element concerned.

229. For the short- and medium-term investment program which will be subject to future full feasibility analysis there will be a further opportunity for the evaluation of alternative technical approaches during the preliminary design stage. However, based on the pre-feasibility assessment carried out under the study, the technical choices made are considered to offer the least-cost option to provide the anticipated benefits. The proposed short- and medium-term projects are subject to financial and economic analysis in the sections below.

5.2 Financial Analysis

230. Financial analysis was carried out for the short- and medium-term investment program, i.e. 2016 to 2020 and 2021 to 2025 programs. Discounted cash flow analysis was used to determine the financial viability of the proposed wastewater management facilities and drainage system. Free cash flows to the project (gross revenues less operating and maintenance expenses and capital expenditure) were computed on the “with-project” and “without-project” scenarios to measure the financial impact of the proposed projects on the city government. Details of the analysis are provided at Appendix N.

231. In the financial analysis, the computed FIRR is compared with the computed weighted average cost of capital (WACC) to determine financial feasibility. The project is considered financially viable if the computed FIRR is at least equal to the WACC that is used in financing the development of the proposed infrastructure improvement program for sanitation, wastewater management and drainage.

5.2.1 Project Cost

232. Investment cost for the short- and medium-term GIWMP investment was assessed at constant parity price level as of January 2016. Total investments amount to PHP 854 million, the details of which are shown in Table 5.1 below.

Table 5.1 GIWMP Investment Program

Cost Components (All costs in PHP million)	Total	% Total	Short-term	Medium-term
Sanitation & WW Management	430	50%	373	57
Drainage & Flood Control	265	31%	132	133
Total Construction Cost	695	81%	505	190
Capacity Building	8	1%	8	-
Project Management Support	151	18%	129	22
Total Project Cost	854	100%	642	212

Source: Consultants' Estimates

5.2.2 Likely Financing Plan

233. Each of the recommended GIWMP program components shall likely be financed through a combination of borrowings, grant funds from the National Government (NSSMP subsidy) and city counterpart/equity contributions (unappropriated accumulated cash balance and from service fees collected from direct beneficiaries) and budgetary allocations to the DPWH. This is illustrated below in Table 5.2 and further explained in the following sections.

Table 5.2 Likely Project Financing Plan

Component	Borrowings	Grant Fund / Subsidy	Counterpart Fund	National Budget	Others	PPP
Sewerage system	MDFO	NSSMP / GOP	City	-	User Fee	-
Sanitation		-	City	-	Beneficiaries	-
Septage management		-	City	-	User Fee	Desludging
Drainage system		-	City	DPWH	-	-

234. **Developmental Loans.** There are a number of sources of development finance available from both public and private domestic sources which could be used to fund the project. The most advantageous source is likely to be the Municipal Development Fund Office (MDFO) under the Ministry of Finance, which has a number of loan windows offering a variety of relatively attractive terms. The project would be eligible for financing through some of these windows.

235. **Grant Funds.** Currently, the National Sewerage and Septage Management Project is offering a subsidy equivalent to 40% of the cost of sewerage system for highly urbanized cities only. However, amendments to its implementing rules and regulations with the objective of widening the scope and coverage to include septage treatment plants and non-HUC cities like San Fernando are under consideration. Should the eligibility be widened, this would be a good opportunity to obtain grant financing to support the project.

236. **Counterpart Funds.** Counterpart funds from the City, which are usually required to demonstrate proof of ownership and commitment shall comprise the bulk of the financing resource for the GIWMP program investments.

237. **GOP Funds.** Financing for the majority of the proposed drainage and flood control structures shall be from the national government through the DPWH.

238. Given the above options for financing the GIWMP investment program, the financial analysis adopts a likely financing plan as presented in Table 5.3 below.

Table 5.3 GIWMP Investment Program

Sources of Funds	Total	% Total	Short-term	Medium-term
Borrowings from MDFO	229	27%	229	-
NSSMP Grant Fund	-	0%	-	-
City Counterpart Fund	325	38%	265	60
DPWH Budget Allocation	186	22%	91	95
Homeowners Contribution	114	13%	57	57
Total Project Cost	854	100%	642	212

Source: Consultants' estimates

5.2.3 Operation and Maintenance Costs

239. The constructed facilities under the GIWMP shall entail incremental operating expenses for the city government. The additional operating expense are estimated as follows:

i. For sewerage services under the DEWATS, incremental operating expenses are estimated to be 1%[28] of the civil works and equipment cost of the WWTP rehabilitation and 3% of the civil works and equipment cost of the new or replacement DEWATS. This translates to PHP 23 million after the completion of short-term investments in 2020. This will increase to PHP 103 million upon completion of medium-term investments. Operating expenses of the existing WWTPs is PHP 22 million in 2015.

ii. For sanitation management, incremental operating expenses are due to the desludging, treatment and disposal of septic sludge collected from households and business establishments. Unit cost per cubic meter of septic sludge is assumed at PHP 435.00.

iii. For the wastewater treatment plants for the slaughterhouse and market, total operating expenses are estimated to be PHP 0.53 million per year.

240. **MSFWD Administrative Cost.** On the basis of the institutional strategy for the sector, it is proposed that MSFWD takes over the operation and management of the septic sludge treatment and DEWATS facilities, including the collection of wastewater management fees through a Memorandum of Agreement (MOA). But ownership of the capital investments

28 This is based on the fact that much of the operational cost in terms of staffing is covered by the existing plant operation.

remains with the city in the short-term. Net receipts from the collection of environmental fees (after deducting the actual cost of operation of the DEWATS facilities and sanitation services including a fixed administrative fee of the MSFWD) shall be remitted to the City Treasurer's Office at the beginning of each year. In the financial analysis, 10% of collections from environmental fees is assumed as a reasonable administrative cost of the MSFWD.

241. **Drainage System.** Operating costs are estimated at 1 % of capital costs for new drainage lines and amount to PHP 0.15 million in 2018 and would increase to PHP 1.08 million by 2026, when all the projects funded by the city government and DPWH have been completed.

5.2.4 Revenue Estimates

242. Revenue were projected based on the population and water demand projections (See Appendix N), and the existing water tariffs (see Table 5.4) and proposed wastewater management fees as will be elaborated in the next section.

Table 5.4 Water Tariff Schedule of City of San Fernando La Union Water District

Consumer	Minimum Charge (First 10m^3)	11-20 m^3	21-30 m^3	31-40 m^3	Over 40 m^3
		PHP per cubic meter			
Residential	250.00	26.00	31.15	39.05	43.85
Commercial	500.00	52.00	62.30	78.10	87.70
Wholesale	2,400.00	78.00	93.45	117.15	131.55

243. Wastewater Management Fees. The following fees were assumed in the estimation of revenue:

i. **Commercial Environmental fee** equivalent to a 30% surcharge on the monthly water bills of commercial, industrial and institutional connections. For commercial, industrial and institutional establishments without water service connections, the sewerage fee is equivalent to a 30% surcharge to the sum of 12-monthly payments at the minimum charge for Commercial category connections to MSFWD.

ii. **Residential Environmental fee** equivalent to a 20% surcharge to the monthly water bills of residential and government connections. For residential connections with billed water consumption not exceeding the lifeline volume of 10 cubic meters a month, the environmental fee is a fixed flat rate of PHP 10 per month. For households and government offices without water service connections, the environmental fee is equivalent to a 20% surcharge on the sum of 12-monthly payments of the minimum charge for Residential category connections to MSFWD.

244. The collection of wastewater management fees from non-customers of the MSFWD shall be accomplished with the close collaboration of the city government, as follows:

i. For business and institutional establishments, proof of payment of the annual sewerage fee shall be among the documentary requirements in the approval of new as well as the renewal of business licenses being processed by the city government through the Business Permits and Licensing Office under the Mayor's office.

ii. For households without water service connections, proof of payment of annual environmental fee shall be required from all real property owners as part of the documentary requirements in the payment of their real property tax assessment.

5.2.5 Financial Results

245. Results of the analysis show that the sanitation and sewerage investments are financially viable based on the assumed cost recovery tariffs that are detailed in the following section. The project results to an unleveraged financial internal rate of return of 4.7% with a net present value of PHP 180 million using the computed weighted average cost of capital of 2.2% as discount rate (See Table 5.5).

Table 5.5 NPV and FIRR

Test Case Scenarios	NPV (PHP Million)	FIRR	SI	FIRR
Base Hypothesis	180	4.7%		
20% Increase in Project Cost	88	3.3%	1.49	67%
20% Increase in Operating Cost	62	3.1%	1.71	56%
20% Reduction in Revenue	-69	1.1%	3.80	26%

246. Further financial analysis shows that under a viability gap financing arrangement wherein the city government shoulders the capital expenditures and partially subsidizes the working capital, the project's financial viability is further enhanced. Leveraged FIRR is 7.5% with net present value of benefits of PHP 244 million using WACC as discount rate. Tables 5-6 below presents the results of this analysis. The full details of the financial analysis are presented in Appendix N.

Table 5.6 NPV and FIRR

Test Case Scenarios	NPV (PHP Million)	FIRR (%)	SI	SV (%)
Base Hypothesis	244	7.5%		
Sensitivity Case Scenarios:				
20% Increase in Project Cost	152	4.9%	1.75	57%
20% Increase in Operating Cost	126	4.9%	1.69	59%
20% Reduction in Revenue	-5	2.1%	3.62	28%

Table 5.7 Weighted Average Cost of Capital (WACC)

Particulars	NSSMP	MDFO Loan	City Gov[t]	Homeowners	Total
Amount in PHP million	0	229.17	156.15	113.92	4,890.4
Percentage Distribution	0	45.9%	31%	23%	100%
Nominal Interest Rate	0%	5.0%	1%	1%	-
Tax Rate	0%	32.0%	12%	12%	-
Tax-adjusted Interest Rate	0%	3.8%	0.9%	0.9%	-
Inflation Rate (2015)	1.4%	1.4%	1.4%	1.4%	
Real Cost	0%	3.7%	0.9%	0.9%	
Weighted Average Cost of Capital (WACC)					**2.19%**

5.2.6 Results of the Sensitivity Analysis

247. Sensitivity analyses were carried out to determine the responsiveness of the FIRR and NPV to changes in financial costs and benefits. The sensitivity analysis assessed the following cases: (i) 20% increase in capital costs; (ii) 20% increase in operating costs; and (iii) 20% decrease in wastewater fee revenue. The computations of the resulting FIRR, NPV, switching values (SV), and sensitivity indices (SI) are set out in Tables 5.6 and 5.7.

5.3 Economic Analysis

248. Economic analysis was also carried out for the short- and medium-term investment program, i.e. 2016 to 2020 and 2021 to 2025 programs. Economic analysis assesses the overall impact of the project on improving the economic welfare of the beneficiary community concerned. Unlike financial analysis, it evaluates the project in the context of the national economy rather than of the project participant or project entity that implements the project. In the quantification of economic costs and benefits, shadow prices are used instead of market prices.

249. The economic analysis was undertaken in accordance with Asian Development Bank (ADB) guidelines: (i) *Framework for the Economic and Financial Appraisal of Urban Development Sector Project* and (ii) *Guidelines for the Economic Analysis of Projects.* The analysis also used as reference the *"Reference Manual of Project Development and Evaluation"* of the National Economic and Development Authority (NEDA). The economic internal rates of return (EIRRs) and economic net present values (ENPVs) were computed to determine the economic viability of the proposed project for the City of San Fernando La Union.

250. The analysis focused on the "with-project" and "without-project" scenarios to measure the incremental impact of the proposed projects. The economic costs and benefits associated only with the project were identified, and other economic costs and benefits that exist whether or not the project will be implemented are excluded.

5.3.1 Sewerage and Sanitation Subproject

5.3.1.1 Economic Costs

251. **Project Cost.** The proposed wastewater and sanitation subproject for the City of San Fernando has an estimated total financial cost of PHP 558 million – PHP 227 million in civil works, PHP 203 million in equipment, and PHP 129 million in project management and implementation support. Total capital cost (net of duties and taxes) comprised 28.0% in tradable goods and services, 5.5% in unskilled labor and the remaining 66.4% in other non-tradable goods and services such as materials, equipment rental and skilled labor. Using the conversion factors mentioned above, the resulting economic cost of project was computed to be PHP 504 million. The detailed project cost estimates are shown in Table 5-8 below.

Table 5.8 Estimated Wastewater Management Project Cost (PHP m, constant 2016 prices)

Particulars	Financial Costs		Economic Costs	
	PHP m	US$ m	PHP m	US$ m
Civil Works and Equipment				
Rehabilitation of Public Market Sewerage	46.48	0.98	43.71	0.92
Rehabilitation of Slaughterhouse Sewers	6.42	0.14	6.04	0.13
Rehabilitation of Septage Treatment Plant	1.15	0.02	1.07	0.02
Replacement of Ecosan Tank in Fishermen's Village (North and South)	116.74	2.46	109.98	2.32
New Dewats at Two Additional Coastal Locations	144.90	3.05	136.54	2.87
Sanitation Program	113.92	2.40	93.58	1.97
Total for Civil Works and Equipment	429.61	9.04	390.92	8.23
Land Acquisition and ROW	---	---	---	---
Project Implementation and Management Support				
Master Plan	11.50	0.24	10.06	0.21
Resettlement Action Plan	47.59	1.00	41.64	0.88
Information and Education Component	5.00	0.11	4.38	0.09
Institutional Reform / Capacity Training	8.00	0.17	7.00	0.15
Environmental Monitoring	5.25	0.11	4.59	0.10
Surveys and Detailed Engineering Design	32.13	0.68	28.12	0.59
Construction Supervision	15.00	0.32	13.12	0.28
Incremental LGU Administration	4.28	0.09	3.75	0.08
Total Project Implementation and Management Support	128.75	2.71	112.66	2.37
Total Project Cost	558.36	11.76	503.58	10.60

252. **Operation and Maintenance Cost.** Operating and maintenance (O&M) costs were assumed to have two components – replacement and/or rehabilitation of wastewater treatment plant (WWTP) in the public market and slaughterhouse, and the construction of the DEWATS in the Fishermen's Village (North and South) and two additional coastal locations. The O&M cost of WWTPs in the public market and slaughterhouse was estimated to be 1% of the civil works and equipment cost. The rehabilitation and/or replacement of the WWTP in the public market and slaughterhouse will be completed by 2018 and 2017, respectively. The O&M cost of the DEWATS was set at 3% of the civil works and equipment cost. The installation of the DEWATS in the Fishermen's Village (North and South), and two additional coastal locations will be both completed by 2019.

253. **Replacement Cost.** The economic analysis also provides replacement costs for the WWTPs in the Fishermen's Village (North and South) and the two additional coastal locations starting in 2035. It is conservatively assumed that the WWTPs have an economic life of 15 years.

5.3.1.2 Subproject Benefits

254. The economic benefits considered in the analysis are health benefits, customer satisfaction, and improvement in land rental values. The analysis assumed that full economic benefits would only be realized from the time of completion of the proposed capital expenditures.

255. **Health Benefits.** The health benefits attributable to the subproject comprise the following: (i) savings in personal health care costs, (ii) savings in government health care costs, and (iii) savings in the cost of productive time lost due to water-borne diseases. Based on previous studies[29], health care benefits attributable to wastewater and sanitation subprojects results in a 10% reduction in the incidence of water-borne diseases in the service area. About 20% of the reduction is considered as directly resulting from the proposed project in San Fernando City. Total health benefits arising from the sewerage and sanitation investments are estimated with an NPV of PHP1.5 million using the NEDA prescribed EOCK of 15% as discount rate.

256. **Increases in Land Rental Values.** Aside from improvements in the environment and public health, the enhancement of the wastewater and sanitation system in San Fernando City will also result in an increase of property values. Land rental values will improve in turn, resulting in additional incomes for the lessors of the properties. Total increases in Land Values arising from the sewerage and sanitation investments for the service area are estimated with an NPV of PHP 771 million using the NEDA prescribed EOCK of 15% as discount rate.

257. **Customer Satisfaction.** This benefit represents the economic value of the wastewater and sanitation project to the direct beneficiaries. Based on economic principles, an economic good or service is valued on the basis of the satisfaction derived by the consumer for that good or service. Simply put, it is the value of money for the good consumed or the service rendered to the consumer. For this economic analysis, the valuation of customer satisfaction from the proposed project is assumed equivalent to the total collected sewerage surcharges applied to the water bill of the households connected. Total Customer Satisfaction arising from the sewerage and sanitation investments for the service area are estimated with an NPV of PHP 242 million using the NEDA prescribed EOCK of 15% as discount rate.

29 ADB Guidelines on Economic Analysis in the water supply and wastewater management sector.

258. There are other economic benefits to be gained in the implementation of the GIWMP in San Fernando City, but these were not considered in this analysis for lack of acceptable valuation methodology. Among these benefits are: (i) improved amenity value resulting from cleaner rivers, watercourses, lagoons and the sea; (ii) multiplier effect to the local economy; (iii) protection of the ground water aquifer from contamination; and possibly (iv) increased visitor arrivals and expenditure due to improved sewerage, sanitation and drainage facilities, among others.

5.3.1.3 Results of the Economic Analysis

259. The economic analysis for the base case yields an EIRR of 32% and an ENPV PHP 509 million using the NEDA prescribed EOCK of 15% as social discount rate, and given a project life of 35 years. These indicate that the proposed wastewater and sanitation subproject is economically viable.

260. The results of the economic analysis are summarized in Table 5.9.

Table 5.9 Results of Economic Analysis and Sensitivity Analysis

Particulars	ENPV (PHPM)	EIRR (%)	SI	SV (%)
Base Case	509.42	32.0%		
1-Year Implementation Lag	440.61	32.0%		
20% Increase in Project Cost	408.43	26.5%	0.99	100.9%
20% Reduction in Economic Benefits	306.55	25.4%	1.99	50.2%
20% Increase in Capital and O&M Costs and 20% Reduction in Benefits	205.56	20.9%	2.98	33.5%

5.3.1.4 Results of the Sensitivity Analysis

261. Sensitivity analyses were carried out to determine the responsiveness of the EIRR and ENPV to changes in economic costs and benefits. The sensitivity analysis assessed the following cases: (i) one-year delay in the implementation of the project (or one-year lag in the economic costs and benefits), (ii) 20% increase in capital, O&M and replacement costs, (iii) 20% decrease in economic benefits, and (iv) 20% decreases in economic benefits combined with a 20% increase in capital, O&M, and replacement costs. The computations of the resulting EIRR, EIRR, switching values (SV), and sensitivity indices (SI) are set out in Table 5-9.

262. The preliminary economic analysis based on combined primary and secondary data concerning likely benefits and preliminary costs of construction and maintenance of the sanitation and sewerage infrastructure indicate that the investment is likely to be economically viable. While the benefit data are not considered particularly robust, the sensitivity analysis indicates that the investment would remain economically viable even if the benefits were less than estimated in the base analysis. This is considered to be sufficiently robust for the investment to be considered economically viable. It is possible that there will be a cost increase at the full feasibility study stage. However, the project costs include a 15% physical contingency and the analysis indicates that the investment would remain economically viable with a cost increase of up to about 101%.

5.3.2 Drainage and Flood Control System Subproject

5.3.2.1 Economic Costs

263. **Project Cost.** The proposed drainage and flood management system for the City of San Fernando, La Union has an estimated total financial cost of PHP 392 million – PHP 362 million in civil works and PHP 30 million in project management and implementation support. Total capital cost (net of duties and taxes) comprise 100% in non-tradable goods and services – 67.9% in local materials, 9.5% in equipment rental, 4.0% in unskilled labor, and 18.7% in skilled labor. Using the conversion factors previously indicated, the resulting economic cost of project is computed to be PHP 341 million. The detailed project cost estimates are shown in Table 5.10 below.

Table 5.10 Estimated Drainage Project Cost (PHP m, constant 2016 prices)

Particulars	Financial Costs		Economic Costs	
	PHP M	US$ M	PHP M	US$ M
Civil Works				
City-Funded				
Sevilla Elementary School Area and Vicinity Drainage	3.34	0.07	2.88	0.06
Sevilla Drainage Canal	48.43	1.02	41.85	0.88
Extension of Existing Oasis Canal	21.18	0.45	18.31	0.39
CBD Drainage Construction	38.09	0.80	32.92	0.69
Carlatan Lagoon Mangrove Forestation	1.38	0.03	1.19	0.03
Ringroad Dike	46.00	0.97	39.76	0.84
Small Water Impounding Dike / Reservoir	23.48	0.49	20.30	0.43
Total for City-Funded	181.90	3.83	157.21	3.31
DPWH-Funded				
Oasis Resto Area Drainage Canal	12.65	0.27	11.07	0.23
Biday-Tanqui-Cabaraoan Creek Channel Improvement	56.70	1.19	49.61	1.04
Narra-Cabaraoan Creek Channel Improvement	60.46	1.27	52.90	1.11
Construction / Rehabilitation: Road Drainage	50.26	1.06	43.97	0.93
Total for DPWH-Funded	180.06	3.79	157.55	3.32
Total for Civil Works	361.95	7.62	314.76	6.63
Project Implementation and Management Support				
Surveys and Detailed Engineering Design	19.89	0.42	17.40	0.37
Construction Supervision	9.28	0.20	8.12	0.17
Incremental LGU Administration	0.98	0.02	0.82	0.02
Total for Project Implementation and Management Support	30.15	0.63	26.35	0.55
Total Project Cost	392.10	8.25	341.11	7.18

264. **Operation and Maintenance Costs.** Operating costs (based on financial prices) are estimated to amount to PHP 0.15 million in 2018 and would increase to PHP 1.08 million by 2026, when all the projects funded by the city government and DPWH have been completed.

265. **Replacement Cost.** The proposed drainage and flood management system will not require any replacement costs. Civil works account for more than 90% of project cost, which have an estimated useful life of at least 50 years.

5.3.2.2 Economic Benefits

266. The economic benefits considered in the analysis are: (i) avoided business losses, (ii) cost savings from property damage, (ii) cost savings from public infrastructure damage, and (iv) cost savings from local government unit (LGU) relief assistance. The analysis assumes that full economic benefits will only be realized from the time of completion of the proposed capital expenditures for each catchment area.

267. The proposed drainage and flood management system was evaluated in terms of different rainfall return periods – 1.8-year, 3.5-year, 5-year, 10-year and 20-year. The analysis focused on the 33 barangays, which are vulnerable to floods and landslides. Based on the 2010 Census of Population and Housing, these barangays have a combined population of 86,420 persons with a total of 18,038 households. These 33 barangays account for more three-fourths of San Fernando's total population.

268. **Avoided Business Losses.** Expected business losses were estimated based on the algebraic sum of the expected foregone revenues for various economic activities associated with depths of flood that are expected with rainfall events of different frequency and severity. Forgone revenues for each flood-prone barangay were based on losses caused by recent heavy rainfall events that have hit the city. Avoided business losses are expressed as a percentage of expected value of foregone revenues resulting from various rainfall events. Using the NEDA prescribe EOCK of 15% as discount rate, the NPV of the estimated avoided business losses due to flooding incidences by return periods are presented in Table 5.11 below.

Table 5.11 Avoided Business Losses

Return Periods	NPV (PHPM)
1.8 Years	5.10
3.5 Years	20.28
5.0 Years	47.82
10 Years	188.32
20 Years	1,013.75

269. **Avoided losses** from property damage. In general, flood-related damage to real property will consist of structural damage and content damage[30]. The value of assets lost due to floods and which need to be replaced for each flood-prone barangay were based on the losses caused by recent high intensity rainfall events which hit the city. As with the valuation of the foregone revenues, estimated losses from property damage were based on the algebraic sum of the expected property real property damage for various land classifications, and associated with depths of flood that are expected with rainfall events of different frequency and severity. Avoided losses from property damage are expressed as a

30 Structural damage refers to losses due to destruction of buildings and fixed-in-place assets. Content damage refers to damage to moveable assets such as household appliances, office equipment, and motor vehicles.

percentage of expected value of real property damage from various rainfall events. Using the NEDA prescribe EOCK of 15% as discount rate, the NPV of the estimated avoided property damage losses due to flooding incidences by return periods are presented in Table 5.12 below.

Table 5.12 Avoided Losses from Property Damages

Return Periods	NPV (PHP m)
1.8 Years	97.06
3.5 Years	196.88
5.0 Years	326.43
10 Years	643.25
20 Years	1,706.17

270. **Cost Savings from Public Infrastructure Damage**. Public infrastructure damaged by typhoons may consist of school buildings, roads, bridges, flood control systems, and other structures. The city government of San Fernando will realize cost savings from the avoidance of public infrastructure damage attributable to floods if the incidence, duration and depths of flooding are reduced. The cost savings from avoidance of public infrastructure damage for each flood-prone barangay was calculated as the product of unit cost, percentage of affected area, and projected number of affected households. Using the NEDA prescribe EOCK of 15% as discount rate, the NPV of the estimated cost savings from public infrastructure damages due to flooding incidences by return periods are presented in Table 5.13 below.

Table 5.13 Avoided Losses from Public Infrastructure Damage

Return Periods	NPV (PHP M)
1.8 – Years	20.32
3.5 – Years	41.35
5.0 – Years	73.72
10 – Years	143.72
20 – Years	367.19

271. **Cost Savings from LGU Flood Relief Assistance**. Flood-affected families usually receive relief assistance from the city government[31]. The city government of San Fernando, La Union will realize cost savings attributable to the project if the number of flood-affected families is reduced as a result of the decrease in the incidence, duration and depth of flooding. The cost savings from LGU flood relief assistance for each flood-prone barangay was calculated as the product of unit cost, percentage of affected area, and projected number of households. Using the NEDA prescribe EOCK of 15% as discount rate, the NPV of the estimated savings from LGU relief assistance due to flooding incidences by return periods are presented in Table 5.14 below.

31 Relief assistance may consist of canned goods, rice, used clothing, blankets and other essential items.

Table 5.14 Savings from LGU Relief Assistance

Return Periods	NPV in PHP million
1.8 Years	0.27
3.5 Years	0.55
5.0 Years	0.97
10 Years	1.90
20 Years	4.85

272. As with the wastewater projects there are other economic benefits to be gained in the implementation of the GIWMP drainage projects in San Fernando City, but these were not considered in this analysis for lack of acceptable valuation methodology. Among these benefits are: multiplier effect to the local economy, reduced incidence of landslide, improved amenity value of water courses, lagoons and coastal waters due to reduced pollution etc.

5.3.2.3 Results of the Economic Analysis

273. The proposed drainage and flood management system will only be economically viable under the 10-year and 20-year rainfall return period. The economic analysis for the base case under the 10-year rainfall return period yields an EIRR of 23.6%% and an ENPV PHP 176 million relative to a social discount rate of 15% and given a project life of 35 years.

274. The results of the economic analysis are summarized in Table 5.15 below.

Table 5.15 Results of Economic Analysis and Sensitivity Analysis (20-Year Rainfall Return Period)

Particulars	ENPV (PHP M)	EIRR (%)	SI	SV (%)
10-Year Rainfall Return Period				
Base Case	176.46	23.6%		
1-Year Implementation Lag	152.28	23.6%		
20% Increase in Project Cost	134.88	20.7%	1.18	84.9%
20% Reduction in Economic Benefits	99.59	20.1%	2.18	45.9%
20% Increase in Capital and O&M Costs and 20% Reduction in Benefits	58.02	17.6%	3.36	29.8%
20-Year Rainfall Return Period				
Base Case	1,137.03	62.9%		
1-Year Implementation Lag	985.02	62.9%		
20% Increase in Project Cost	1,095.46	55.2%	0.18	547.0%
20% Reduction in Economic Benefits	868.05	53.6%	1.18	84.5%
20% Increase in Capital and O&M	826.48	46.8%	1.37	73.2%

Particulars	ENPV (PHP M)	EIRR (%)	SI	SV (%)
Costs and 20% Reduction in Benefits				

Source: Consultants' estimates

5.3.2.4 *Results of the Sensitivity Analysis*

275. Sensitivity analyses were carried out to determine the responsiveness of the EIRR and ENPV to changes in economic costs and benefits. The sensitivity analysis assessed the following cases: (i) one-year delay in the implementation of the project (or one-year lag in the economic costs and benefits), (ii) 20% increase in capital, O&M and replacement costs, (iii) 20% decrease in economic benefits, and (iv) 20% decreases in economic benefits combined with a 20% increase in capital, O&M, and replacement costs. The computations of the resulting EIRR, EIRR, switching values (SV), and sensitivity indices (SI) are set out in Table 5-15 above.

5.4 Affordability and Cost Recovery Considerations

5.4.1 LGU Affordability Analysis

276. Aside from the financial efficiency parameter of FIRR, affordability of the GIWMP investments by the San Fernando City Government is also factored into the financial analysis. The results of the financial analysis show that the city's finances remain robust even with the implementation of the investments. Accumulated cash balances remain substantial over the next 10 to 15 years.

277. Debt service coverage of regular revenue of the city is way below the statutory limit of maximum 20%. Highest debt coverage ratio attained is only 3.3% in years 2020 and in 2021. Thereafter, debt coverage gradually decreases until the sewerage loan is fully amortized in 2035.

5.4.2 User Tariff Affordability Analysis

278. As previously discussed, the level of user tariffs is determined based on the affordability of end users and the funding mix for implementing the physical interventions. Based on international practice, the affordability of wastewater tariffs is measured in combination with the water bill. As a rule, the combined user charges for both water and wastewater management services should not exceed a maximum 5% of the average monthly income of low-income families.

279. In the absence of actual statistical data on family income and expenditures in San Fernando City, the results of the 2009 Family Income and Expenditures Survey in the Ilocos Region is utilized for the affordability analysis. Average monthly income of families belonging to the low-income strata is PHP 4,292 in 2009 which is equivalent to PHP 5,207 at current 2016 price levels, using the consumer price indices for the years 2009 to 2015 as reported by the Philippine Statistical Authority.

280. At 5% of the monthly income of PHP 5,207, the maximum combined monthly water and sewerage service charge for families belonging to the low-income strata is equivalent to PHP 260.35. Since the minimum charge for residential connections already amounts to PHP 250,

only PHP 10 can be levied as surcharge to water users belonging to the low-income strata. Hence, the recommended environmental fee for residential water connections with billed water not exceeding the lifeline volume of 10 cubic meters a month has been fixed at the PHP 10 in order to comply with the widely-accepted affordability parameter for combined water and sewerage services.

6 Project Due Diligence and Safeguards

6.1 Initial Environmental Impact Assessment

6.1.1 Outline Initial Environmental Evaluation

281. The national policies on environmental safeguards for wastewater management and drainage are consistent with those of the ADB. The Environmental Management Bureau (EMB) of the Department of Environment and Natural Resources (DENR) implements specific guidelines and regulations on environmental impact assessment. The initial environmental assessment report prepared for the GIWM project is consistent with the requirements of environmental assessment as provided in the ADB's 2009 Safeguards Policy Statement (SPS) and the safeguard review procedures of ADB's Operations Manual[32]. The safeguards policies stipulated in the SPS are also consistent with other multi-lateral and bilateral development partners such as GIZ, JICA and the World Bank.

282. The Philippine regulatory framework on environmental assessment is prescribed under the Philippine Environmental Impact Assessment Law - PD 1586. Environmentally critical projects (ECPs) are classified as Project Category A, while those which are not ECPs but are likewise considered to significantly affect the quality of the environment are classified as Project Category B. Category C projects are environment enhancement projects while Category D projects are those projects that are unlikely to cause significant adverse impact to the environment.

283. In the case of category A or B projects (GIWM is likely to be classified as B) an environmental compliance certificate (ECC) ensures that the construction process is carried out in a manner that will minimize negative impacts on the environment. The wastewater management and drainage infrastructure included under the project, while enhancing the quality of the environment, will likely have significant negative environmental impacts such as dust and noise generation, loss of vegetation and generation of construction wastes. Thus, these projects will be required to secure an ECC prior to construction.

284. An initial environmental examination (IEE) has been drafted for the GIWM project covering: (i) a review of existing environmental conditions in San Fernando City including climate change analysis and hazard assessment; and (ii) anticipated impacts of the proposed projects - particularly during drainage construction and sewer pipe laying activities. The full IEE report with the proposed environmental and social management plan is presented at Appendix P.

285. The proposed subprojects will inevitably create some negative impacts on the surrounding land, air, water, biological environment and local population during both construction and operational phases. Table 6-1 summarizes the identified environmental and social impacts that may be created based on the proposed project activities. The significance of each impact is also indicated to determine the following:

- Will the perceived impact generate positive/negative effects?
- Will the perceived impact cause direct/indirect effects?

32 OM section F1/OP; 20 January 2010

- Will the perceived impact cause long/short term effects?
- Will the perceived impact be reversible/irreversible?

Table 6.1 Analysis of Anticipated Environmental and Social Impacts

Activities	Aspects	Environmental Impacts	Parameter Most Affected	Significance of Impact +/-	D/In	L/S	R/I
A. Expansion and improvement of wastewater management system and drainage network (Septage treatment, DEWATS, sewer lines, drainage network and flood protection)							
Major civil works including pipe laying, excavation, DEWATS construction and drainage improvement	Earth-movement and other civil works	Generation of solid wastes	Land	-	D	S	R
		Dust propagation and migration	Air	-	D	S	R
		Restriction or alteration of stream flows	Water	-	D	S	R
		Stormwater run-off	Water	-	D	S	R
		Siltation and increased water turbidity	Water	-	D	S	R
		Disturbance/ displacement of flora and fauna	Flora Fauna	-	D	S	I
		Traffic congestion	People	-	D	S	R
		Displacement of human settlements	People	-	D	S	I
	Use of heavy equipment	Ground vibration	Land	-	D	S	R
		Generation of hazardous wastes (i.e. used oil)	Land	-	D	S	I
		Increase in air emission levels	Air People	-	D	S	R
		Increase in noise levels	Air People	-	D	S	R
		Increased risks to occupational safety	People	-	D	S	R
	Ingress of heavy equipment and workers	Generation of solid wastes	Land	-	D	S	R
		Generation of wastewater	Water	-	D	S	R
		Traffic congestion	People	-	D	S	R
		Generation of employment	People	+	D	S	R
B. Operations & Maintenance of DEWATS, Septage, Sewerage and Drainage Facilities							

Activities	Aspects	Environmental Impacts	Parameter Most Affected	Significance of Impact			
				+/-	D/In	L/S	R/I
Operation of DEWATS including septage treatment plant	O&M	Generation of treated effluents meeting	Water	+	D	L	R
		Noise	People	-	In	L	R
		Generation of sludge	Land	-	D	S	R
		Less flooding; less overflow of sewer	People	+	D	L	R
C. Abandonment							
Closure	Demolition	Generation of solid wastes	Land	-	D	S	R
		Generation of wastewater	Water	-	D	S	R
		Traffic congestion	People	-	D	L	R

KEY: (+) positive, (-) negative; (D) direct, (In) indirect; (L) long-term, (S) short-term; (R) reversible, (I) irreversible

6.1.2 Outline EMP

286. An environmental and social management plan (ESMP) has been developed to manage the impacts of the proposed projects, especially during construction phases. Factors addressed include: erosion and sediment control, air and water quality management, noise and vibration, solid waste management, occupational health and safety and vehicular traffic management.

287. **Controlling runoff during excavation and pipe laying works.** Excavation of soil for civil works might trigger localized erosion in the subproject areas. To address this risk, the following measures should be implemented: (i) planning the sites with temporary facilities for storm water drainage to prevent channelling of water flows and erosive velocities; (ii) reduction of the length of exposure of an area through sequencing site-clearing and rehabilitation works; (iii) construction of diversion banks and channels to prevent runoff from flowing through the exposed areas; (iv) site vehicle washing facilities to remove the soil and mud from vehicles and machinery before leaving the site; and (v) decreasing flow velocities through stone paving to control erosion.

288. **Limiting air pollution.** Generation of dust will affect air quality and may impact the surrounding communities and environment. To prevent or minimize the generation of dust, the following should be implemented: (i) avoid excavation activities during periods of strong winds; (ii) use water trucks for dust suppression; (ii) implement vehicle speed limits near the site; (iv) use tarpaulins to cover the loads and limit the loads of haul trucks to avoid spillage; and (v) reduce exhaust emissions through regular maintenance of construction machinery and vehicle.

289. **Preventing contamination of nearby water bodies.** Water quality of adjacent water bodies may be negatively impacted by wastewater generated from construction works. In order to address this, the following measures should applied: (i) installation of buffer zones along river banks; (ii) placing stockpiles of potential water pollutants away from local watercourses

or drainage; (iii) diverting oil-contaminated runoff into an oil and water separator before discharging water into the waterway; (iv) construction of a wash-down area for mud removal from vehicles and disposal to a sediment basin; (v) preparation of Emergency Spills Contingency Plan; and (vi) conduct of awareness training of site personnel with regards to maintaining water quality.

290. **Controlling noise and vibration nuisance**. Heavy equipment causes noise and vibration during construction and pumps during operation, which may cause nuisance and discomfort to adjacent communities. In order to limit or mitigate the impacts of noise and vibration, the following measures shall be taken: (i) monitoring of vibrations at the nearest vibration-sensitive receptor; (ii) modify construction activities to generate only low vibrations; (iii) select low noise equipment and work practices during construction; (iv) limit hours of operation; (v) provision of ear protection equipment; (vi) monitor and apply effective silencing measures for equipment; and (vii) schedule construction activities during the time of the day when there are less sensitive receivers.

291. **Solid waste management.** Solid wastes from construction (spoils and oily wastes) will be generated and shall be covered by a solid waste management plan: (i) issuance of a waste segregation (biodegradable and non-biodegradable) policy for all construction and operations personnel; (ii) provision of solid waste handling and storage facilities, such as dumpsters, trash cans in common areas and strategic locations; (iii) implement a paper usage reduction program in the administration office by re-using paper; (iv) sort non-biodegradable wastes, such as plastics, and metals, and sell to service providers; and (v) dispose of residual and other general solid wastes in accordance with the schedule of the City's solid waste collection system.

292. **Health and safety.** City occupational health and safety policies should be implemented during construction works and operations. This will reduce the likelihood of injuries/fatalities and also protect valuable equipment and properties against damage. The project will ensure: (i) all management, technical, and non-technical personnel to undergo specialized training courses to familiarize themselves with the operations and maintenance of the project; (ii) emergency response plan shall be updated regularly, and emergency drills shall be performed regularly to improve personnel's response technique and time; (iii) personnel shall undergo scheduled annual health check-ups; (iv) safety signage, adequate illumination, anti-skid steps and guard rails, fire extinguishers, first-aid kits, and other safety features shall be established particularly in the treatment plants; and (v) personal protective equipment (PPE), which includes safety boots, hard hats, gloves, safety goggles (in some instances) shall be mandatory for construction workers (during construction phase) and San Fernando City personnel (during operational phase).

293. **Traffic management.** Construction works will be implemented in built-up areas with very narrow streets and alleys generating traffic impact along these areas due to the ingress of heavy equipment and excavation equipment. To manage traffic, the City will implement the following measures: (i) provision of safety barriers, warning signs and lights, traffic marshals within the vicinity of subproject sites, and adequate parking spaces; (ii) all deliveries of construction materials and heavy equipment, either inbound or outbound of construction areas, carried out during off-peak hours and at designated delivery hubs located near the project area to prevent blockage of traffic flow along public roads; and (iii) assistance of barangay personnel in directing traffic coming in and out of the construction sites. To avoid traffic congestion, possible alternative routes through a traffic management plan may be developed.

6.2 Social Development and Poverty Reduction

6.2.1 Poverty Profile

294. Based on the Philippine Statistics Authority's city and municipal small area poverty statistics for 2012, San Fernando City has a poverty incidence of 3.8%, which is comparably low when compared to the provincial average of 19.8%, and national average of 22.3% (PSA, 2012). The City's progress based on the Millennium Development Goals (MDG) indicators has showed a decrease in the proportion of households without access to safe water supply (Level 3), from 55.20% in 2000 to 44.80% in 2007. At the provincial level, the proportion of population below the poverty threshold has decreased from 43.5% in 2000 to 30.20% in 2007; and the proportion of households served with sanitary toilet facilities increased from 81.81% to 92.02% (NSCB Regional Division 1, 2007). Poor levels of access to a piped water supply and poor sanitation increase the incidence acute gastroenteritis - an illnesses which is recorded to be consistently in the top ten causes of morbidity in the city[33].

6.2.2 Social and Poverty Reduction Sector Assessment

295. Essential to the preparation of the pre-feasibility assessment for the investment program for San Fernando City, is the conduct of a social and poverty assessment to identify and recommend program design features. The social and poverty assessment: (i) reviews data on urban poverty in relation to the proposed investment program; (ii) conducts an assessment of potential social and poverty impacts of project components and identifies significant social issues; and (iii) recommends interventions to mitigate potential adverse social impacts and ensure measures for poverty reduction and social inclusion are adequately reflected in the program. From the results of the socioeconomic household social survey and focus group discussions, and based on project proposals, the potential social benefits of the proposed projects include:

i. **Improved access to sanitation and wastewater management services**: Presently, not all households have access to sanitary toilet facilities. The proposed investments in wastewater management improvements will impact either directly or indirectly on all urban barangays, including the poor and vulnerable households in both the coastal and inland areas. Through the investment program, the sanitation and wastewater collection and disposal services will be expanded to include all residential, commercial and institutional establishments. It is anticipated that direct beneficiaries will include a total of about 1,500 in the CBD benefiting from the market system improvements, 4,300 in the Cabaraon area benefitting from the slaughterhouse improvements and a total of more than 25,000 from sanitation improvements in the coastal areas where the majority of households are from the low-income groups (details given in Appendix Q). About 1,000 households, many from low-income barangays, will benefit directly from the drainage and flood control investments. The entire urban population of more than 85,000 will be indirect beneficiaries of the project.

ii. **Health benefits resulting from improved sanitation:** Incidence of waterborne diseases such as diarrhoea, amoebiasis, gastroenteritis, and leptospirosis, often due to poor sanitation conditions, and during floods, are likely to decrease if all households have improved access to proper sanitation and wastewater

33 Based on the City's health statistics from 2011 to 2013.

management facilities. Children and the elderly, who are considered the most vulnerable, will be better protected from these diseases. Health benefits and potential savings will be generated for the targeted poor households as a result of better environmental conditions, better sanitation and hygiene practices, and reduced flooding damage and other negative impacts. It is conservatively estimated that there will be a 20% reduction in the incidence of household illness due to gastro-enteric disease as a result of the project.

iii. **Protection of property and other assets:** Residential, commercial, and government assets and infrastructure, will be protected from the risk of further structural damage due to floods, through the proposed flood control and drainage improvement works. Business losses due to flooding will be reduced, particularly in flood-prone barangays.

iv. **Savings on medical and other household expenses**: Potential household savings can be made from reductions in medical expenses related to waterborne diseases, house repairs necessitated by flood damage, and expenses during evacuation. Potential savings from these will allow the households to utilize these resources for more important items such as food, education, health, and livelihood. The impact on the income among poor households who are unable to work during flooding, will be reduced.

v. **Potential employment opportunities and increase in household income**: Improvements in drainage and sewerage networks, and flood control structures, will indirectly improve business activities, particularly those related to tourism and services. Improvement in local businesses will in turn encourage more employment opportunities. Jobs for skilled and unskilled labourers will be created during the construction and operations of the new facilities. During the operations and maintenance phase of the project, community residents particularly women headed households will have opportunities to obtain employment or livelihood opportunities from activities such as the collection of debris from the canal inceptors that will be built along the drainage canals. Women community facilitators can also be engaged to assist in public education on sanitation, flood control and related issues and activities.

vi. **Reduce city government expenses and resources in disaster response**: The City government spends resources for rescue and relief operations, evacuation activities, clean-up after floods, and repair of damaged local infrastructure. Potential savings from the expenses for disaster response and rehabilitation activities and repair of damage on city infrastructure can be used for other priority social programs and projects.

vii. **Opportunities for the City government and the Barangays to engage and participate in sustainable drainage system (SuDS) initiatives.** Community involvement in such activities can result in community benefit and a reduction of city's expenses for parks maintenance. Barangays can take the lead in rainwater collection and storage for household use or in watering community gardens, roof gardens, pocket parks, and garden strips including other measures to increase water filtration and contribute to replenishment of ground water.

viii. **Increase in San Fernando City's Tourism Value as growing coastal tourist destination**. The practice of green and integrated wastewater management,

drainage improvement, and SuDS measures, as well as citizens' engagement in resolving sanitation and flooding issues can become a key element in improving the city's environment and thus protecting its coastal resources. The City tourism office can showcase good governance practices in promoting and increasing visitor arrivals and at the same time putting in place measures in addressing sanitation and urban drainage issues with a strong focus on partnership and participation of various stakeholders to improve environmental quality and assets.

6.2.3 Social Action Plan

296. A Social Development Action Plan (SDAP) presented at Appendix Q has been prepared to address the adverse social impacts and risks associated with the projects proposed under the investment program. The mitigating measures cover the key social issues per program phase from feasibility study, detailed engineering design, bidding, construction, and operations and maintenance (O&M) phases. The SADP also is prepared in line with LARP, the gender action plan (GAP), and the Communication Plan for the Program. Among the key measures that the City Government needs to implement are the following:

i. **Ensure regular stakeholder consultations.** Consultative activities, following the Communication Plan, will include regular meetings with barangay officials, residents, affected persons, NGOs, business organizations, national government agencies, and service providers. The stakeholders should be engaged not only during the project planning and preparation, but throughout the implementation and monitoring of the program. Public awareness programs on proper household hygiene and sanitation should be implemented to highlight benefits of having sanitary toilet facilities and wastewater connections for households.

ii. **Enhancement of affordability for poor households**. There are poor households who may not be able to afford the connection charges or tariffs for wastewater connection. Government subsidies (such as deferred connection charges) and other forms of financial assistance, such as credit and savings schemes for poor households, should be explored and be further studied at the detailed feasibility stage. Potential employment opportunities include options for involvement of poor beneficiaries in construction, operation, and maintenance, or potential participation in service delivery or in cooperation with a particular project component (e.g., drainage canal waste collection, waste segregation/ recycling, community engagement with women households engaged in delivery of billing and collection notices). Phasing of infrastructure standards could also be used to facilitate affordability by poor households. It may be that in some locations the affordable option initially is the provision of common or shared connections to the wastewater treatment facility. After some time, when the household's economic situation has improved, they will be able to afford individual connections.

297. The Social Development Action Plan prepared for this project includes: (i) public awareness program on sanitation and public health issues; (ii) public information and discussion forum on wastewater tariff rates and increases; and (iii) targets for employment of city constituents (men and women), and particularly for the poor during construction and operation. Implementation will be monitored through the project performance management system and project progress reports. The Social Action Plan is presented at Appendix Q.

6.2.4 Gender Impact Assessment and Action Plan

298. In the short and medium-term phases of GIWMP, there are no significant differential impacts between men and women. The project features are compliant with GAD guidelines and project design has adequately considered the differential needs of men and women as well as of vulnerable groups. The Project is classified as having some gender elements. At the onset of program implementation, the following measures should be taken to address these issues: (i) incorporate gender concerns into the planning, design, and implementation of improvements in flood management and wastewater management and sanitation; and (ii) organize awareness campaigns among women of the affected households on the importance of the Program. Whenever feasible, training and strengthening the participation of women in Program implementation is encouraged.

299. The Gender Action Plan for the project is summarized and is included in the social poverty strategy plan. (Appendix Q) It addresses the gender issues attendant to each Project milestone. The plan provides for the following key strategies to be pursued: (i) put into use existing city gender-compliant (GAD) policies and regulations; (ii) Gender-responsive employment support provided during project construction so that gender capabilities for equitable participation in employment with adequate institutional support for men and women workers are ensured; (iii) awareness sessions on gender Issues and GAD mainstreaming efforts are in place, such that community-driven sanitation and flood mitigation activities are advocated and institutionalized; and (iv) ensure that the gender plan and guidelines for gender mainstreaming are effectively carried out, including the provision of continuing advocacy and regular monitoring.

6.2.5 Outline Land Acquisition and Resettlement Requirements

6.2.5.1 Land Acquisition and Resettlement Framework

300. The outline for the project Land Acquisition and Resettlement Framework (LARF) has been prepared to ascertain potential impacts on people and assets or private properties that may be affected to ensure adequate compensation and intervention assistance. In the case that people will be physically and economically displaced, it is to be ensured they are given compensation for lost assets and appropriate resettlement packages that will improve (or at least not worsen) their livelihood and socio-economic situation compared to pre-project levels.

301. The key objectives of the LARP include the safeguards set forth in related national government policies, and the ADB's Policy on Involuntary Resettlement. Among the key LARP objectives are: (i) avoiding involuntary resettlement, wherever possible, (ii) ensuring that the affected people are fully informed and consulted on resettlement and compensation options; (c) enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and (d) improve the standards of living of the displaced poor and other vulnerable groups.

6.2.5.2 Land Acquisition and Compensation Strategy

302. The City is guided by Republic Act 8974, Republic Act 7279 and other city ordinances as the legal basis in negotiating with impacted land and property owners. For the expansion and rehabilitation of DEWATS and drainage project components, the provisions of the RA 8974 on valuation, compensation and negotiation procedures will be adopted. For the valuation of

structures and other assets, Republic Act 7279 and other legal basis of the City and its authorized negotiating team undertaking the assessment will govern the negotiations.

303. Resettlement planning will be undertaken with those who will be temporarily displaced or potentially relocated to provide mitigation measures to compensate for their losses. In addition, a package of resettlement assistance will be drawn up to restore their livelihood and sustain their current livelihood undertakings to the existing or a better income level.

304. For the short-term phase of the investment plan, there are no land acquisition and resettlement requirements. However, such impacts may be a feature of the implementation of the medium- and long-term project investments. If at all applicable, these components will require a full resettlement plan will be prepared, and thus cost for land acquisition and resettlement will be included in the overall project cost to be covered by the city funds. The city government of San Fernando will be responsible for the land acquisition, and preparation of the resettlement action plan making reference to national laws and international mechanisms for the preparation and in the execution of the plan.

305. However, the GIWMP proposed infrastructure projects in the medium-term phase do not have anticipated significant resettlement requirements associated with implementation of the investment program. However the proposed sub-project components may have temporary impact on some existing structures, for instance under drainage works and rehabilitation of the Wet Market wastewater treatment plant.

306. Resettlement planning will also be undertaken with those who will be temporarily displaced or potentially relocated to provide mitigation measures to compensate for their losses. In addition, a package of resettlement assistance will be drawn up to restore their livelihood and sustain their current livelihood undertakings to the existing or a better income level.

307. Proposed outline of a Land Acquisition and Resettlement Framework, (LARF) following the prescribed outline based on ADB Safeguard Policy on Involuntary Resettlement is provided at Appendix R.

7 Project Benefits, Impacts, Assumptions and Risks

7.1 Summary of Project Benefits

308. The Immediate Action Program (Sort-term Program: 2016-2020 and Medium-term Program: 2021-2025), is projected to deliver the following benefits:

i. Improved access to good quality and affordable sanitation and wastewater management services to the majority of the population of San Fernando city and its transient population of students, traders and visitors.

ii. Improved system efficiency and effectiveness through the use of innovative approaches to improve and bring down the cost of sanitation and wastewater management service provision in areas which are difficult to serve, and where affordability levels are low.

iii. A sustainable and self-financing wastewater management service provider, which is customer-oriented and in a position to attract both government (including sovereign loan) funds, and private sector capital.

iv. As a result of the above, more efficient sanitation and wastewater management and improved quality of ground and surface water in and around San Fernando, and of coastal waters and mangrove areas in and around the city.

v. Improved urban drainage and flood control measures – including enhanced watershed management to both improve conservation of water resources and attenuate flood peaks.

vi. Economic and social benefit around planning system improvements which will: (i) support metropolitan approach to providing more efficient and effective planning system; and (ii) as a result improve the prospects for affordable and effective sanitation provision and minimisation of risk of flood and associated flood damage in San Fernando and surrounding municipalities.

7.2 Project Assumptions

309. The basic assumptions made, which identify the conditions which need to occur for the program to generate the anticipated benefits are:

i. Continued political support for the development of San Fernando as a centre for tourism, health facilities and education and as a commercial and service centre for the Region 1.

ii. The city supports the progressive introduction of water district household water supply connections through the phasing out of water supply from individual shallow wells.

iii. Increased growth of investment in San Fernando resulting in commercial and institutional development and the generation of additional jobs, and thus enabling improved sanitation and wastewater management services to be paid for.

iv. A progressive increase in population as a result of improved economic opportunity, and an enhanced willingness and ability of residents to pay for sanitation and wastewater management infrastructure.

v. Continued focus and commitment of the national and city governments to addressing sanitation, wastewater management, drainage and flood control issues in the context of resilient approaches to urban development and groundwater, surface water and coastal waters pollution reduction.

vi. The city government is effective in mobilising the community to support the program, and the community supports the investments by paying for improved services

vii. An increasingly favourable environment for the attraction of both domestic and international investment – including to the service sector – supported by a framework and environment that is favourable to inward investment

viii. Strengthened support for, and action on, the progressive move towards the adoption of a metropolitan level planning approach which can guide an integrated development agenda which optimises efficiency of urban growth and the associated storm water drainage and wastewater management infrastructure provision, the latter progressively falling under the control of the Metropolitan San Fernando Water District.

7.3 Project Risks

310. The major risks to timely and effective program implementation and/or realization of project outcomes, and associated mitigation measures are summarized in Table 7-1 below.

Table 7.1 Project Risks and Mitigation Measures

Risks	Mitigating Measures
Failure of the national economy or city economy to grow fast enough to ensure program is affordable	Elements of the program which support greater efficiency are robust against economic stagnation. Growth elements of the program – such as the pace of expansion of the wastewater management network - can be accelerated or slowed down based upon advancement in the local economy and beneficiary wealth.
National Government fails to continue to commit resources to support the development of San Fernando as an tourism destination and centre for health, education and commerce	The city government must continually lobby the national government, and particularly the Ministry of Public Works and Highways to deliver on its commitment to support the continued development of the drainage and flood control infrastructure development in San Fernando.
Absence of funding for Investment Program implementation	Funding is already available, or is potentially available for parts of the program through (i) city resources; (ii) resources from NSSMP (possible if eligibility extended) and (iii) resources from the national line agencies – particularly DPWH. It is important that this project (particularly institutional and service reform and capacity development) is used to lay the foundation for the reform necessary to ensure that further funding is attracted for

Risks	Mitigating Measures
	the Investment Program
No demand due to lack of investment in San Fernando	Government at both National and city level must maintain support to the strategy for the continuing development of San Fernando as a commercial, health services and educational hub.
Lack of commitment of sector institutions to work collaboratively	The realisation of the sector strategies is dependent on common and integrated approaches being developed between differing sector agencies. The program will need to be supported by: (i) mechanisms to encourage and operationalise closer institutional collaboration and (ii) a public awareness and information campaign to mobilise public support for this collaborative approach
Poor technology design or poor quality construction and equipment installation will compromise system performance	Optimisation of design, equipment specification and operation under the conditions prevailing in San Fernando should be ensured through provision of technical assistance as necessary and through top management supervision and third party quality assurance throughout construction, commissioning and early stages of operation of assets created under the program.
Delay in program implementation due to staff absence or inexperience	The city government must ensure that suitably qualified and skilled staff are assigned to the support the further detailing, design, execution and implementation of the program. The program includes proposals for institutional development and capability building for government staff in matters of procurement and program management.
Lack of community and private sector involvement in development of San Fernando	Throughout program implementation, community engagement and private sector involvement must be supported. The city Government, supported by the program unit, will facilitate, supervise, and coordinate the improved planning, coordination and infrastructure development process. Along with the updated comprehensive land use plan, the activities will maximize benefits to current and future residents. Enhanced roles for the private sector in sanitation will be supported.
San Fernando City implementation capacity is not sufficient for large and sophisticated works	Specific funding covers institutional development and reform for San Fernando sanitation and wastewater management which provides consulting services, support, and additional staff with experience and suitable skills. San Fernando City Government and Water District capacity and performance will be built during program implementation, particularly in the areas of project and contract management, financial management and project performance monitoring and reporting.
Lack of clarity on long-term arrangements for sanitation and wastewater management	There is a need for clarity over the long-term arrangements for ownership, planning, capital investment, operation and maintenance of sanitation and wastewater management infrastructure and services in the city. The sector roadmap includes an action plan for establishing optimal long-term institutional arrangements for wastewater management operations through and MoU between the city and MSFWD.
Political change through local government elections	Mitigation of potential negative impacts of political change will be achieved by ensuring public information dissemination and public support for the proposals included under the program, and through the robustness of project proposals and pre-feasibility analysis.
Inefficient procurement and corruption	Reviews will assess procurement capacity and will address gaps that may impede program effectiveness. Relevant provisions of the

Risks	Mitigating Measures
	Governments anti-corruption policy will be adhered to. As the executing agency, San Fernando City will disclose to the public and annually update the program's current status and how program proceeds are being used.

8 Next Steps

311. It is important that this output is reviewed by all stakeholders to: (i) confirm that the proposed investment program and projects respond to the identified key sector requirements; and (ii) that they represent a potentially feasible and achievable set of interventions which the city, along with other development partners, has the resources and capability to execute and operate.

312. In the immediate-term it is important that further actions are taken to disseminate the proposals contained herein in accordance with the project information and dissemination plan presented above in section 4.7 and in Appendix S. It is also important that CDIA, supported by members of the project team (if deemed appropriate) again bring these proposals to the city, and preferably including to a further session of the Sangguniang Panlungsod[34], to articulate to the city's legislative and executive bodies the short- and long-term benefits to the city of it supporting implementation of the proposed program.

313. A number of specific early actions need to be taken to support: (i) further preparation of the proposed projects, and (ii) establishment of the supporting mechanisms which can facilitate early project execution. Foremost among these are the following:

i. Engagement and dialogue between the City and MSFWD on: (i) the institutional roadmap for the sector – who should be doing what; (ii) the basis for an agreement on an MoU/MoA between the city and MSFWD to cover the proposed institutional responsibilities and reform path in the sector; and (iiii) execution, implementation and procurement arrangements for the project in order to ensure the most advantageous outcome from joint efforts by the city, MSFWD and its private sector partners – Prime Water.

ii. Agree enhanced arrangements for inter-departmental coordination and information-sharing within the city Government, and agree on next steps to be taken to institutionalise the improvements and improve information availability and sharing.

iii. Agree on the Term of Reference for the Wastewater Management Drainage and Green Development Masterplan and seek to obtain financing for this either internally or externally.

iv. Develop a mechanism to intensify the dialogue with NEDA and with other central La Union municipalities to strengthen the sub-regional coordination on planning and development through MLUDCC and CELUMPA.

34 A presentation of the PFS DFR was made to the Sangguniang Panlungsod in San Fernando on March 23rd 2016

ANNEXES

Annex 1 Design and Monitoring Framework

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
Impact	By 2035		Assumptions
Reduced wastewater pollution and flooding, and a cleaner and safer urban environment in San Fernando	a. Increased wastewater collection and treatment service coverage b. Economic losses from flooding reduced c. Financially sustainable sanitation service operation d. Coastal and Lagoon Water Quality improved from class SC to class SB (fit for bathing and swimming)	a. Water district and City Government figures on total and new sewer connections b. City records and insurance records on flood damage c. Water district and city government accounts d. Coastal and lagoon water quality records by DENR	The Philippines and San Fernando economic development remains strong City Governments' commitment to improve wastewater operation and management, and reduce flooding remains strong Risk City Government fails to support: (i) leveraging of additional funds; and (ii) service, institutional and tariff reforms
Outcome	By 2025		Assumptions
1. Sound long-term planning framework for wastewater management and drainage improvement established and operational 2. Sustainable improved sanitation and wastewater management services for all. 3. Increased wastewater and septage collection and treatment coverage in San Fernando. 4. Reduced incidence and duration of flooding in San Fernando 5. Sustainable sanitation and wastewater management services established.	1. Masterplan for wastewater management and drainage improvement reflected in CLUP, ratified and being followed. 2. 100% septage generated from septic tanks in San Fernando regularly collected and treated to national discharge standards 3a. 5% of households and businesses in San Fernando with individual sewerage connections 3b. 100% of sewage in San Fernando treated to national discharge standards 4. Flood incidence duration and depth reduced from annual to 1 in 10 year flood at depth <1 m and duration <3 hours in San Fernando.	1. City and Water district records and investment prioritisation. 2. City and Water District customer figures 3. City and Water District human resources records 4. City, media and insurance company records of flood losses 5a. City and Water District corporate accounts 5b. City DRRMC reports and monitoring records	San Fernando City Government and local water district remain committed to: (i) progressive introduction of mains household water supply; (ii) implementing the program, (iii) enforcing new tariffs, and (iv) reform the wastewater institutional framework Risk The City Government fails to attract investment for sanitation, wastewater management and drainage and flood control improvements. Water district and city fail to agree on joint approaches to service and institutional reforms Weak coordination between national agencies and city government on

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
	5. Sanitation and wastewater management services self-financing		infrastructure planning and execution, and disaster preparedness
Outputs	By 2020		Assumptions
1. Wastewater Management and Drainage Masterplan Completed. 2. Unsealed septic tanks and "lusob" toilets replaced by sealed septic tanks 3. Existing sewer networks and facilities rehabilitated. 4. Existing septage management facility rehabilitated and capacity increased. 5. Existing wastewater management facilities at wet market and slaughterhouse rehabilitated 6. DEWATS WWTPs installed at eco-tank sites operating and delivering effluent within national effluent discharge limits. 7. New residential, commercial and industrial developments fully served with sewerage and sewage treatment. 8. Drainage network extended and flood control measures improved 9. Institutional reforms to wastewater management arrangements completed, and capacity to operate and oversee systems enhanced. 10. Wastewater systems operated by self-sustaining customer-facing utility organizations	1a. Wastewater Management and Drainage Masterplan prepared, discussed and approved by city in CLUP. 1b. City Government and water district with a strong pipeline of economically and financially viable sector investments likely to attract interest from sources of private sector finance 2. 100% of households with access to sanitary latrines 3. 5% of San Fernando city households and businesses with household sewer connections 4a. 90% of households with septic tanks are served with septage collection systems 4b. Throughput of septage management facility increased from 5 cum/day to 30 cum/day 5. Wet Market and Slaughterhouse DEWATS facilities treating WW to discharge standards. 5, 6. Incidence of effluent standard exceedance at San Fernando WWTPs< 1% of samples 2, 3, 4, 5, 6, 7. Reduction of 20% in gastro-enteric diseases reported in low income households living in the 64 barangays	1a. Proceedings of the Sangguniang Panlungsod. 1b, 2, 3. City and Water District Project monitoring reports. 2, 3, 4, 6. City and Water District operational records. 5, 6, 7. DENR and city government monitoring reports 7, CEO & DPWH-DEO program and accomplishment reports 8. City DRRMC monitoring and event reports. 9, 10. City and Water District Financial Records and Annual Reports	Investments deliver intended outputs Risk Insufficient investment financing is attracted from government, lenders, donors or private sector Failure of city and Water District to agree on common arrangement and targets.

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
	served by the network compared to pre-project status. 6, 7. Treatment capacity of San Fernando DEWATS WWTPs of 4 x 150 cum/day 8a. 1.4 Km of new RCP stormwater drainage installed and operational 8b. 26.5 Km of road drainage replaced or rehabilitated 8c. 1.8 Km of river revetment and training works completed 8d. 3 ha of parkland and other open land identifies as emergency flood storage capacity 8e. Flood incidence reduced from annual to 1 in 5 years, with depth < 1 m and duration < 6 hours 8f. Economic damage from floods reduced from an average of PHP tens of millions per annum to less than PHP 10m per annum. 8g. Regular programme for data exchange established to support CLUP updating and SuDS approaches. 1 to 8. 10% of low income households in 25 impacted barangays obtain short- or tong-term employment as a result of the project. 9a. Operational ratio for WW system 175% 9b. Collection efficiency		

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
	for WW system 95% 9c. Accounts receivable 60 days 9d. 8 staff per 1,000 connections 9e. Capacity of water district to construct and operate wastewater management facilities and of the city to oversee the sector enhanced. 9f. Enhanced skills and arrangements for inter-departmental collaboration improve planning outcomes. 10. 90% customer satisfaction with affordable wastewater services. **By 2025** 3a. 20% of San Fernando city households & businesses with household sewer connections 3b. 100% of households with septic tanks are served with septage collection systems 4b. Throughput of septage management facility increased from 5 cum/day to 30 cum/day 6a. 600 cum/d of additional sewage treatment capacity added through 4 No. decentralized package WWTPs 6b. Treatment capacity of San Fernando DEWATS WWTPs of 600 cum/day 6c. Incidence of effluent		

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
	standard exceedance at San Fernando WWTP < 1% of samples 7a. New Decentralized package plant WWTPs providing effluent in accordance with Government discharge standards 8a. 1.4 Km of new RCP stormwater drainage installed 8b. 53 Km of road drainage replaced or rehabilitated 8c. 4.8 Km of river revetment and training works completed 8d. 10 ha of parkland and other open land identifies as emergency flood storage capacity 8e. Coastal and lagoon water quality satisfies DENR standards for full contact recreational use 8f. Flood incidence reduced from annual to 1 in 10 years, depth < 1.0 m and duration < 3 hours 8g. Economic damage from floods reduced from an average of PHP tens of millions per annum to less than PHP 10m per annum. 9a. Operational ratio for WW system 111% 9b. Collection efficiency for WW system 97% 9c. Accounts receivable 45 days 9d. 7 staff per 1,000		

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
	connections. 10. 95% customer satisfaction with affordable wastewater services.		
Activities with Milestones By 2020 1. Preparation and approval of drainage and sewerage masterplan prepared 2. Replacement of 1 Km of sewer main in existing central urban area of San Fernando 3. Installation of 2 Km of new sewer main in newly sewered areas in CBD 4. Construct 1.4 Km of new RCP drainage main and outfall 5. Replace or rehabilitate 26.5 Km of national road drainage line 6. Construct 1.8 Km of river training and revetment works 7. Identify and make operational 3 Ha of land for use as flood storage area 8. Make 400 new and replacement household and commercial sewer connections 9. Install 100 new sewer inspection chambers 10. Install and make operational 4 decentralized package plant WWTPs in San Fernando 11. Rehabilitate and improve the performance of the existing septage and WWTPs in San Fernando 12. Assess institutional weaknesses and prepare and start implementing institutional development plan 13. Provide organizational and human resource development, and capacity building of San Fernando City Government and Water Districts 14. Provide staff training for the implementing agencies for program works, and any project implementation units formed 15. Conduct policy dialogue on institutional improvements, tariff reforms, and mount public awareness campaigns By 2025 1. Replace 2 Km of sewer main in existing central urban areas 2. Install 5 Km of new sewer main in existing and new development areas 3. Install 1.4 Km of new RCP drainage main 4. Replace and/or rehabilitate 53 Km of national road drainage lines 5. Complete and make operational 4.8 Km of river training and revetment works 6. Identify and utilise 10 Ha of land as flood storage area 7. Make 6,000 new household and commercial sewer connections 8. Construct and install 300 new sewer inspection chambers 9. Construct and install 6 decentralized package plant WWTPs in San Fernando 10. Organizational and human resource development, and capacity building of San Fernando City Governments and Water Districts			Inputs Loans, Government Funding and Private sector Investment 2016-2020 Wastewater Management PHP 0.50 billion Drainage, Flood Control and Watershed Management PHP 0.11 billion 2021-2025 Wastewater Management PHP 0.60 billion Drainage, Flood Control and Watershed Management PHP 0.06 billion 2026-2030 Wastewater Management PHP 0.50 billion Drainage, Flood Control and Watershed Management PHP 0.26 billion 2031-2035 Wastewater Management PHP 0.60 billion Drainage, Flood Control and Watershed Management PHP 0.1 billion

Annex 2 Project Summary Fiches

TA 8556 REG: Supporting CDIA Pre-Feasibility Studies for the "Green and Integrated Wastewater Management for San Fernando, La Union.

PROJECT SUMMARY FICHE # 1

Name of project	**Rehabilitation of Public Market Sewerage, San Fernando**

Technical description

The existing market's wastewater is treated by a small sequencing batch reactor wastewater treatment plant that collects wastewater from the adjacent dry and wet markets. However, its sewerage collection system which uses both channels and pipes which flow to septic tanks. The effluent is then pumped to the treatment plant. The wastewater currently does not reach the treatment plant or the pumps, although the two pumps are reported as working. The pipes are blocked and in many cases not connected to the source of wastewater. Some wastewater channels have reverse flow and wastewater drains to the drains around the market.

To complement a proposed renovation of the market, it is proposed to rehabilitate the treatment plant and replace the existing pipes

Location map

Existing Facility

Implementing agency	City Engineer's Department
Operating agency	CENRO
Base cost (PHP million)	Sewers 27.72 WWTP 12.70 Total 40.42
Annual operating cost (PHP per annum)	2,560,000
Implementation period	2017-2018
Potential Financing Options for Construction	By city or include as part of market reconstruction
Potential Financing Options for Operation and Maintenance	From market vendors' fees

Project Impacts

Project outcomes	Wet market wastewater fully treated and not polluting the groundwater table in the city center.	
Who will be the beneficiaries	The market vendors and residents living around the wet market area in Barangays 3 and 4 with estimated populations of.1,524 in 2020 and 1,650 in 2025.	
Potential adverse impacts	Potential Impact	Mitigation
Social, poverty, gender and resettlement impacts	Market vendors may need to be relocated during construction.	Ensure relocation area for vendors is equivalent to existing area and compensate for relocation costs.
Environmental Impacts	Main environmental issues will be during construction (possible increase of siltation, traffic and air/noise pollution) when trenches will be dug for the canal and culverts.	Implement the ESMP and adopt environmental code of practice for construction particularly for erosion and run-off control.

TA 8556 REG: Supporting CDIA Pre-Feasibility Studies for the "Green and Integrated Wastewater Management for San Fernando, La Union.

PROJECT SUMMARY FICHE # 2

Name of project	**Rehabilitation of Slaughterhouse Wastewater Treatment, San Fernando**

Technical description The existing slaughterhouse has an on-site wastewater treatment plant built in 2007. This utilizes The plant discharges its effluent to an adjacent creek. Treatment is by anaerobic baffled reactor to an upward flow to an upflow anaerobic sludge blanket reactor then to a settling tank. Due to the high concentrations of animal waste, the inlet blocks, while the treatment does not function effectively. The proposal is to construct improved waste conveyance to the treatment plant	
Implementing agency	City Engineer's Department
Operating agency	City Veterinary's Office
Base cost (PHP million)	Sewers 3.59 WWTP 2.00 Total 5.59
Annual operating cost **(PHP per annum)**	190,000
Implementation period	2017
Potential Financing Options for Construction	By city
Potential Financing Options for Operation and Maintenance	From users' fees

Location map

Project Impacts		
Project outcomes	The slaughterhouse waste will be treated and the effluent produced will cease to pollute the adjacent river. The sludge generated will be treated at the septage treatment facility.	
Who will be the beneficiaries	The livestock farmers and other users of the slaughterhouse and the residents living around the creek in Barangay Cabaraon that receives its wastewater which is envisaged to have a population of 4,300 in 2020 and 4,600 in 2025.	
Potential adverse impacts	Potential Impact	Mitigation
Social, poverty, gender and resettlement impacts	Some temporary relocation may be required during construction.	Plan to minimize any relocation or resettlement and compensate accordingly.
Environmental Impacts	Main environmental issues will be during construction (possible increase of siltation, and air/noise pollution).	Implement the ESMP and adopt environmental code of practice for construction particularly for erosion and run-off control.

TA 8556 REG: Supporting CDIA Pre-Feasibility Studies for the "Green and Integrated Wastewater Management for San Fernando, La Union

PROJECT SUMMARY FICHE # 3

Name of project	**Rehabilitation of Septage Treatment Facility, San Fernando**

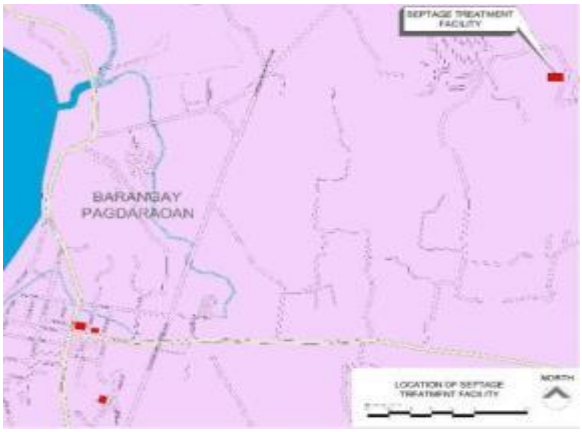
Technical description

The septage treatment facility was constructed in 2007 to treat septic tank sludge (septage) with a capacity of 30 m^3 per day. The facility is currently underutilized which affects its effective functioning. Treatment is by anaerobic baffled reactor to an upward flow to an upflow anaerobic sludge blanket reactor then to a series of settling ponds.

The proposal is to renovate and modify the facility to allow its effective operation through lower uses by using only one stream.

Implementing agency	City Engineer's Department
Operating agency	CENRO
Base cost (PHP million)	1.00
Annual operating cost (PHP per annum)	170,000
Implementation period	2017
Potential Financing Options for Construction	By city
Potential Financing Options for Operation and Maintenance	From septage collection fees already being collected

Location map



Existing Facility

Project Impacts

Project outcomes	The septage treatment facility will function better and can be ready to potentially accommodate septage collected from the greater San Fernando area.	
Who will be the beneficiaries	The 73% of San Fernando (74,000 people) currently served by septic tanks By 2020 in San Fernando this will have reduced to 54,000 (50% of the population) as the new Dewats systems reduce the need for septic tanks. If, as proposed, Metro San Fernando Water District assume the operation of the facility, then all septic tank users in the 5 local government units served by the water district. Thus by 2020 around 80,000 to 100,000 people could benefit.	
Potential adverse impacts	Potential Impact	Mitigation
Social, poverty, gender and resettlement impacts	None, as it's an existing site.	
Environmental Impacts	Some increased traffic on rural roads to facility.	

TA 8556 REG: Supporting CDIA Pre-Feasibility Studies for the "Green and Integrated Wastewater Management for San Fernando, La Union.

PROJECT SUMMARY FICHE # 4

Name of project	**Replacement of ecosan tanks at Fishermen's Village (North and South of creek), San Fernando**

Technical description

Many of the City's fisher folk live along the sea front which is vulnerable to storms. Some have been relocated to other areas along the sea front.

Two large ecosan tanks were constructed to serve areas north and south of a large creek that receive the toilet wastewater from the adjacent houses. These houses still have septic tanks that receive the sullage (non-toilet wastewater) that drain to the groundwater table. There ecosan tanks have been constructed above ground, due to a high water table, and the wastewater requires pumping. The pumps currently do not function while the number of connections and location of sewers is not wholly known.

The proposal is to replace each non-functioning existing system with a full DEWATS. Importantly, the treatment process should be placed underground to avoid pumping of effluent, while all wastewater from the recipient households should be collected and treated. This will necessitate new larger diameter sewers, and ensuring that connection bypass existing bottomless (lubsol) septic tanks. Each system should be able to treat 150 m^3 per day.

Location map

Existing Facility

Implementing agency	City Engineer's Department
Operating agency	CENRO
Base cost (PHP million)	Sewers 88.81 WWTPs 12.70 Total 101.51
Annual operating cost (PHP per annum)	5,520,000
Implementation period	2018-2019
Potential Financing Options for Construction	By city
Potential Financing Options for Operation and Maintenance	From users, but subsidy may be required.

Project Impacts		
Project outcomes	The quality groundwater in this area, which is used for non-drinking purposes will be improved with wastewater treated. The quantity of untreated wastewater flowing into San Fernando Bay will also be reduced.	
Who will be the beneficiaries	The direct beneficiaries will be the people living around the creek in Barangay Catbangen which has a projected 2020 population of 11,900 and 12,900 in 2025. About 700 houses will need to be connected to make the systems' operations financially viable. At present about 87% of families are without piped water connections and use ground water for non-drinking purposes. They will also benefit	
Potential adverse impacts	Potential Impact	Mitigation
Social, poverty, gender and resettlement impacts	Some temporary relocation may be required during construction.	Plan to minimize any relocation or resettlement and compensate accordingly.
Environmental Impacts	Positive	Implement the ESMP and adopt environmental code of practice for sludge disposal to septage treatment facility and effluent quality monitoring.

TA 8556 REG: Supporting CDIA Pre-Feasibility Studies for the "Green and Integrated Wastewater Management for San Fernando, La Union

PROJECT SUMMARY FICHE # 5

Name of project	**New DEWATS construction in coastal areas, San Fernando**

Technical description Due to the high water table, the areas along the shore in San Fernando are currently served by a few communal latrines of variable sanitary quality. The proposal is to extend the DEWATS concept to construct two more DEWATS systems in this area. Wastewater will low by gravity to DEWATS constructed away from the shore towards the road. Each system will again be able to treat around 150 m^3 per day. Potential locations have been identified but these still need to be confirmed.	**Location map**
Implementing agency	City Engineer's Department
Operating agency	CENRO
Base cost (PHP million)	Sewers 130.00 WWTP 13.00 Total 143.00
Annual operating cost (PHP per annum)	7,650,000
Implementation period	2018-2019
Potential Financing Options for Construction	By city
Potential Financing Options for Operation and Maintenance	From users, but subsidy may be required.

Project Impacts		
Project outcomes	The quality groundwater in this area, which is used for non-drinking purposes will be improved with wastewater treated. The quantity of untreated wastewater flowing into San Fernando Bay will also be reduced.	
Who will be the beneficiaries	The direct beneficiaries will be the people living along the sea front in Barangays Ilocanos Norte, Ilocanos Sur, Barangays, 3 & 4 and parts of Catbangen, a total of around 10,000 in 2020 and 11,000 in 2025. 6,000 families in this area without piped water connections and use ground water for non-drinking purposes will also benefit.	
Potential adverse impacts	Potential Impact	Potential Impact
Social, poverty, gender and resettlement impacts	Some temporary relocation may be required during construction.	Plan to minimize any relocation or resettlement and compensate accordingly.
Environmental Impacts	Positive	Implement the ESMP and adopt environmental code of practice for sludge disposal to septage treatment facility and effluent quality monitoring.

TA 8556 REG: Supporting CDIA Pre-Feasibility Studies for the "Green and Integrated Wastewater Management for San Fernando, La Union.

PROJECT SUMMARY FICHE # 6

Name of project	**Sanitation Program, San Fernando**

Technical description At present around 90% of the city has access to sanitary latrines. While the many lubsol (bottomless) septic tanks pollutes groundwater in areas where water is used for bathing and other non-drinking purposes. This project will facilitate the provision of 4,000 latrines to ensure 100% sanitation coverage in the city. It will also aim to assist in the replacement of lubsol septic tanks. This will be prioritized in areas with low consumer water connection coverage. This will initially require updated information on the number and location of those without sanitary latrines and the septic tanks. This information can be sued to prioritize interventions also be used for the DEWATS projects listed above and will be done as a first component of the Master Plan and Data Digitization for Wastewater Management, Stormwater Drainage and Green Urban Development in San Fernando City (Project sheet below). Commercial establishment with Lubsol septic tanks will be required to seal them at their own cost. Residential properties should be provided a grant of 50% of the cost to do this.	**Location map not applicable. Intervention City wide**
Implementing agency	CENRO with City Engineer's Dept and Planning Dept
Operating agency	n/a
Base cost (PHP million)	99.06 (flexible)
Annual operating cost (PHP per annum)	0 to city
Implementation period	2016-2025
Potential Financing Options for Construction	City
Potential Financing Options for Operation and Maintenance	n/a

Project Impacts		
Project outcomes	The City will have 100% sanitation coverage. The groundwater, particularly in areas where poor people who cannot afford piped water connections will have reduced pollution.	
Who will be the beneficiaries	Those families without sanitary latrines. Families without piped water connections who use ground water for non-drinking purposes estimated at 5,000 households.	
Potential adverse impacts	Potential Impact	Mitigation
Social, poverty, gender and resettlement impacts	Some temporary relocation may be required during construction.	Plan to minimize any relocation or resettlement and compensate accordingly.
Environmental Impacts	Positive	

TA 8556 REG: Supporting CDIA Pre-Feasibility Studies for the "Green and Integrated Wastewater Management for San Fernando, La Union

PROJECT SUMMARY FICHE # 7

Name of project	**Master Plan and Data Digitization for Wastewater Management, Stormwater Drainage and Green Urban Development in San Fernando City**

Preparation of an integrated master plan for wastewater management and stormwater drainage to improve San Fernando city's overall environment and make the city a more attractive place for investment, its inhabitants and visitors. Separate plans for wastewater management and stormwater drainage will be prepared that will contain details for the phased introduction and expansion of the sewerage system, wastewater treatment and stormwater drainage systems. The masterplan will also assist the city create an updated database of the location, assets types and customers information for wastewater and stormwater drainage.		**Location map – not applicable**
Implementing agency	City Planning Office with City Environment and Natural Resources Office (CENRO), City Engineers Office, City Finance Office and Department of Public Works and Highways	
Operating agency	Not applicable	
Project cost (PHP million)	11.5	
Annual operating cost (PHP per annum)	Not applicable	
Implementation period	2016	
Potential Financing Options for Construction	By City or development partner	
Potential Financing Options for Operation and Maintenance	n/a	

Project Impacts		
Project outcomes	The City of San Fernando should have a costed phased investment program for wastewater management and stormwater drainage up to 2045 with detailed maps and plans. The City of San Fernando and the Metropolitan San Fernando Water District will also have updated digitized spatial, asset and customer data whose synthesis into information will allow more effective management of the systems and revenue to be raised accordingly.	
Who will be the beneficiaries	The inhabitants of San Fernando and adjacent local bodies.	
Potential adverse impacts	Potential Impact	Mitigation
Social, poverty, gender, resettlement impacts	Covered in the Master Plan	Covered in the Master Plan
Environmental Impacts	Covered in the Master Plan	Covered in the Master Plan

PROJECT SUMMARY DESCRIPTIONS

PROJECT SUMMARY FICHE # 8

Name of project	**Proj. No. A.2.1: Sevilla Elementary School Vicinity Area Drainage**

Technical description

This drainage project aims to convey run-off from the low-lying area (or basin) in the vicinity of the Sevilla Elementary School at Barangay Sevilla (north). There is an existing parallel culvert drain crossing the Diversion Road and a residential apartment compound, discharging to a vacant lot where water becomes ponded and eventually discharge to the east canal of Quezon Avenue. The parallel Diversion Road and Quezon Avenue is 1.9 km apart.

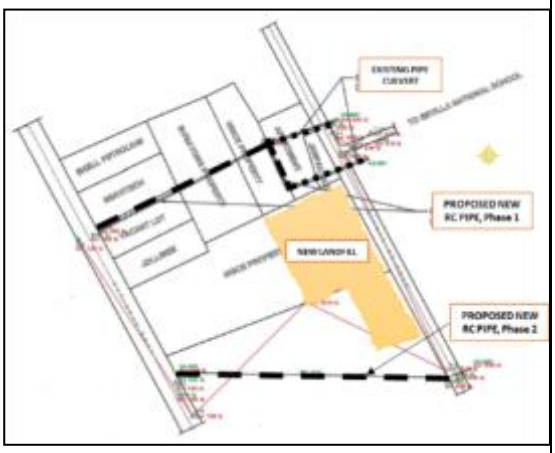
Land filling is planned for the low-lying vacant lot at similar levels to the recently filled land at its south side.

The plan is to rehabilitate the existing 750 mm x 500 m culvert and lay a 1250 mm diameter reinforced concrete pipe during the landfilling operation at the vacant lot, and thereon also lay a line crossing the developed land strip east of Quezon Ave.
Phase 2 of the project is a similar extension of the existing cross drain about 1.5 km south.

Right-of-way the drainage route need to be resolved with the private lot owners.

Implementing agency	City Engineer's Office
Operating agency	City Engineer's Office
Project cost (PHP million)	2.9
Annual operating cost (PHP p.a.)	50,000
Implementation period	Yr 2016-17
Potential Financing Options for Construction	City's Internal Revenue Allotment
Potential Financing Options for Operation and Maintenance	By city

Location map



Layout Plan of the Drainage Project

On-going landfill at the west side of Diversion Road at Phase 2 of Drainage Project

Project Impacts		
Project outcomes:	Reduced inundation around the Sevilla Elementary School, the creation of potentially more flood free land for development and general inconvenience during flood events.	
Who will be the beneficiaries?	The Inhabitants of the area as well as the adjacent landowners.	
Potential adverse impacts	Potential Impact	Mitigation
Social, poverty, gender, resettlement impacts	With rights of way still to be resolved there could be some impact on disadvantaged groups or families.	A resettlement and rehabilitation plan to be developed to address all land acquisition and resettlement issues.
Environmental Impacts	Overall the environment should be improved as flooding will be reduced. Main environmental issues will be during construction (possible increase of siltation, traffic and air/noise pollution) when trenches will be dug for pipes and manholes. .	Implement the ESMP and adopt environmental code of practice for construction particularly for erosion and run-off control.

PROJECT SUMMARY FICHE # 9

Name of project	Proj. No. A.2.2: Sevilla Drainage Canal

Technical description

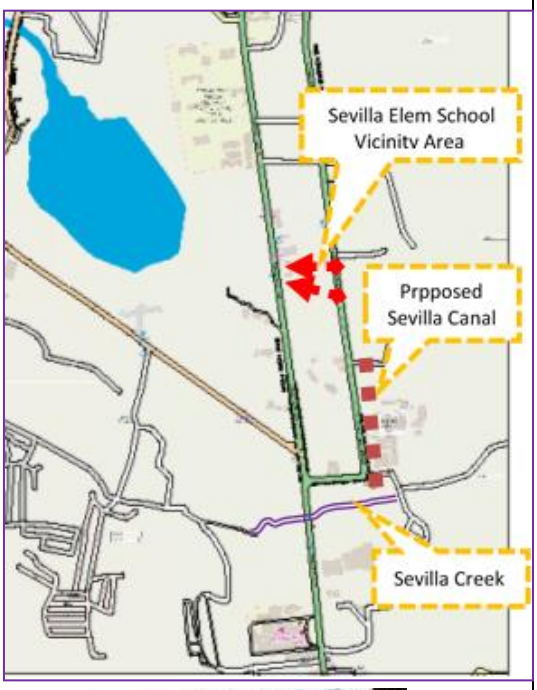
The proposed Sevilla Canal drains the low-lying basin east of the Diversion Road in Barangay Sevilla. It is intended to accommodate large typhoon floods when the proposed Sevilla RCP drainage system becomes inadequate.

The proposed canal is 2 m x 2 m x 800 m long concrete channel with a box culvert at road crossings and at high ground cover. The canal discharges to the Sevilla Creek nearby the south end of the Diversion Road which is a low-lying area with fish ponds as well as land to retain and attenuate large storm flows.

The right of way needs to be resolved as the proposed route is a former railroad track now occupied by government buildings and private residences.

Implementing agency	City Engineer's Office
Operating agency	CEO
Project cost (PHP million)	42.11
Annual operating cost (PHP p.a.)	100,000
Implementation period	Yr 2019-21
Potential Financing Options for Construction	ODA
Potential Financing Options for Operation and Maintenance	LGU IRA

Location map



Flooding situation during Typhoon Egay of July 2015 at front of the Christian Praise Fellowship Bldg.

Project Impacts		
Project outcomes:	Reduced inundation at Barangay Sevilla Central around the end of Diversion Road doing large storms. This will improve traffic flow during storms.	
Who will be the beneficiaries?	The Inhabitants of the area as well as the adjacent landowners. Multiple road users using Diversion Road.	
Potential adverse impacts	Potential Impact	Mitigation
Social, poverty, gender, resettlement impacts	With rights of way still to be resolved there could be some impact on disadvantaged groups or families.	A resettlement and rehabilitation plan to be developed to address all land acquisition and resettlement issues.
Environmental Impacts	Main environmental issues will be during construction (possible increase of siltation, traffic and air/noise pollution) when trenches will be dug for the canal and culverts.	Implement the ESMP and adopt environmental code of practice for construction particularly for erosion and run-off control.

PROJECT SUMMARY FICHE # 10

Name of project	Proj. No. A.2.3: Oasis Resto Area Drainage Canal Improvement

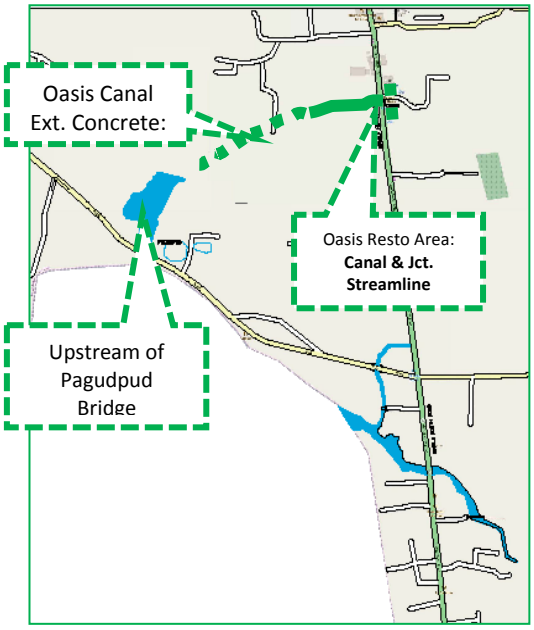
Technical description:

The creek draining catchment no.1 outfalls to the Quezon Ave. east canal and crosses the road through a box culvert. The development of the Oasis Restaurant and Hotel covered the drains frontage to enable convenient access to Quezon Ave. The junction requires streamlining of the drains for an unobstructed flow of floodwater.

The streamlining work requires removal of obstructions, canal bank revetment improvement, dredging, etc. A detailed site survey is required to assess the exact reconstruction work to be carried out.

Implementing agency:	DPWH Region 1, 1st DEO
Operating agency:	-do-
Project cost (PHP million):	11.0
Annual operating cost (PHP p.a.):	50,000
Implementation period:	Yr 2021-22
Potential Financing Options for Construction	ODA
Potential Financing Options for Operation and Maintenance	none

Location map



Inflowing creek to the canal junction

Project Impacts

Project outcomes:	Reduced inundation at Quezon Avenue around the Oasis Hotel area. This will also reduce flooding impacts on traffic flows along a major highway.	
Who will be the beneficiaries?	Residents and businesses around the Hotel Oasis and road users along the Manila North Road (Quezon Avenue).	
Potential adverse impacts	Potential Impact	Mitigation
Social, poverty, gender, resettlement impacts	Some temporary relocation may be required during construction.	Plan to minimize any relocation or resettlement and compensate accordingly.
Environmental Impacts	Main environmental issues will be during construction (possible increase of siltation, traffic and air/noise pollution) when canal rehabilitation / improvement work are undertaken.	Implement the ESMP and adopt environmental code of practice for construction particularly for erosion and run-off control.

PROJECT SUMMARY FICHE # 11

Name of project	**Proj. No. A.2.4: Extension of Existing Oasis Canal to Purok Bataan and Removal of Obstruction at Upstream of Pagudpud Bridge**

Technical description:

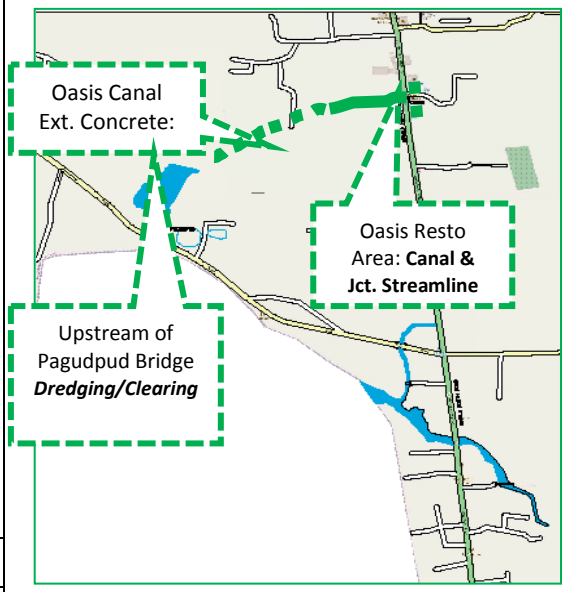
This project is integrated with the above project No. A.2.3. The above project will be implemented by DPWH, while this project will be implemented by the CoSF. Although clearly complementary, they are considered different projects.

The creek draining catchment no.1 outfalls at the Quezon Ave. east canal and crosses the main road via a box culvert. Downstream of the culvert crossing is a lined canal that ends in an open field with residential houses and rice fields.

There is a need to extend the canal via the settled and cultivated areas to the ponds upstream of the Pagudpud bridge.

The proposed extension will adopt same section as the existing canal with a length of about 1,000 m. The works will include the dredging the upstream side of the Pagudpud bridge.

Location map



Unlined canal downstream section of the Oasis canal

Implementing agency:	City Engineer's Office
Operating agency:	City Engineer's Office
Project cost (PHP million):	18.42
Annual operating cost (PHP p.a.):	50,000
Implementation period:	Yr 2021-22
Potential Financing Options for Construction	ODA
Potential Financing Options for Operation and Maintenance	None

Project Impacts

Project outcomes:	Comprehensive approach to drainage in this area should reduce flooding and increase run-off to the sea which should also reduce inundation on the agricultural land and roads in this area.	
Who will be the beneficiaries?	The residents, farmers and commercial activities of this peri-urban area as well as road users.	
Potential adverse impacts	Potential Impact	Mitigation
Social, poverty, gender, resettlement impacts	Some temporary relocation may be required during construction.	Plan to minimize any relocation or resettlement and compensate accordingly.
Environmental Impacts	Positive as inundation reduced. Downstream areas could be impacted upon. Main environmental issues will be during construction (possible increase of siltation, traffic and air/noise pollution) when trenches will be dug. .	Detailed check of retention capacity of downstream receiving areas required. Implement the ESMP and adopt environmental code of practice for construction particularly for erosion and run-off control.

PROJECT SUMMARY FICHE # 12

Name of project	**Proj. No. A.2.5: Construction / Rehabilitation of Central Business District Area Drainage – Batch 1A**

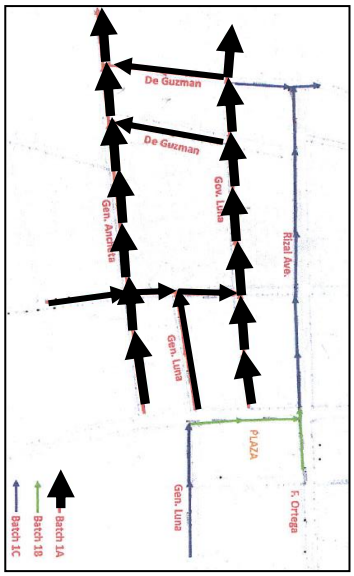
Technical description:
Due to its low-lying condition, dense mixed-use settlement and old drainage pipes, the Central Business District (CBD) becomes flooded during heavy rain. As part of the recent CBD Development Master Planning, a Drainage Master Plan recommended total replacement of existing pipes (upper figure at right). This Plan consist of 200-1400 mm diameter reinforced concrete pipes with a total length of 8,342 m, pavement breaking & restoration, and extensive street landscaping. Total cost estimate is PHP 188.4 M. Implementation is by Batches 1, 2, & 3, with Batch 1 planned in the short term.

Based on Study Team site flooding assessment, the catchment by the drain pipes of Ancheta, Luna and de Guzman Streets is the most depressed area in the CBD. This is referred to as Batch 1A of the Master Plan (shown in lower figure at right). Batch 1A drainage plan consists of 200-600 mm diameter RCP with a total length of 1,461 m. Drainage outfalls to the Bay shore.

Implementing agency:	City Engineer's Office
Operating agency:	City Engineer's Office
Project cost (PHP million):	33.12
Annual operating cost (PHP p.a.):	100,000
Implementation period:	Yr 2016-17
Potential Financing Options for Construction	LGU IRA
Potential Financing Options for Operation and Maintenance	none

Location map

CBD Drainage Master Plan Layout



Batch 1A – Ancheta-Luna-De Guzman Streets

Project Impacts

Project outcomes:	Reduced flooding in a core portion of the city center with stormwater being released more quickly to the sea. Reduced damage to roads and structures due to flooding.	
Who will be the beneficiaries?	Direct beneficiaries are the residents, business people and their clients of the city center area.	
Potential adverse impacts	Potential Impact	Mitigation
Social, poverty, gender, resettlement impacts	Some temporary relocation may be required during construction.	Plan to minimize any relocation or resettlement and compensate accordingly.
Environmental Impacts	Positive as inundation reduced, but discharge capacity to sea needs to be checked against spring tide levels and climate change. Main environmental issues will be during construction (possible increase of siltation, traffic and air/noise pollution) when trenches and manholes will be dug.	Implement the ESMP and adopt environmental code of practice for construction particularly for erosion and run-off control.

PROJECT SUMMARY FICHE # 13

Name of project	Proj. No. A.2.6.1: Carlatan Lagoon Improvement: Mangrove Expansion / Forestation

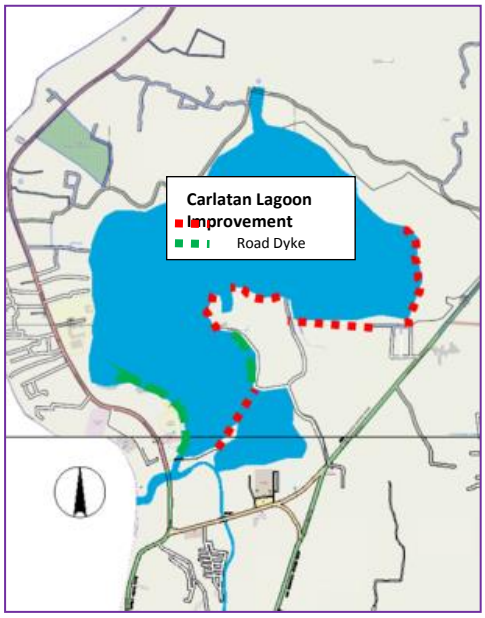
Technical description:

The 200-ha lagoon is the receiving waterbody of the Biday-Caramoan-Narra Creek catchment (No.3) as well as a north catchment (No.5). The lagoon is subdivided into multiple fish farming ponds with its outlet to San Fernando Bay being at the Carlatan Bridge on the Manila North Road at the southwest end of the lagoon.

The proposed improvement to the lagoon is to continue with the mangrove forestation with a target of 2 ha in the next 10 years or a tree planting rate of 2,000 sq m per year. The indicative location of new mangrove is shown but will be subject to further survey.

Implementing agency:	CENRO / NGOs
Operating agency:	CENRO
Project cost (PHP million):	1.20
Annual operating cost (PHP p.a.):	50,000
Implementation period:	Yr 2016-25
Potential Financing Options for Construction	NGOs
Potential Financing Options for Operation and Maintenance	None

Location map



Existing mangrove at the Lagoon

Project Impacts		
Project outcomes:	Improved environment of the area and protection of the lagoon, particularly to maintain its water quality. The improved water quality will also contribute to reduced pollution in san Fernando Bay	
Who will be the beneficiaries?	The local fish farmers who breed fish in the ponds as well as all the city with cleaner water.	
Potential adverse impacts	Potential Impact	Mitigation
Social, poverty, gender, resettlement impacts	None	
Environmental Impacts	Positive	

PROJECT SUMMARY FICHE # 14

Name of project	**Proj. No. A.2.6.2: Carlatan Lagoon Improvement: Ring Road / Dyke**

Technical description:

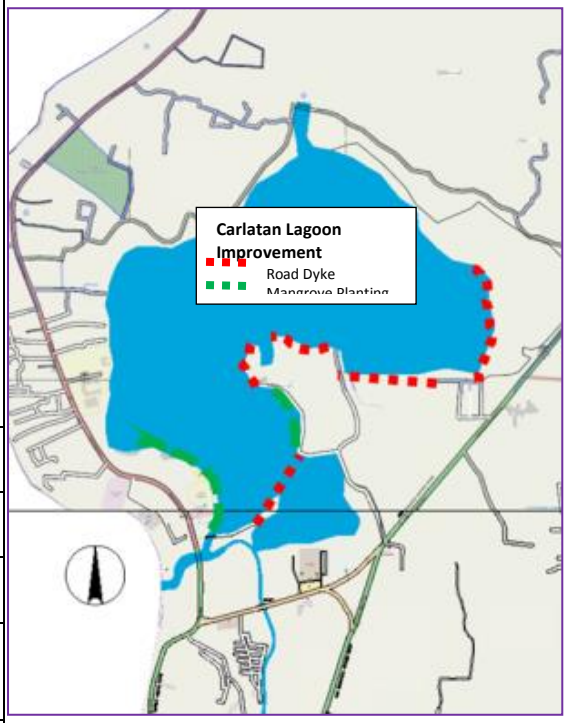
This project supports and complements the mangrove extension in the above project.

The 200-ha lagoon is the receiving waterbody of the Biday-Caramoan-Narra Creek catchment (No.3) as well as a north catchment (No.5). The lagoon outlet to San Fernando Bay is at the Carlatan Bridge of Manila North Road at the southwest end of the lagoon. It is proposed to provide clearer demarcation of the lagoon area as well facilitating its maintenance, by constructing a road that will also improve access to the area.

The proposed road dyke expansion will adopt similar design as shown in the photo at below right. The target road length is 4 km with a width of 3.7 meters with passing places to discourage through traffic.

Implementing agency:	City Engineer's Office
Operating agency:	City Engineer's Office
Project cost (PHP million):	40.0
Annual operating cost (PHP p.a.):	200,000
Implementation period:	Yr 2020-25
Potential Financing Options for Construction	Private Sector
Potential Financing Options for Operation and Maintenance	None

Location map



Existing Lagoon periphery road

Project Impacts		
Project outcomes:	Upgraded access to one section of the lagoon on its Eastern bank to protect other, more environmentally sensitive areas of the lagoon, to the West.	
Who will be the beneficiaries?	The local fish farmers who breed fish in the ponds as well as all the city with cleaner water. Also, city inhabitants and visitors.	
Potential adverse impacts	Potential Impact	Mitigation
Social, poverty, gender, resettlement impacts	The road may require land acquisition and both permanent and temporary resettlement on affected settlers.	A full land acquisition and resettlement plan to be prepared and implemented.
Environmental Impacts	The road will be adjacent to a partially degraded environmentally sensitive area and will need careful design and layout.	Implement the ESMP and adopt environmental code of practice for construction particularly during landfilling for road dyke construction.

PROJECT SUMMARY FICHE # 15

Name of project	**Proj. No. A.2.7: Small Water Impounding dam / Reservoir at 3 Sites (Integrated Watershed Resources Management Master Plan)**

Technical description:

The City's Integrated Water Resources Management Plan identifies water retaining structures for watershed management. Such structures aim to attenuate flood peaks and recharge groundwater. Candidate sites are in Catchment Nos. 1, 3 & 5 that impact on the coastal urban area and the Carlatan Lagoon. Such structures provide regional control in the SUDS water management policy.

The retaining structure could be porous dams (similar to Sabo dam) or low dams to retain run-off. The proposed 3 sites are indicated as large arrow in the map at the right. Site selection will be included in the drainage master plan study.

Location map

Implementing agency:	CEO / CENRO
Operating agency:	CENRO
Project cost (PHP million):	20.42 (3 sites)
Annual operating cost (PHP p.a.):	75,000
Implementation period:	2020-2022
Potential Financing Options for Construction	National Fund
Potential Financing Options for Operation and Maintenance	NGOs

Project Impacts		
Project outcomes:	Increase attenuation of stormflows with greater infiltration into the subsurface and recharge of groundwater that will lead to reduced run-off and flows in drains, which in turn will reduce flooding.	
Who will be the beneficiaries?	All city inhabitants and visitors.	
Potential adverse impacts	Potential Impact	Mitigation
Social, poverty, gender, resettlement impacts	The dams should not impact adversely upon local users of surface water. The reservoirs may increase local rural inundation.	Ensure reservoirs flood land with no direct economical value – mainly non-agricultural land.
Environmental Impacts	Main environmental issues will be during construction (possible increase of siltation, traffic and air/noise pollution) when impounding dams are constructed. Area may become a potential mosquito breeding ground.	Implement the ESMP and adopt environmental code of practice for construction particularly for erosion and run-off control. Domestic wastewater discharging to the reservoir should be diverted and treated.

PROJECT SUMMARY FICHE # 16

Name of project	Proj. No. B.1: Biday – Tanqui – Cabaroan Creek Channel Improvement

Technical description:

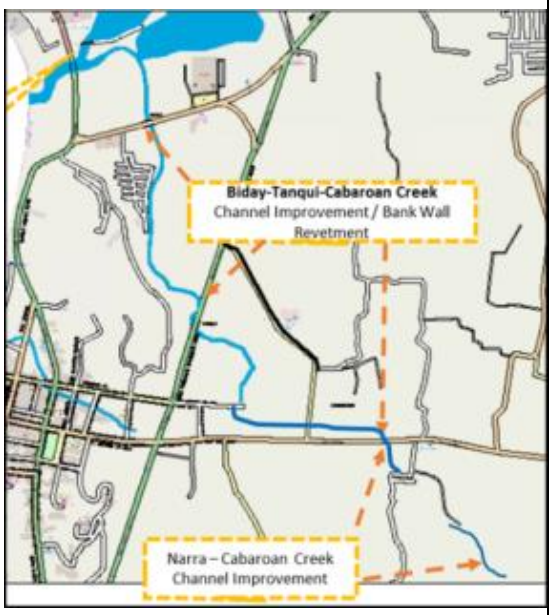
As part of its program for flood management services, the DPWH construct/rehabilitate flood mitigation structures and drainage systems such as the photo at right which is the Tanqui Creek Channel consisting of concrete revetment walls. This program is expected to continue for the remaining section of the Biday-Tanqui-Cabaroan as shown in the location plan at right.

The Creek channel typical section is illustrated by the sketch at below right. On the average, the trapezoidal channel depth is 3 m with a top width of 4.5 m. Estimated length of the Biday-Tanqui and Tanqui-Cabaroan sections are 800 m and 1,800 m respectively. The grouted or concrete wall has 4:1 slope,

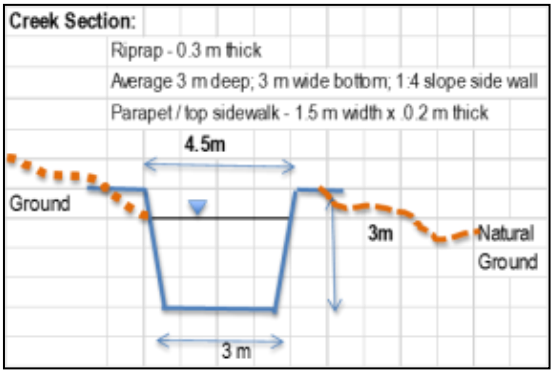
The channel walls are most often above existing ground aimed to contain flood of over 1:25 year return period.

Implementing agency:	DPWH Region 1, 1st District EO
Operating agency:	-do-
Project cost (PHP million):	49.3
Annual operating cost (PHP p.a.):	100,000
Implementation period:	Yr 2017-19
Potential Financing Options for Construction	ODA / JICA
Potential Financing Options for Operation and Maintenance	None

Location map



Location Plan



Sketch of Creek Channel Section

Project Impacts		
Project outcomes:	Improved hydraulics of the creek that will increase its discharge and avoid stormwater backing up in the channel and spilling into the adjacent low-lying areas.	
Who will be the beneficiaries?	All the residents and commercial activities' operators in the low lying areas along the creek that are subject to annual flooding.	
Potential adverse impacts	Potential Impact	Mitigation
Social, poverty, gender, resettlement impacts	Some temporary relocation may be required during construction.	Plan to minimize any relocation or resettlement and compensate accordingly.
Environmental Impacts	Positive as inundation reduced, but retention capacity needs to be checked to ensure no back up of water that cause flooding elsewhere.	Implement the ESMP and adopt environmental code of practice for construction particularly for erosion and run-off control. .

PROJECT SUMMARY FICHE # 17

Name of project	Proj. No. B.2: Narra-Cabaroan Creek Channel Improvement

Technical description:

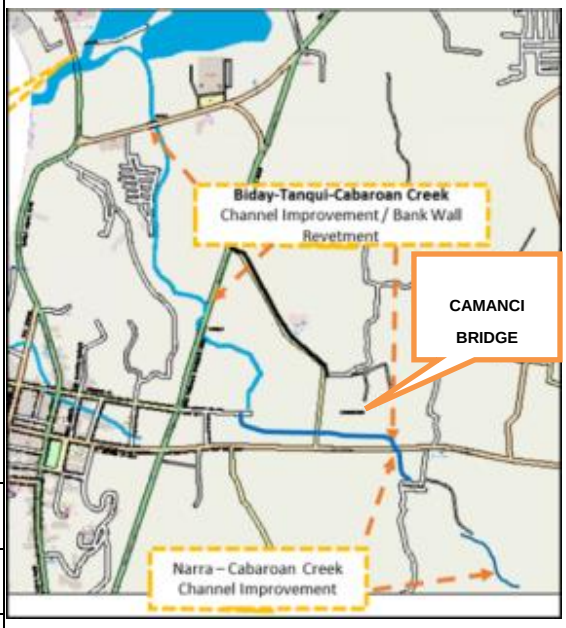
The Narra-Cabaroan Creek is the upstream reach of the Cabaroan-Biday Creek (from the Camanci Bridge of Ortega Highway) and the Project aims to ensure the containment of the floodwater of the Narra - Biday Catchment. The catchment is the central floodplain of the City, at the east side of the urban area.

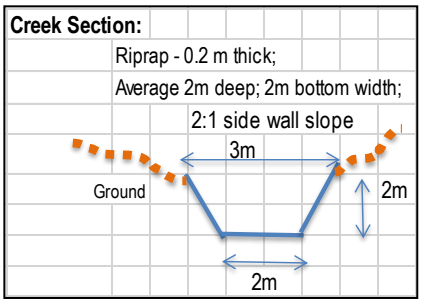
The Creek channel typical section is illustrated by the sketch at below right. On the average, the trapezoidal channel depth is 2 m with a top width of 3 m. Estimated length is 3,000 m The channel bank is a grouted or concrete wall at 2:1 slope. Site evaluation will establish sections for improvement.

Apply appropriate SUDS measures such Bio-retention areas; Detention Basins; Filter strips; Green roofs; Greenways; Infiltration trenches; Multifunctional landscapes; Permeable surfaces; Retention Basins; Rain gardens; Swales; Wet Grasslands; Wet Woodlands

Implementing agency:	DPWH Region 1, 1st District EO
Operating agency:	DPWH
Project cost (PHP million):	52.57
Annual operating cost (PHP p.a.):	100,000
Implementation period:	Yr 2021-23
Potential Financing Options for Construction	National Gov't
Potential Financing Options for Operation and Maintenance	none

Location map





Typical Creek Channel Section

Project Impacts		
Project outcomes:	Improved hydraulics of the creek that will increase its discharge and avoid stormwater backing up in the channel and spilling into the adjacent low-lying areas.	
Who will be the beneficiaries?	All the residents and commercial activities' operators in the low lying areas along the creek that are subject to annual flooding.	
Potential adverse impacts	Potential Impact	Potential Impact
Social, poverty, gender, resettlement impacts	Minor, but some temporary relocation may be required during construction.	Plan to minimize any relocation or resettlement and compensate accordingly.
Environmental Impacts	Positive as inundation reduced, but retention capacity needs to be checked to ensure no back up of water that cause flooding elsewhere; Main environmental issues will be during construction (possible increase of siltation, traffic and air/noise pollution).	Implement the ESMP and adopt environmental code of practice for construction particularly for erosion and run-off control.

PROJECT SUMMARY FICHE # 18

Name of project	**Proj. No. B.3: Construction / Rehabilitation of Roads and Drainage Systems / Slope Protection**

Technical description:

There is over 50 km of national roads in the City consisting of primary, secondary and tertiary roads. In 2016, the DPWH Region 1, 1st District Engineering Office programmed the rehabilitation / reconstruction / upgrading of damaged paved roads including drainage systems, slope collapse, landslide, etc. of national roads at a budget of PHP 126 million. About 80% of the budget is allotted to drainage system and slope protection works.

The location of the national roads is shown at right Improvements are at sections evaluated during the previous year. Example of road and drainage improvement project in 2015 is shown in the photo.

Apply appropriate SUDS measures such as: Bio-retention areas; Detention Basins; Filter strips; Green roofs; Greenways; Infiltration trenches; Multifunctional landscapes; Permeable surfaces; Retention Basins; Rain gardens; Swales; Wet Grasslands; Wet Woodlands.

Location map

Implementing agency:	DPWH R1 DEO 1
Operating agency:	-do-
Project cost (PHP million):	43.7
Annual operating cost (PHP p.a.):	200,000
Implementation period:	Yr 2016-25
Potential Financing Options for Construction	National Gov't
Potential Financing Options for Operation and Maintenance	None

Drainage improvement at Pennsylvania Ave

Project Impacts

Project outcomes:	Improved drainage along the main roads passing through the city that integrate with the overall stormwater drainage regime.	
Who will be the beneficiaries?	Residents and commercial activities operators adjacent to the roads. Road users, particularly pedestrians.	
Potential adverse impacts	Potential Impact	Mitigation
Social, poverty, gender, resettlement impacts	Minor, but some temporary relocation may be required during construction.	Plan to minimize any relocation or resettlement and compensate accordingly.
Environmental Impacts	Positive. Main environmental issues will be during construction (possible increase of siltation, traffic and air/noise pollution) when roads and drainage are rehabilitated. .	Implement the ESMP and adopt environmental code of practice for construction particularly for erosion and run-off control.