Plan for Infrastructure Investments in the Canal Area, 2002–06

March 2002

Task Order No. 831
Contract No. PCE-I-00-96-00002-00

Plan for Infrastructure Investments in the Canal Area, 2002–06

Submitted for
USAID/Panama

Submitted by
International Resources Group

March 2002

Environmental Policy and Institutional Strengthening Indefinite Quantity Contract (EPIQ)

Partners: International Resources Group, Winrock International, and Harvard Institute for International Development

Subcontractors: PADCO; Management Systems International; and Development Alternatives, Inc.

Collaborating Institutions: Center for Naval Analysis Corporation; Conservation International; KNB Engineering and Applied Sciences, Inc.; Keller-Bliesner Engineering; Resource Management International, Inc.; Tellus Institute; Urban Institute; and World Resources Institute

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Executive Summary

The Authority of the Interoceanic Region (ARI) is the entity responsible for integration of the reverted properties of the Panama Canal Area into the national economy and territory. For ARI to achieve its institutional objectives to promote economic development will require considerable investment in urban and environmental infrastructure. In spite of the general plan's US$700 million in programmed improvements, investment during 1997–2000 was a modest US$45 million.

The objective of the present draft of the Plan for Infrastructure Investments in the Canal Area, 2002–06 is to assist ARI in identifying 1) the infrastructure investments most crucial to the promotion of economic development and environmental protection, and 2) the institutional and financial framework most appropriate for successfully carrying out these investments. Sectors included in the plan are: roads, potable water, sanitary sewers, storm sewers, solid waste management, electricity, and telecommunications.

The Panamanian legal and regulatory framework facilitates infrastructure investments in the Canal Area. Development plans and regulations define areas of future development, permitted soil uses, and the rhythm and character of future urbanization. The institutional framework establishes an appropriate division of labor between regulatory entities and infrastructure providers, while the laws and regulations define in sufficient detail an ample range of financing mechanisms, including the direct provision of infrastructure and public services on the part of private enterprise.

The brief duration of the investment plan emphasizes the need to identify priority investments that could motivate others in turn to undertake important economic investments. To maximize the impact of these investments, focus was placed on zones of current or potential economic development. After a quick evaluation of developmental tendencies in the different communities and subregions of the interoceanic area, the following areas were identified as priorities: North Coco Solo/Francia Field, Telfers, Espinar, Balboa Industrial, Balboa, Albrook, Rodman, and Amador.

The analysis of infrastructure requirements in the Canal Area produced three development scenarios. Scenario 1, which estimated the occupancy possible within the framework of existing spatial planning, projected a daytime population of around 277,000 people in 2006, divided by type of soil use. Scenario 2 evaluated these conclusions in the context of current employment tendencies in key economic sectors—tourism, commerce, industry, maritime development—and concluded that there will be less growth than predicted by the planning framework: a daytime population of approximately 177,000 people in 2006. Scenario 3 takes the conclusions from Scenario 2 and adds the additional population corresponding to the proposed Governmental City in Chivo Chivo.

Infrastructure requirements were calculated for each of the three scenarios. It was concluded that the supply of electric energy and telecommunications, now privately owned, is flexible enough to be able to respond to the development predicted for the Canal Area. Adequate provision of

potable water is less certain, though the supply should be sufficient if the programmed enlargement of water treatment plants is carried out. To assure sustainable development and accommodate current and future demand, it will be necessary to make important investments in waste water and solid waste, where collection is inadequate and treatment and disposal ranges from problematic to nonexistent.

Currently, a wide variety of mechanisms are employed to finance infrastructure and urban services. Valorization is often used for roads and drainage systems, but a weak "payment culture" limits its effectiveness. Only 11 percent of the nominal value of completed projects has been recovered. Telecommunications and electric energy were completely privatized, and services are currently provided by five companies. For roads, highways such as the North Corridor and the Panama-Colon Highway have been constructed through long-range BOT (build-operate-transfer) concessions. But in spite of the general success of private participation in the provision of public services in Panama, the government does not favor the application of these mechanisms to other sectors of infrastructure.

Evaluations of the seven infrastructure sectors concluded that all networks and projects will require significant expansion to be able to accommodate predicted development in the Canal Area. The potable water analysis emphasized the need to not only enlarge production plants and extend distribution networks, but to reduce loss by rehabilitating existing networks and improving system maintenance. Although Panama's waste water networks continue to work after 50–80 years of service, many pumping stations do not function and almost all waste water is released into the canal and other bodies of water with no treatment whatsoever. The absence of waste water treatment is the gravest environmental threat posed by future Canal Area development.

The absence of road drainage maintenance already causes regular flooding during the rainy season. If the system's capacity is insufficient for current needs, it will be that much more inadequate as predicted growth takes place. The road capacity of the Canal Area is also insufficient. Connections between communities are lacking, and the pavement of some roads is in poor condition. Cover material for the Cerro Patacon sanitary landfill is in short supply, and, on the Atlantic side, a site for a new landfill to replace the Mount Hope landfill is needed. Programs to expand electric energy are well defined. Generally speaking, for this sector and telecommunications, service is extended to wherever there is a demand.

The project portfolio of the Plan for Infrastructure Investments in the Canal Area incorporates 68 projects worth a total of US$238.5 million. Road projects dominate the portfolio, calling for 86 percent of the total. The objective of many of these projects is to improve access to priority development zones (such as Howard/Rodman/Kobbe in the west and North Coco Solo/Francia Field in the east) or to widen connections between communities. In spite of modest investment sums, the environmental infrastructure projects—potable water, sanitary and storm sewers, solid waste management—are essential to achieving sustainable development that will preserve and enhance the environment of the Canal Area and its hydrographic basin.

To carry out the plan for infrastructure investments, a combination of financing mechanisms should be used, including public-private association, valorization, concession, and state budgeting. Through associations with private developers, ARI can secure key infrastructure investments that

will add value to its properties, in return giving the promoter a portion of the improved terrain. To improve the effectiveness of valorization, collection should be carried out by non-governmental organizations that will receive a percentage in return for their services. Concession should be used not only for large road projects but also for improvements to the potable water system of the Canal Area, with IDAAN delegating responsibility for this service to a private company for a predetermined period of time. To ensure the most productive use of budgeted state funds, ARI and public-sector infrastructure providers must agree on the need to carry out certain investments that are critical to the economic development of not only the Canal Area but the entire country.

A draft of the plan for investments was presented to key individuals from various infrastructure sectors during an ARI workshop on May 4, 2001. Dividing themselves into work groups by technical sector, the participants collaborated actively in revising and modifying the project portfolio. The final portfolio, as presented in this report, has the support of the key Panamanian protagonists.

1. Introduction and Objectives

The Authority of the Inter-oceanic Region (ARI) is responsible for integrating the reverted properties of the Panama Canal Area into the national economy and territory. The regulatory framework for the development of the Canal Area—including the Regional Plan for Development of the Inter-oceanic Region and the General Plan for the Use, Conservation, and Development of the Canal Area—specifies that the integration of these properties must respond to objectives for both economic development and environmental protection.

Achieving these objectives requires substantial investment in urban and environmental infrastructure. There are former military bases and civilian communities with great potential for development in the key economic sectors—maritime, tourist, commercial, and industrial. But if road access, electric energy, potable water, and other basic services are not provided, it will be difficult to benefit from this potential and promote dynamic and sustainable economic development.

At the same time, current development contributes to the deterioration of the environment in many cases. While the population of existing communities increases and new tourist, commercial, and maritime installations are being built, the greater part of the sewage produced continues to be dumped untreated into the canal. Solid waste treatment is also inadequate. To protect and enhance the environment of the canal and its hydrographic basin, it will be necessary to invest substantially in sanitary and storm sewer systems and solid waste treatment in the inter-oceanic region.

The authors and administrators of the general plan have been aware of these needs. The total value of programmed investments in the plan is approximately US$700 million spread over 15 years starting in 1997. But in spite of efforts by ARI to obtain the necessary financing resources, investment in infrastructure during 1997–2000 was a modest US$45 million, mainly in road projects. To achieve the dual objectives of environmental preservation and economic development, ARI and the government will have to make additional efforts to identify reliable and substantial sources of funds for future financing of infrastructure projects in the Canal Area.

The overall goal of this study, then, is to assist ARI in identifying 1) the infrastructure investments most crucial to promoting economic development and environmental protection, and 2) the institutional and financial framework most appropriate for successfully carrying out these investments. The specific objectives of the technical assistance are:

- To determine medium- and long-term infrastructure requirements in accordance with proposed and current zoning in the reverted areas, taking into account the current economic activity of the area.
- To identify, in order of importance over the next five years, infrastructure investments conducive to economic development in the inter-oceanic region.
- To establish a financing strategy for execution of the infrastructure projects proposed over the next five years.

The Plan for Infrastructure Investments for the Canal Area, 2002–06 will serve ARI as input for preparation of the section on the Canal Area in the government of Panama's Five-Year Plan for Public Investments, 2002–06.

The Plan for Investments team consisted of three international experts—in urban planning, infrastructure financing, and municipal engineering—financed by the United States Agency for International Development (USAID) and 15 experts from ARI specializing in engineering, financing, urban planning, and environmental management.

During the first phase of work (November–December 2000), the team reviewed existing conditions and consulted with the groups involved, such as regulatory bodies, private promoters, private companies, municipalities, and community groups. In phase 2 (January–March 2001) data gathering was completed and the present draft of the Plan for Infrastructure Investments was prepared.

A workshop on canal area infrastructure was programmed for the beginning of May to continue consultations with the groups involved and achieve a consensus on what actions are needed to provide the necessary infrastructure. Subsequently, the team will conclude the Plan for Infrastructure Investments with the addition of an action plan, as determined in the workshop.

This report is divided into nine chapters. In Chapter 2, the geographic area covered by the plan is defined. In Chapter 3, the legal and regulatory framework for urban planning and provision of infrastructure in the Canal Area is presented. Guidelines for identifying and prioritizing investments are explained in Chapter 4. Following the analysis of technical requirements in Chapter 5, an evaluation of existing financing mechanisms is given in Chapter 6. Infrastructure profiles by sector are presented in Chapter 7. Chapter 8 presents the integral Plan for Infrastructure Investments and a preliminary analysis of environmental impact, while Chapter 9 specifies strategies for financing and execution.

2. Definition of the Area

The area of study covers the zones governed by the General Plan for Soil Uses, which consists of the territory that constituted the former Panama Canal Zone as it existed at the signing of the Panama Canal Treaty of 1977. Today it is occupied by the districts of Cristobal and Ancon on 93,210 hectares in the provinces of Colon and Panama. The metropolitan areas of Panama and Colon were analyzed with respect to their relationship to the Canal Area.

The area of study is distinct from the area of the Plan for Infrastructure Investments in that the former represents the area for which the initial diagnosis of population, quantity and capacity of existing infrastructures, and norms and laws currently in effect was made. In contrast, the area of the Plan for Investments refers to the zones for which definite proposals will be made for infrastructure investments over the next five years (2002–06); it consists of 5,335 hectares on the Atlantic and 8,189 hectares on the Pacific, for a total of 13,524 hectares.

The following criteria were employed to define the area of the Plan for Infrastructure Investments:

- Developed and developable areas designated in the General Plan as priority areas for infrastructure development in Phase 2 (2000–10). The areas of phase 3 are excluded, as their development has been programmed for a period not considered in the Plan for Infrastructure Investments.
- Developed and developable areas that, according to ARI's sector plans, will experience greater development in the next five years.
- Areas designated for mega-projects managed by the Panamanian government within the area of the General Plan.
- Areas under the control and jurisdiction of ARI—in other words, areas under the jurisdiction of the Canal Authority were not included.
- High-priority developed and developable areas where an infrastructure deficit has been identified.

The area in the Plan for Infrastructure Investments covers part or all of the following communities:

Pacific

- Veracruz (partial)
- Howard (includes Kobbe and Farfan)
- Rodman (includes Cocoli)
- Amador
- Balboa
- Balboa Industrial
- Curundu Industrial
- Curundu Heights
- Curundu Housing

- Diablo
- Albrook
- Corozal
- Los Rios
- Cardenas
- Clayton (partial)
- San Francisco Valley

Atlantic

- Sherman (urban area)
- Davis (partial)
- Brazos
- Telfers
- Mindi
- Margarita
- Arco Iris
- Espinar
- Coco Solo
- Francia Field
- Margarita Island

3. Legal and Regulatory Framework

This chapter deals specifically with the plans, laws, and regulations governing the development of the Canal Area, and generally with the provision of urban infrastructure. Legal texts are divided into sections: planning and control of urban development and provision of infrastructure, and other laws which govern the financing of infrastructure. More complete summaries of all the elements of the legal framework are presented in Annex C. For each legal text, a brief description of content and scope is given, as well as an evaluation of its impact on future infrastructure investments in the Canal Area.

3.1 Planning and Control of Urban Development

3.1.1 General Plan for Soil Uses in the Canal Area

The General Plan provides the overall development goal of the Canal Area, with a view to achieving the following objectives:

- Generation of income and permanent jobs
- Conservation of canal efficiency
- Protection of natural resources
- Integration of the reverted areas into the rest of the national economy
- Political and social acceptance of the strategy chosen for development of these areas

The fundamental concept of the plan is to achieve sustainable development that takes into account the need for economic growth, the efficient operation and future expansion of the canal, and the conservation of the existing natural resources of the Canal Area.

In accordance with the Regional Plan for Development of the Inter-oceanic Region, the General Plan identifies the greater part of the 932 square kilometers of land in the Canal Area as undevelopable (reserved for national parks and other uses). For urban and developing urban areas, located for the most part within the metropolitan areas of Panama and Colon, the plan establishes the overall framework for soil uses and delimits industrial, commercial, and institutional areas, as well as residential areas of low, medium, and high density. But it does not specify the exact proportions for distinct soil uses or the parameters for physical development, leaving these details to be defined at a later date when zoning for specific communities is prepared (see below).

For urban infrastructure, the General Plan includes an exhaustive revision of existing installations and proposes a portfolio of priority investments with a total cost of US$700 million. It has been proposed that this portfolio be carried out during the three phases of the Plan: Phase 1 (1996–2000), Phase 2 (2000–10) and Phase 3 (2010–20).

Finally, the General Plan presents a strategy for execution through integrated sectoral development and public-private cooperation, both for the provision of infrastructure as well as for the completion of real estate projects.

3.1.2 Urban Development Plan for Metropolitan Areas of the Atlantic and Pacific (Metropolitan Plan)

The study concentrates on a surface area of 320,000 hectares in the districts of Panama, San Miguelito, Arraijan, La Chorrera, Chepo, and Capira on the Pacific and the district of Colon on the Atlantic. These districts have 1,135,000 inhabitants distributed among 60 subdistricts. The study's general objectives are:

- To definitively integrate the reverted areas of the Panama Canal Area with the cities of Panama and Colon.
- To facilitate close coordination between the public and private sectors in matters of infrastructure investment and community capacitation.
- To introduce a transportation system that will provide access to employment centers for the greatest number of inhabitants from all income categories.
- To facilitate the furnishing of an adequate level of basic infrastructure services and community capacitation, making maximum use of existing systems and equipment.

Regionally, the Metropolitan Plan underscores the importance of containing urban growth outside the Panama Canal Basin (maximum environmental conservation) and within the areas equipped with basic infrastructure services (roads, potable water, electricity). On a metropolitan scale, more decentralized development is proposed with the goal of balancing current centers of attraction, particularly in Panama City. In Colon, the plan seeks to revitalize the current center and balance it with new points of economic activity in outlying areas.

The plan formulates a series of development scenarios based on population distribution and the structure of employment-generating centers and residential areas. This analysis permits the definition of a certain number of "principal urban nodes," including Colon, Nuevo Colon, Davi,s and Espinar on the Atlantic, as well as Central, East Ancon, West Ancon, Arraijan, and Tocumen on the Pacific. The inclusion of zones within the Canal Area would cause development on the metropolitan level to fan out, above all in the metropolitan area of Panama City.

The document includes a plan for short-, medium-, and long-term investments composed principally of infrastructure projects. The cost of the programmed medium-term investments (2001–05) is US$5,224 million, of which US$1,731 million must be financed by the public sector.

The operational measures for execution of the plan focus on the planning and control of urban development; few guidelines exist for the financing and furnishing of infrastructure. At the same time, the recommended institutional framework specifies the division of labor between ARI and the Ministry of Housing (MIVI). The Metropolitan Plan was approved in Cabinet Council in late 2000.

Table 3.1 Distribution of Employment

Urban Node	Employment, 2020 (positions)
East Ancon	113,268

West Ancon	113,268
Tocumen	76,094
Belisario Porras	33,855
J.D. Espinar	30,387
Central	254,899
East Arraijan	12,814
West Arraijan	12,814
La Chorrera East	42,906
La Chorrera West	42,906
Colon	105,879
Davis	20,973
Espinar	20,061
New Colon	15,218
Total	**895,342**

Source: Metropolitan Plan (MIVI).

3.1.3 Special Norms for Maintaining the Character of the Garden City in the Inter-oceanic Region

The codification was approved by Ministerial Resolution Nº 139 of August 8, 2000. The first section deals in general terms with the concept, objectives, and application of the codification. Details are given on such aspects as the scope of the norms, the region to which they will be applied, time in effect, agencies responsible for application, and the role of community participation.

The second part deals with norms for urbanization and landscaping. This segment regulates zoning, road categories, road easements, the size of sidewalks and paths, handicapped facilities, islets, telephone service, parking, waterway easements, street lighting and other infrastructures. The use of green areas, protection of the urban treescape, and regulation of urban buildings and signs are also covered. In the same manner, the chapter deals with the correct method for implementation of the norms in the field, requiring use of the cluster system of residential grouping.

The third section refers to regulatory violations and sanctions. It should be pointed out that the Authority of the Inter-oceanic Region is not empowered to sanction or punish the infraction of any or all of the regulations contained in this document.

3.1.4 Urban Development Codes for the Inter-oceanic Region

This document is a sequel to the codification governing the Garden City and stems from the need to create standard design guidelines for the inter-oceanic region which will serve to protect investment values and the environment, within the context of sustainable development. Regulated activities are:

- Residency: Nine categories which vary from low to medium to high-density and intensity.
- Mixed Use: Three categories depending on the combination of commercial activities and their intensity.
- Institutional Service: Divided into residential and urban levels, covering activities such as security, administration, health, religion and education.
- Urban Green Areas: Nine categories of open spaces were established, including those for sports and recreational activities.
- Tourism: Divided into the categories of natural tourism and urban tourism, with their respective intensities.
- Basic Services: The necessary outfitting of the infrastructure network, including water tanks, water treatment plants, electrical sub-stations, etc. Divided between urban and residential.
- Transportation: Installations for receiving and distributing passengers by air, land or sea. Not yet drafted.
- Industry: All light, semi-heavy, heavy, non-contaminating and contaminating industries. Not yet drafted.

In general terms the norms regulate aspects such as: percentage of occupancy of open areas and infrastructure vs. useful area, density, intensity, heights, parking, free green areas, percentage of lot occupancy, setbacks and the specific types of activities which can be carried out in each space.

This document has not received formal approval; however, the Ministry of Housing—the state entity responsible for final approval of the document—has already accepted its use within the inter-oceanic region. The document will be official once it is completed.

3.1.5 Zoning

Through zoning, the definition of permitted soil uses within specific Canal Area communities (former military bases or civilian districts) is refined. Based on the overall soil uses specified in the General Plan, the zoning process utilizes the Urban Development Codes for the Inter-oceanic Region in order to define the uses, densities and intensities which govern future development.

The zoning process carried out to date by the ARI, by region of planning, is presented as follows:

East Pacific Region: Includes 21 communities, eleven of which have a Regulatory Plan or Zoning. Of these, ten are residential areas of military or civilian origin, while one is basically for tourist use (Amador). The ARI has submitted to and received approval from the MIVI for seven zonings. The rest are in process (3), prepared (8) and not yet initiated (3) for industrial sectors.

East/West Atlantic Region: Includes 18 communities, eight of which have a Regulatory Plan or Zoning. Eight are prepared, one is in process and four have not yet been initiated. The ARI has submitted two to the MIVI. Some sectors belong to the Canal Authority (3), others are protected by the Plan.

East Central Region: Includes three populated areas, none of which has approved zoning; two have the documents prepared and one is governed by the Canal Authority (Summit).

In general terms, the ARI still faces the task of providing zoning for large sectors which must be integrated into the economic development of the West Pacific sub-region, such as the former Howard military base. The ARI must also rezone sectors already submitted to the MIVI, as well as those which are currently governed by a Regulatory Plan but need to be adapted to the dispositions of the General Plan.

The new programmed densities which result from these zonings and from those included in the new codes under the category of Low-Density Residential Areas, are along the order of 50–300 inhabitants per hectare. In the category of Medium-Density Residential Areas, densities range from 125–600 inhabitants per hectare. And in the category of High-Density Residential Areas, they are along the order of 200–800 inhabitants per hectare; in other words, ten times greater than the former densities, considering an average density of 45 inhabitants per hectare for civilian and military canal communities. In light of the fact that existing infrastructure systems were only designed to satisfy the demand generated by former uses based on former densities, it becomes clear that in order to accommodate the densities permitted in the regulatory framework, significant expansion of urban infrastructure systems will be required in almost all Canal Area communities.

3.1.6 Summary of Documents on Road Easements in the Canal Area

During the preparation of several projects studied for the Canal Area, certain roads have received special consideration in light the development predicted for the various communities or priority economic development zones. New roads are needed in some areas to complement existing routes; in others, to avoid heavy traffic in existing residential zones; and in yet others, to provide access to a large number of lots available for development under the General Plan. In order to facilitate adequate development of a road network in the Canal Area, the ARI has prepared and presented easement proposals for these roads to the Ministry of Housing.

In all communities with approved zoning, official plans also exist with complete information on the easements which have been approved for each one of the roads, along with their corresponding line of construction. This information is important for improvements to existing structures as well as for new constructions, without necessarily implying that investments in improvements will be needed, as they possess the capacity for predicted developments according to the zoning in each instance.

Table 3.2 presents a list of documents related to road easements, which were approved on the basis of studies presented by the ARI to the competent authorities.

Table 3.2 Documents Related to Approved Road Easements

Document	Contents	Level of Importance	Nº
Resolution 246-93 of Dec. 28, 1993	By which easement is assigned to the North Corridor	Primary—a section going east is still needed	s1
Resolution 109-94 of June 29, 1994	By which easement is assigned to branches of the North Corridor	Primary—improvement of 4-lane road , Paical branch	s2
Resolution 136-94 of	By which the “Regulatory Road Plan”	Complementary Document	

August 31, 1994	document is approved		
Resolution 137-94 of August 31, 1994	By which the Regulatory Road Plan is approved and easement is included for:		s3
	Panama-Arraijan Highway	National	
	Gaillard Road	Primary	
	Cerro Ancon Road	Under construction	
	Access to Highway	Constructed	
	El Paical Road	Primary	
	M. Sosa Road Extension	Constructed	
Regulatory Road Plan	Easement for Ascanio Villalaz Avenue	Primary	s4
Resolution 18-97 of August 8, 1997	Easement, East Airport Marginal and East Albrook transversal road	Primary	s5
Resolution 22-98 of May 11, 1998	Harmond Road easement	Secondary	s6
Resolution 23-98 of May 11, 1998	Telfer Road easement	Primary	s7
Resolution 36-98 of July 17, 1998	Easement, Harmond Road and INAFORP Street	Secondary—modifies resolution 22-98	s6
Resolution 42-98 of July 27, 1998	Easement, Albrook-Corozal East circumvallation road	Primary	s8
Resolution 06-99 of February 1, 1999	Easement, sectors of Mindi, Telfers and Coco Solo, as follows:		
	Canal View	Secondary	s9
	Mindi	Primary	s10
	Espinar Extension	Primary	s11
	Mindi Dock	Primary	s12
	North diversion	Secondary	s13
	West diversion	Secondary	s14
	Gatun	Secondary	s15
	Galeta	Secondary	s16
	Caribbean Circumvallation	Primary	s17
Resolution 23-99 of May 17, 1999	Easement, Ascanio Arosemena Avenue	Primary	s18

3.2 Provision of Infrastructure

The legal, regulatory and institutional framework for the provision of services and maintenance of infrastructure is subdivided according to the current ordering system into those services provided directly by the State and those with a private component, by means of an operator or through concession.

Diverse governmental institutions directly provide potable water, sanitary sewer, storm drainage and road services.

Through concession, the state has delegated the task of providing telecommunications services and those related to the generation, transmission and distribution of electric energy.

In general terms, the following entities and companies are in charge of providing these services in the zones comprehended in the analysis:

Table 3.3 Service Providers

Service	Provider
Potable water	IDAAN and ACP
Wastewater	IDAAN
Solid waste	Panama City and Municipality of Colon
Storm Drainage	MOP
Road system	MOP
Generation of energy	Various private concessionaires and ACP
Transmission of energy	ETESA
Distribution of energy	ELEKTRA, EDEMET
Stationary telephone	Cable & Wireless
Cellular telephone	C&W and BellSouth

3.2.1 Potable Water, Waste Water and Solid Waste

The goal of the dispositions currently in force (Decree Law 2, January 1997) is to promote the uninterrupted provision of quality, affordable services for potable water and sanitary sewers, while utilizing natural resources in a sustainable fashion and protecting the environment. The decree permits private participation by various methods, long-term concession being one of them.

The environmental legislation (Law 41, July 2000) establishes the basic principles and norms for environmental protection, conservation and recovery, promoting the sustainable use of natural resources.

This basic legislation is complemented by other dispositions related to the discharge of liquids to waste water collection systems or directly to bodies of water; the use and final disposal of sludge; environmental impact studies; and shellfish activity.

In the water sector, service providers must comply with existing regulations, but there is no control over the quality with which services are provided. In the case of potable water, billing without measurement of consumption is tolerated, promoting wasteful, rather than rational, water use. Furthermore, waste water disposal is not billed as an additional service.

3.2.2 Roads and Drainage

Executive Decree 205 of December 28, 2000, by which approval is given to the Urban Development Plan for the Metropolitan Areas of the Atlantic and Pacific, and which is attributed to the Ministry of Housing's General Administration for Urban Development and its General

Regulations, establishes that the Metropolitan Plan must permit the introduction of a transportation system which can provide optimum access to centers of employment for the greatest number of inhabitants, and that "the transportation system to be developed in the metropolitan area will be a road structure with a reticular pattern which responds to soil use demand through the provision of adequate service according to population and employment distribution. The road hierarchy permits the differentiation of road network segments in the following manner: Highways, primary and secondary roads, collection roads and local roads."

In addition, policies and strategies are proposed for improving accessibility and mobility:

- Introduce a transportation system capable of facilitating maximum access to centers of employment for the greatest number of inhabitants.
- Promote decentralization of the existing urban system and facilitate the introduction of public transportation scenarios which are in accord with existing and future soil use demands.
- Offer an effective, safe, multi-modal transportation system which will reduce traveling time, operation costs and environmental contamination.
- Achieve maximum access to residential areas and community services for the greatest number of inhabitants.

Resolution 139-2000 of August 8, 2000, of the Ministry of Housing, "by which approval is given to the special norms for maintaining the character of the Garden City in the Inter-oceanic Region," guarantees that areas reverted to the national economy will conserve the high-quality environmental character they have always enjoyed.

The Road Design Manual of the Ministry of Public Works of the Republic of Panama, 1999 version, is available in the National Office of Contract Administration of the Ministry of Public Works, so that civil engineering professionals and construction companies can have access to a guide for methods of road construction, which is recommended by the governing entity in this matter in the Republic of Panama.

The most recent version of this manual is divided into six chapters describing general aspects of the road system, calculation methods for geometric road design, elements and methods of calculation for determining the movement of earth necessary during construction, methods for design of drainage and pavement structure, and methods for drafting the horizontal and vertical road alignments.

3.2.3 Energy

Provision of electric energy is regulated by Law 6 of February 3, 1997. Generation of energy for Canal operations is carried out by the ACP; for the rest of the country it is done privately. The distribution of electricity in the provinces of Colon and Panama has been given in concession to ELEKTRA and EDEMET, and ultimately it will be these companies that supply the needs of the reverted areas.

3.2.4 Telecommunications

The provision of stationary telephone service has been given in concession to the company Cable & Wireless, which must expand the service to include any and all populated areas of the country. Cable & Wireless and BellSouth provide cellular phone service throughout the country.

4. Guidelines for Identifying and Prioritizing Projects

This chapter presents general guidelines for identifying and prioritizing projects, the results of the revision of current economic growth tendencies, and other important conclusions related to the planning and control of urban development.

4.1 General Guidelines

The following guidelines were taken into consideration during the process of identifying and prioritizing projects for inclusion in the Plan for Infrastructure Investments:

- Focus on current or potential zones of economic development. To achieve the objective of promoting economic development, it is important to **concentrate investments in those areas currently experiencing development**, or which show high development potential. In the same manner, spatial concentration in selected geographic zones permits synergy among the different types of investments.
- **In priority zones, identify those projects necessary to the achievement of projected economic development.** Projects should be selected on the basis of the General Plan, the knowledge of ARI personnel, the data on economic and real-estate investments, consultation with key protagonists, and field tours. Only those projects which eliminate obstacles to development (such as lack of access to the site) or which have in some other way been identified as essential to supporting the type of economic investment anticipated for the priority zone (such as adequate management of solid waste in a tourist zone) will be included.
- **Concentrate the majority of investments in areas which have already been developed.** During the period covered by the Plan, the real estate market will be busy with the assimilation of existing properties, particularly those which are for residential and industrial use and which constitute the bulk of Canal Area properties. To facilitate this process and permit the higher densities accepted under the development plans, it is generally preferable to repair and expand existing systems before undertaking construction of new systems.
- **Identify investments necessary for minimizing the most significant current negative environmental impacts.** Particular attention will be given to minimizing negative impacts on the hydrographic basin of the Canal.
- **Formulate proposals and projects which are consistent with development plans and sectoral infrastructure plans.** The proposals made in the Plan for Infrastructure Investments should agree with the General Plan, the Regional Plan, and the Metropolitan Plan, as well as with sectoral plans where these exist.
- **Concentrate on residential areas which complement the growth of employment areas.** To promote efficient urbanization and limit transportation requirements, the Plan must favor investments in communities located near current and planned (priority) employment areas.
- **Respect and take advantage of existing institutions**, regulations and mechanisms for the provision and financing of infrastructure. Wherever it is possible and efficient to do so, use should be made of the existing regulatory framework, which offers a wide variety of options in the matter of mechanisms for infrastructure financing. Also, duplication of efforts can be

minimized through the integration of existing institutions within the executive framework of the Plan.

4.2 Analysis of Current Economic Investment Tendencies

Table 4.1 presents investment projects that have been contracted or are currently underway, by economic sector, for the period from 1999–2005, therefore covering the period of the Plan for Infrastructure. It should be noted that the most significant investment is located in the maritime sector, which represents more than 42 percent of the total value of projects currently underway. Investments by Panama Ports Company (Balboa), Manzanillo and Evergreen (Coco Solo) constitute the anchors for this sector. All three companies have plans to expand operations in the near and mid-future.

The commercial and service sectors are also benefiting from important investments such as the Albrook Commercial Center. Many of these projects are located in Balboa, Albrook and Espinar, currently the main centers for commercial and real-estate development in the Canal Area.

The tourism sector appears to be fairly robust, with US$88 million in projects currently underway and another US$17 million contracted. The Amador project will undoubtedly attract additional tourism investments in the near future. The industrial sector continues to represent only a small percentage of total investments (2 percent of projects currently underway).

The data found in table 4.1 suggest the following conclusions about the geographic distribution trends of present investments in the Canal Area:

East Atlantic Region: Investment is concentrated in North Coco Solo (maritime and industrial sectors) and Espinar (tourism and commercial sectors).

East Pacific Region: Investment is scattered with some concentration in Balboa and Albrook (commercial sector) and in Balboa Industrial and Corozal (maritime sector).

West Pacific Region: Investment is very limited. What little there is deals with projects proposed by Alireza Mobil in the Rodman Area.

To complement this information, the consultant team compiled data on private real-estate investments in the Canal Area. Table 4.2 shows construction permits given by the Panama, Arraijan and Colon Councils during 1998, 1999 and 2000 (to October 31).

Table 4.1 Current and Programmed Investments in the Canal Area, 1999–2005 (millions of US dollars)

Detail	Total Investment	1999	2000	2001	2002	2003	2004	2005
1. Projects contracted, not yet initiated	**109.2**	**-**	**1.3**	**35.8**	**28.6**	**24.0**	**10.3**	**9.2**
Maritime Sector	***36.5***	***-***	***-***	***9.3***	***10.1***	***4.3***	***4.3***	***8.5***
Empresas International Sea Land Terminal	1.0			0.5	0.5			
Container Storage and Repair Center	2.2			1.2	1.0	-	-	-
Panama Central Terminal Inc.	3.0			1.0	2.0			
Kaiser Latin American	30.3			6.6	6.6	4.3	4.3	8.5
Commercial and Service Sector	***4.0***	***-***	***1.0***	***2.0***	***1.0***	***-***	***-***	***-***
Location of Band Antennas (C&W)	1.0			-	1.0	-	-	-
Lot 820 Mts (ESPINAR) (C&W)	1.0			1.0	-	-	-	-
Sale Building 75 in Davis (C&W)	1.0			1.0	-	-	-	-
Commercial Lots Bella Vista 5	1.0		1.0	-	-	-	-	-
Tourism Sector	***16.8***	***-***	***0.3***	***8.3***	***4.2***	***4.0***	***-***	***-***
Brazos Brooks Golf Club Hotel	12.0			4.0	4.0	4.0		
Bidasa	0.7			0.7				
Panama-Korea Development Corporation	2.6			2.6				
Paraiso Restaurant	1.2			1.00	0.20	-	-	-
Tinajas S.A. Tourist Craft Center	0.3		0.3					
Industrial Sector	***47.9***	***-***	***-***	***15.2***	***10.3***	***15.7***	***6.0***	***0.7***
Center For Strategic Food Exports	43.4			10.7	10.3	15.7	6.0	0.7
Panama - Korea Development Corporation (Cardenas)	2.0			2.0				
Coloci Processing Zone Espanam	2.5			2.5				
Real Estate	***4.0***	***-***	***-***	***1.0***	***3.0***	***-***	***-***	***-***
San Francisco Valley Project	4.0			1.0	3.0			
2. Projects Underway	**823.8**	**223.7**	**217.0**	**187.4**	**151.8**	**33.9**	**2.5**	**7.5**
Maritime Sector	***351.1***	***95.9***	***66.9***	***92.6***	***73.7***	***12.0***	***2.5***	***7.5***
Arileza Mobil Oil	33.8	1.5		1.6	8.7	12.0	2.5	7.5
PETROPORT	0.5	0.5	-	-	-	-	-	-
Panama Railroad	75.0		50.0	25.0	-	-	-	-
Evergreen	19.2	19.2	-	-	-	-	-	-
Manzanillo International	12.5	1.5	10.0	1.0				

Detail	Total Investment	1999	2000	2001	2002	2003	2004	2005
Terminal								
Panama Port Company	209.2	73.2	6.0	65.0	65.0	-	-	-
Intertrade Industrial Stores	0.9		0.9					
Commercial and Service Sector	***241.3***	***59.1***	***91.3***	***30.1***	***55.2***	***5.6***	***-***	***-***
Location of Band B Antennas (C&W)	1.0			1.0	-	-	-	-
Tecno Auto	1.0	1.0						
Colpan Motors	2.0	2.0						
Silaba Group	1.0	1.0						
Curundu Bowling Alley	0.4	0.4						
Espinar Barracks	2.4	2.4						
Bella Vista Lots	0.5	0.5						
Solama Investments	1.2	1.2						
Sale Lot 2,941 and Bldgs. in Balboa	1.0			1.0	-	-	-	-
4 Altos Commercial Center	34.9	1.0	8.0	10.1	10.2	5.6	-	-
Albrook Commercial Center	132.1	27.1	42.0	18.0	45.0			
Rental of 28 Offices in W. Place	1.0	0.5	0.5	-	-	-	-	-
Fiber Optic Project	60.0	22.0	38.0		-	-	-	-
Lot in Colon Corridor	1.3		1.3	-	-	-	-	-
Bella Vista Commercial Lots 4	1.5		1.5					
Real Estate	***86.6***	***23.7***	***29.6***	***26.5***	***6.8***	***-***	***-***	***-***
Sun City (ESPINAR)	29.8	4.3	10.0	8.7	6.8	-	-	-
Remodeling of Barracks in Espinar	31.1	12.1	9.5	9.5	-	-	-	-
Construction Casa Bella (3.5 ha)	12.2	7.3	4.9		-	-	-	-
Albrook Garden	10.4		5.2	5.2				
Horoko Golf Club	3.1			3.1				
Tourism Sector	***88.0***	***45.0***	***20.4***	***22.6***	***-***	***-***	***-***	***-***
Horoko Golf Club	5.6			5.6		-	-	-
Nikos Café	2.2	1.3	0.9					
Happy Hours (Café Iguana)	0.6	0.6						
Meliá Panama Canal	21.0	21.0						
Canopy Tower	0.5	0.5						
Tropical Rainforest Resort En Gamboa	20.0	15.0	5.0	-		-	-	-
Fort Amador Resort & Marina	17.7	2.7	8.0	7.0		-	-	-
Summit Golf Club	10.0	3.5	1.5	5.0	-	-	-	-
UNESA (Hotel Amador)	10.0		5.0	5.0	-	-	-	-

Detail	Total Investment	1999	2000	2001	2002	2003	2004	2005
ULACIT	0.4	0.4						
Industrial Sector	***17.0***	***-***	***1.1***	***6.1***	***5.2***	***4.6***	***-***	***-***
Davis Processing Zone	2.0		1.0	1.0	-	-	-	-
Interespacios Modulares, S.A.	0.1		0.1					
East Albrook Processing Zone	14.9			5.1	5.2	4.6	-	-
Farm Sector	***39.8***	***-***	***7.7***	***9.5***	***10.9***	***11.7***	***-***	***-***
Forest Projects	39.8		7.7	9.5	10.9	11.7		
TOTAL (1+2)	**933.0**	**223.7**	**218.3**	**223.2**	**180.4**	**57.9**	**12.8**	**16.7**

Source: Office of Economic Planning, ARI

It should be noted that recent real-estate investments in the East Atlantic Region are mainly concentrated in North Coco Solo/France Field (commercial construction permits) and in Espinar (residential permits). This distribution confirms the tendencies observed in the data on investment projects shown above.

In the East Pacific Region, real-estate investments are focused in Albrook (commercial permits) and in Albrook and Ancon (residential permits). For the most part, this is the result of the transfer of properties programmed by the ARI.

This analysis, together with interviews of key individuals in the public and private sector, permits identification of current zones of economic development within the Canal Area, i.e., North Coco Solo/France Field, Espinar, Balboa, Balboa Industrial and Albrook.

At the same time, there are other zones which have not been developed until now due to the program for transfer of property, both at the international level (reception by the Panamanian Government) and the national level (transfer by the ARI). Among these zones, it is important to identify Howard and Rodman for maritime, logistic and industrial development; Telfers for industrial development; and Amador and Sherman for tourism development.

To sum up, the areas of current and potential economic development are:

- North Coco Solo/France Field
- Telfers
- Espinar
- Sherman
- Balboa Industrial
- Balboa
- Albrook
- Howard
- Rodman
- Amador

These areas, then, are defined as priority zones in the context of the Plan for Infrastructure Investments.

4.3 Additional Conclusions Related to Urban Planning and Development

Additional conclusions with respect to urban planning and development, reached during the analysis phase, should be mentioned:

In general terms, the Urban Planning Department of the ARI has completed half of the local planning needed to guide urban development in the Canal Area. As summarized in more detail in Chapter 3, the ARI has completed seven of the 18 zonings needed in the East Pacific Subregion, with an additional three underway. Zonings for the West Pacific do not exist, but the ARI and its consultants continue to prepare the economic development scenarios for Howard and Rodman. In the East Atlantic, nine of 13 zonings are complete, with one more underway.

It will take 2–3 years for the current offering of real estate in the Canal Area to be assimilated. This was one of the conclusions of the metropolitan real-estate market analysis carried out by IRG/PADCO towards the end of 1999.[1] Observations made this year by the team indicate that this term continues to be a realistic estimate of the time required to complete the sale of remaining housing units and other real-estate properties. This would imply that during the period covered by the Plan for Infrastructure, concentration of investments in already-developed areas is recommended, as opposed to opening new areas to the urbanization process.

Government assignations entities encompass significant positions on the East Pacific area (particularly Mocambo, Balboa and Clayton) and of the East Atlantic area (Brazos, Mindi and France Field). The opportunity cost of such assignations vary with each case. In Mocambo, assignation of lots for government offices which would transfer from locales outside the Canal Area could represent significant costs. Alternatives to assigning lots in Campo de Francia to a private industrial or commercial developer could represent a more efficient use of the space.

The new residential densities in effect vary from 50–800 persons/hect., an average of 5–10 times more residents in these areas than at the time of reversion. Achieving these densities will require significant expansion of existing infrastructure systems.

[1] "Technical Assistance for Implementation of the Urban Development Component of the General and Regional Plans," IRG/PADCO, December 31, 1999.

5. Analysis of Infrastructure Requirements in the Canal Area, 2002–06

To establish the requirements in terms of infrastructure, it was first necessary to become familiar with advances made in the area of specific studies dealing with current soil uses, regulations and occupancy to date.

The work carried out, which tended to cover the entire Plan Area, consisted of establishing a division of the area based on the specific studies and their preliminary or final results as contained in the zonings, directly involving the technicians of the Department of Urban Planning responsible for each study and proposal.

This process of "community by community" analysis permitted an estimate to be made of probable development and, subsequently, soil occupancy according to soil use during the period covered by the Plan. The information on spatial occupancy (persons) was then translated into infrastructure requirements based on consumer indexes for each type of urban service.

Three scenarios were formulated for calculating spatial occupancy and infrastructure requirements. Scenario 1, titled "Spatial Planning Framework," estimates the infrastructure requirements needed to facilitate the urban development permitted under the regulatory framework. The predominant factor in this calculation were the development limits defined by the General Plan and zonings.

Nevertheless, the fact that this development is permitted within the spatial planning framework does not guarantee that it will happen. In the long term, market conditions will also be a deciding factor. With this in mind, the team formulated a second scenario taking into account the market's effect on soil occupancy estimates. Specifically, spatial occupancy projections for industry, commerce and tourism were compared with employment and investment tendencies in each sector, and the projections were adjusted to more precisely reflect employment-generating capacities in the Canal Area. This second scenario is titled "Scenario 2: Employment Generating Market."

Finally, the team prepared a third scenario which includes the construction of the proposed Governmental City in Chivo Chivo (East Pacific). With the exception of the inclusion of this project, Scenario 3: Market + Governmental City is identical to Scenario 2.

The chapters which follow describe in detail the methodology used in calculating spatial occupancy and infrastructure requirements for the three scenarios.

5.1 Scenario 1: Spatial Planning Framework

5.1.1 Methodology

The following steps were carried out for each one of the communities located within the area of the plan:

- Calculation of the total area of polygonals, indicating the surface value of green areas to be maintained.
- Calculation of the gross currently-developed area within each of these polygonals.
- Calculation of the surface area to be developed, subtracting from this amount those areas which are not developable or are to be maintained as green areas.
- Differentiation of areas of residential, institutional, commercial and industrial use.
- Indication of the maximum soil occupancy permitted by the categories of use produced through zoning or established in the General Plan, so that their average may be used as a point of reference.
- Calculation of the soil occupancy index (persons per hectare) corresponding to the categories—residential and non-residential—established through existing zoning, in accordance with foreseen economic activity. For the residential population, population is equal to the number of inhabitants. For other uses, it is a question of "average" daytime population, which would include employees and users such as students in schools and shoppers in stores.
- Definition of the year of development saturation for each type of soil use per community. The year of saturation is defined as the moment in which all future edifications have been constructed and no more will be built. For this calculation, criteria such as current economic and urban development tendencies, the vocation of the sector in question, and analysis of the real-estate market are used.
- Calculation, by soil use category, of the daytime population within the Plan Area in the year of saturation, based on the occupancy indexes.
- Calculation of the population in the year 2006, based on the saturation population. If it is estimated that the community will become saturated before 2006, the saturation population is used. If saturation will occur after 2006 (as is usually the case), the rhythm of development is estimated and a calculation is made of the percent of total development which will have occurred by 2006.

Table 5.1 presents minimum and maximum soil occupancy values by soil use. The values selected within each range, for each type of soil use in each community, depend on specific local conditions.

Table 5.1 Occupancy Indexes by Soil Use

Soil Use	Type of User	Minimum Occupancy Index (persons/hect.)	Maximum Occupancy Index (persons/hect.)
Residential	Inhabitants	50	500
Commercial	Clients and Employees	250	400
Institutional	Users and Employees	300	400
Industrial	Employees	50 (maritime)	225 (manufacturing)
Tourism	Tourists and Employees	150	300

5.1.2 Results

The results for Scenario 1 are presented in Table 5.2. The daytime population in 2006 totals 277,554 in the Plan Area. The Pacific Region will continue its tendency to generate greater growth and, therefore, to demand infrastructure, with a population of 184,235. It is followed by the Atlantic Region, with a population of 88,349. Whereas the greater part of residential and institutional development occurs along the Pacific, the Atlantic Region will experience greater tourism development and almost the same amount of industrial growth. In accordance with the zoning in the General Plan, there will be little development in the Central Region.

Table 5.2 Results of Scenario 1: Spatial Planning Framework—Daytime Population of the Canal Area in 2006

Region	Total	Residential	Institutional	Commercial	Industrial	Tourism
Pacific	184,325	50,022	56,085	48,210	24,004	6,005
Atlantic	88,349	28,820	11,337	13,929	20,103	14,160
Central	4,880	3,241	1,187	333	120	–
Total	**277,554**	**82,083**	**68,608**	**62,472**	**44,227**	**20,165**

5.2 Scenario 2: Employment-Generating Market

5.2.1 Methodology

In this scenario, the estimates for future employment from Scenario 1 were compared with each one of the economic sectors corresponding to soil uses. The Department of Economic Planning assisted the consultants by providing current data and characterizing growth perspectives for key economic sectors of the inter-oceanic region.

Recent employment tendencies served as the quantitative context for this analysis.

Table 5.3 Canal Area Employment by Sector, 1997–99

	1997	1998	1999	V% 97–98	V% 98–99
Tourism	237	271	442	14.35	63.10
Commercial	2,489	2,434	4,390	(2.21)	80.36
Industrial	5,608	5,729	6,242	2.16	8.95
Institutional	22,280	24,875	24,795	11.65	(0.32)
Other Sectors	6,303	8,332	12,228	32.19	46.76
Total	**36,917**	**41,641**	**48,641**	**12.80**	**15.50**

Based on this data, a quick analysis was made of the possibilities for creation of employment in the following sectors:

Tourism—It is estimated that development in the area of tourism doubles each year; in five years the number of new job positions created will reach 5,000. According to national statistics, there is one employee for each five tourists. For 2006, this would represent an approximate total of 25,000 users, between employees and tourists.

Commercial—Annual growth in this sector is about 15 percent, representing an estimated 4,000 new positions in the next five years. According to estimates, there is one employee for each three clients, meaning almost 33,000 users for the year 2006, between employees and clients.

Industrial—Annual growth in this sector is about 10 percent. Five years from now there could be some 12,000 employees. Adding this number to the mega-projects of the multimodal center (3,000 employees) and of Howard (3,000 employees) would give an approximate total of 18,000 users. The percentage of shoppers or visitors to the industrial sector, which is supposedly quite small, was not considered to be an additional factor.

Institutional—This refers mainly to administrative dependencies and other entities which have been established in the Plan Area for several years, and is based on the premise of a consonant annual increase of 4 percent, which represents the average for the types of growth observed in the last few years.

5.2.2 Results

The suppositions based on current tendencies for sectoral growth and employment produce much more moderate estimates for an increase in soil occupancy. As can be seen in the following table, the total daytime population reaches 177,000, or a little less than two-thirds of the estimated population for Scenario 1. It should be noted that the industrial and commercial populations decreased considerably (by 59 and 47 percent, respectively). The economic analysis had less effect on tourist occupancy and almost no effect on the residential population.

Table 5.4 Results of Scenario 2: Employment Generating Market—Daytime Population of the Canal Area, 2006

	Total	Residential	Institutional	Commercial	Industrial	Tourism
Pacific	114,437	46,358	24,975	25,392	10,268	7,444
Atlantic	58,556	28,820	4,105	7,290	7,845	10,496
Central	4,124	3,241	528	306	49	–
Total	**177,117**	**78,419**	**29,608**	**32,988**	**18,162**	**17,940**

Inasmuch as it incorporates the analysis of growth perspectives for key economic sectors, Scenario 2 is preferred for evaluating specific infrastructure requirements.

5.3 Scenario 3: Market + Governmental City

5.3.1 Methodology

The third scenario assumes that the Governmental City proposed for Chivo Chivo will be accomplished. To date, it is not clear whether the Government has made the decision to go

through with this project. Likewise, no details of the proposal have been published—the area of construction and expected daytime population, for example—making it difficult to estimate soil occupancy and, therefore, infrastructure requirements.

In the absence of solid data, Scenario 3 gathers the figures from Scenario 2 and adds to the daytime population another 60,000 people who would work in the Governmental City. The majority of these additional people (50,000) would work in government offices; the other 10,000 would provide commercial support services required by the government and sports complexes. These projections take into account the fact that some public sector employees will simply be transferred to the Governmental City from offices already located in the Canal Area.

5.3.2 Results

The suppositions with respect to the Governmental City increase the daytime population to around 237,000 people, of whom 80,000 are involved in institutional activities. In this scenario the institutional population surpasses the residential population both in the Pacific Region and in the entire Canal Area.

Table 5.5 Results of Scenario 3: Market + Governmental City—Daytime Population of the Canal Area, 2006

Region	Total	Residential	Institutional	Commercial	Industrial	Tourism
Pacific	174,437	46,358	74,975	35,392	10,268	7,444
Atlantic	58,556	28,820	4,105	7,290	7,845	10,496
Central	4,124	3,241	528	306	49	–
Total	**237,117**	**78,419**	**79,608**	**42,988**	**18,162**	**17,940**

5.4 Analysis of Infrastructure Requirements

5.4.1 Methodology

The information on soil occupancy for each community was translated into infrastructure requirements based on average consumption indexes per person according to the type of soil use. The indexes were arrived at through average values from design experience in Panama City, as per a direct conversation with individuals furnishing various services, in order to plan the adequate provision of service to the user. The consumption indexes are presented in Table 5.6.

Table 5.6 Indexes of Urban Infrastructure Consumption

	Unit	Residential	Institutional	Commercial	Industrial	Tourism
Potable Water	gallons/person/day	125	40	25	40	150
Sewer System	gallons/person/day	100	32	20	32	120
Electric Energy	kwh/person/day	6	3	10	4	8
Telecommunications	lines/1,000 persons	300	100	80	80	300
Solid Waste	kg/person/day	1.2	0.8	1.5	0.8	2.0

5.4.2 Results

The results of the analysis are presented in Tables 5.7–5.11. Dedicated to one infrastructure sector apiece, each table is in turn divided into three subtables with projections based on the three development scenarios. The principal findings for sectoral requirements are as follows:

Potable Water—For each of the three scenarios, adequate service can be provided, taking into account the programmed enlargements of treatment plants and control of leakage, which is presently at 50 percent. In Scenario 2 (Employment-Generating Market), a total of 15.23 million gallons per day (MGD) will be required in the Canal Area in 2006. Of this amount, 59 percent (8.96 MGD) will be needed to support foreseen development in the Pacific Region. As a percentage of metropolitan requirements, those of the Canal Area represent only 6 percent in 2006.

Waste Water—Waste water production in 2006 in the inter-oceanic area varies from 12.18 MGD in Scenario 2 to 15.49 MGD in Scenario 1. Sewage treatment plants are almost totally lacking, as can be observed in the tables for all three scenarios.

Solid Waste—Solid waste disposal in Cerro Patacon and Mount Hope can be projected for all three scenarios, taking the capacity of these locations into account and noting that not all the solid waste produced will end up there. In addition, recycling should be promoted to alleviate handling costs for solid waste. According to Scenario 2, 0.218 thousand tons/day will be produced in 2006.

Electric Energy—The 12 electric generators in existence show a decided capacity for providing the required service, which will rise to 1,105,194 kwh per day in 2006 in the inter-oceanic area. What is needed is improvement in the quality of service, since the breaks to which the electric current is subjected generate a lack of confidence in the employment-generating business sector.

Telecommunications—Almost 36 million telephone lines will be needed in the Canal Area in 2006, according to Scenario 2. In reality, the balance for all three scenarios sets forth numbers of telephone lines, but the great advances being made in the field of telecommunications leaves no doubt as to the provision of this service which, having been privatized in Panama, has been entrusted to the free market.

Table 5.7A Expected Potable Water Consumption—Scenario 1: Spatial Planning Framework

Community	Residential	Institutional	Commercial	Industrial	Tourism	Total	Unit
Population							
Canal Area							
Pacific	50,022	56,085	48,210	24,004	6,005	184,326	persons
Atlantic	28,820	11,337	13,929	20,103	14,160	88,349	persons
Central	3,241	1,187	333	120	0	4,881	persons
Total	82,083	68,609	62,472	44,227	20,165	277,556	persons
Panama metro, 2006						1,520,000	persons
Colon metro, 2006						245,000	persons
Consumption	***125***	***40***	***25***	***40***	***150***		***GPD***
Canal Area							
Pacific	6.25	2.24	1.21	0.96	0.90	11.56	MGD
Atlantic	3.60	0.45	0.35	0.80	2.12	7.33	MGD
Central	0.41	0.05	0.01	0.00	0.00	0.47	MGD
Total	10.26	2.74	1.56	1.77	3.02	19.36	MGD
Panama metro, 2006						190	MGD
Colon metro, 2006						31	MGD
			Pacific			202	MGD
			Atlantic			38	MGD
			Central			0	MGD
			Grand Total			*240*	*MGD*
Capacity/Tanks							
			Pacific	Miraflores		70	MGD
				Chilibre		135	MGD
				Laguna Alta		20	MGD
				Chorrera		10	MGD
				Villalobos		2	MGD
				Mañanitas		2	MGD
				Cabras		2	MGD
				Pacora		2	MGD
				Total		243	MGD
			Atlantic	Mount Hope		22	MGD
				Sabanitas		6	MGD
				Gatún		3	MGD
				Total		31	MGD
			Grand Total			*274*	*MGD*
			Surplus			*34*	*MGD*

MGD = millions of gallons per day

Table 5.7B Expected Potable Water Consumption— Scenario 2: Employment Generating Market

Community	Residential	Institutional	Commercial	Industrial	Tourism	Total	Unit
Population							
Canal Area							
Pacific	46,358	24,975	25,392	10,268	7,444	114,437	persons
Atlantic	28,820	4,105	7,290	7,845	10,496	58,556	persons
Central	3,241	528	306	49	0	4,124	persons
Total	78,419	29,608	32,998	18,162	17,940	177,117	persons
Panama metro, 2006						1,520,000	persons
Colon metro, 2006						245,000	persons
Consumption	***125***	***40***	***25***	***40***	***150***		***GPD***
Canal Area							
Pacific	5.79	1.00	0.63	0.41	1.12	8.96	MGD
Atlantic	3.60	0.16	0.18	0.31	1.57	5.84	MGD
Central	0.41	0.02	0.01	0.00	0.00	0.44	MGD
Total	9.80	1.18	0.82	0.73	2.69	15.23	MGD
Panama metro, 2006						190	MGD
Colon metro, 2006						31	MGD
			Pacific			199	MGD
			Atlantic			36	MGD
			Central			0	MGD
			Grand Total			*236*	*MGD*
Capacity/Tanks							
			Pacific	Miraflores		70	MGD
				Chilibre		135	MGD
				Laguna Alta		20	MGD
				Chorrera		10	MGD
				Villalobos		2	MGD
				Mañanitas		2	MGD
				Cabras		2	MGD
				Pacora		2	MGD
				Total		243	MGD
			Atlantic	Mount Hope		22	MGD
				Sabanitas		6	MGD
				Gatún		3	MGD
				Total		31	MGD
			Grand Total			*274*	*MGD*
			Surplus			*38*	*MGD*

MGD = millions of gallons per day

Table 5.7C Expected Potable Water Consumption—Scenario 3: Market + Governmental City

Community	Residential	Institutional	Commercial	Industrial	Tourism	Total	Unit
Population							
Canal Area							
Pacific	46,358	74,975	35,392	10,268	7,444	174,437	persons
Atlantic	28,820	4,105	7,290	7,845	10,496	58,556	persons
Central	3,241	528	306	49	0	4,124	persons
Total	78,419	79,608	42,998	18,162	17,940	237,117	persons
Panama metro, 2006						1,520,000	persons
Colon metro, 2006						245,000	persons
Consumption	***125***	***40***	***25***	***40***	***150***		***GPD***
Canal Area							
Pacific	5.79	3.00	0.88	0.41	1.12	11.21	MGD
Atlantic	3.60	0.16	0.18	0.31	1.57	5.84	MGD
Central	0.41	0.02	0.01	0.00	0.00	0.44	MGD
Total	9.80	3.18	1.07	0.73	2.69	17.48	MGD
Panama metro, 2006						190	MGD
Colon metro, 2006						31	MGD
			Pacific			201	MGD
			Atlantic			36	MGD
			Central			0	MGD
			Grand Total			*236*	*MGD*
Capacity/Tanks							
			Pacific	Miraflores		70	MGD
				Chilibre		135	MGD
				Laguna Alta		20	MGD
				Chorrera		10	MGD
				Villalobos		2	MGD
				Mañanitas		2	MGD
				Cabras		2	MGD
				Pacora		2	MGD
				Total		243	MGD
			Atlantic	Mount Hope		22	MGD
				Sabanitas		6	MGD
				Gatún		3	MGD
				Total		31	MGD
			Grand Total			*274*	*MGD*
			Surplus			*36*	*MGD*

MGD = millions of gallons per day

Table 5.8A Waste Water Treatment Required—Scenario 1: Spatial Planning Framework

Community	Residential	Institutional	Commercial	Industrial	Tourism	Total	Unit
Population							
Canal Area							
Pacific	50,022	56,085	48,210	24,004	6,005	184,326	persons
Atlantic	28,820	11,337	13,929	20,103	14,160	88,349	persons
Central	3,241	1,187	333	120	0	4,881	persons
Total	82,083	68,609	62,472	44,227	20,165	277,556	persons
Panama metro, 2006						1,520,000	persons
Colon metro, 2006						245,000	persons
Production	***100***	***32***	***20***	***32***	***120***		***GPD***
Canal Area							
Pacific	5.00	1.79	0.96	0.77	0.72	9.25	MGD
Atlantic	2.88	0.36	0.28	0.64	1.70	5.87	MGD
Central	0.32	0.04	0.01	0.00	0.00	0.37	MGD
Total	*8.21*	*2.20*	*1.25*	*1.42*	*2.42*	*15.49*	*MGD*
Panama in 2006						152	MGD
Colon in 2006						25	MGD
Grand Total						*192*	*MGD*

1. Adequate information was not available to establish a comparison
2. There is only one treatment plant in Howard and one other in Ancon
3. MGD = millions of gallons per day

Table 5.8B Waste Water Treatment Required—Scenario 2: Employment Generating Market

Community	Residential	Institutional	Commercial	Industrial	Tourism	Total	Unit
Population							
Canal Area							
Pacific	46,358	24,975	25,392	10,268	7,444	114,437	persons
Atlantic	28,820	4,105	7,290	7,845	10,496	58,556	persons
Central	3,241	528	306	49	0	4,124	persons
Total	78,419	29,608	32,988	18,162	17,940	177,117	persons
Panama metro, 2006						1,520,000	persons
Colon metro, 2006						245,000	persons
Production	***100***	***32***	***20***	***32***	***120***		***GPD***
Canal Area							
Pacific	4.64	0.80	0.51	0.33	0.89	7.16	MGD
Atlantic	2.88	0.13	0.15	0.25	1.26	4.67	MGD
Central	0.32	0.02	0.01	0.00	0.00	0.35	MGD
Total	*7.84*	*0.95*	*0.66*	*0.58*	*2.15*	*12.18*	*MGD*
Panama in 2006						152	MGD
Colon in 2006						25	MGD
Grand Total						*189*	*MGD*

1. Adequate information was not available to establish a comparison
2. There is only one treatment plant in Howard and one other in Ancon
3. MGD = millions of gallons per day

Table 5.8C Waste Water Treatment Required—Scenario 3: Market + Governmental City

Community	Residential	Institutional	Commercial	Industrial	Tourism	Total	Unit
Population							
Canal Area							
Pacific	46,358	74,975	35,392	10,268	7,444	174,437	persons
Atlantic	28,820	4,105	7,290	7,845	10,496	58,556	persons
Central	3,241	528	306	49	0	4,124	persons
Total	78,419	79,608	42,988	18,162	17,940	237,117	persons
Panama metro, 2006						1,520,000	persons
Colon metro, 2006						245,000	persons
Production	***100***	***32***	***20***	***32***	***120***		***GPD***
Canal Area							
Pacific	4.64	2.40	0.71	0.33	0.89	8.96	MGD
Atlantic	2.88	0.13	0.15	0.25	1.26	4.67	MGD
Central	0.32	0.02	0.01	0.00	0.00	0.35	MGD
Total	*7.84*	*2.55*	*0.86*	*0.58*	*2.15*	*12.98*	*MGD*
Panama in 2006						152	MGD
Colon in 2006						25	MGD
Grand Total						*190*	*MGD*

1. Adequate information was not available to establish a comparison
2. There is only one treatment plant in Howard and one other in Ancon
3. MGD = millions of gallons per day

Table 5.9A Expected Management of Solid Waste—Scenario 1: Spatial Planning Framework

Community	Residential	Institutional	Commercial	Industrial	Tourism	Total	Unit
Population							
Canal Area							
Pacific	50,022	56,085	48,210	24,004	6,005	184,326	persons
Atlantic	28,820	11,337	13,929	20,103	14,160	88,349	persons
Central	3,241	1,187	333	120	0	4,881	persons
Total	82,083	68,609	62,472	44,227	20,165	277,556	persons
Panama metro, 2006						1,520,000	persons
Colon metro, 2006						245,000	persons
Production	***1.2***	***0.8***	***1.5***	***0.8***	***2.0***		***kg/pers./ day***
Canal Area							
Pacific	60	45	72	19	12	208	tons/day
Atlantic	35	9	21	16	28	109	tons/day
Central	4	1	0	0	0	5	tons/day
Total	98	55	94	35	40	323	tons/day
Panama metro, 2006						1,824	tons/day
Colon metro, 2006						294	tons/day
Grand Total						2,441	tons/day
Capacity/Disposition of Solid Waste							
			Pacific	Cerro Patacón		116	tons/day
			Total			116	tons/day
			Atlantic	Mount Hope		122	tons/day
			Total			112	tons/day
			Grand Total			*1,282*	tons/day
			Production/Capacity			*190%*	

Table 5.9B Expected Management of Solid Waste—Scenario 2: Employment Generating Market

Community	Residential	Institutional	Commercial	Industrial	Tourism	Total	Unit
Population							
Canal Area							
Pacific	46,358	24,975	25,392	10,268	7,444	114,437	persons
Atlantic	28,820	4,105	7,290	7,845	10,496	58,556	persons
Central	3,241	528	306	49	0	4,124	persons
Total	78,419	29,608	32,988	18,162	17,940	177,117	persons
Panama metro, 2006						1,520,000	persons
Colon metro, 2006						245,000	persons
Production	***1.2***	***0.8***	***1.5***	***0.8***	***2.0***		***kg/pers./ day***
Canal Area							
Pacific	56	20	38	8	15	137	tons/day
Atlantic	35	3	11	6	21	76	tons/day
Central	4	0	0	0	0	5	tons/day
Total	94	24	49	15	36	218	tons/day
Panama metro, 2006						1,824	tons/day
Colon metro, 2006						294	tons/day
Grand Total						2,336	tons/day

Capacity/Disposition of Solid Waste			
	Pacific	Cerro Patacón	116	tons/day
	Total		116	tons/day
	Atlantic	Mount Hope	122	tons/day
	Total		112	tons/day
	Grand Total		*1,282*	tons/day
	Production/Capacity		*182%*	

Table 5.9C Expected Management of Solid Waste—Scenario 3: Market + Government City

Community	Residential	Institutional	Commercial	Industrial	Tourism	Total	Unit
Population							
Canal Area							
Pacific	46,358	74,975	35,392	10,268	7,444	174,437	persons
Atlantic	28,820	4,105	7,290	7,845	10,496	58,556	persons
Central	3,241	528	306	49	0	4,124	persons
Total	78,419	79,608	42,988	18,162	17,940	237,117	persons
Panama metro, 2006						1,520,000	persons
Colon metro, 2006						245,000	persons
Production	***1.2***	***0.8***	***1.5***	***0.8***	***2.0***		***kg/pers./ day***
Canal Area							
Pacific	56	60	53	8	15	192	tons/day
Atlantic	35	3	11	6	21	76	tons/day
Central	4	0	0	0	0	5	tons/day
Total	94	64	64	15	36	273	tons/day
Panama metro, 2006						1,824	tons/day
Colon metro, 2006						294	tons/day
Grand Total						2,391	tons/day

Capacity/Disposition of Solid Waste			
	Pacific	Cerro Patacón	116	tons/day
	Total		116	tons/day
	Atlantic	Mount Hope	122	tons/day
	Total		112	tons/day
	Grand Total		*1,282*	tons/day
	Production/Capacity		*186%*	

Table 5.10A Expected Energy Consumption—Scenario 1: Spatial Planning Framework

Community	Residential	Institutional	Commercial	Industrial	Tourism	Total	Unit
Population							
Canal Area							
Pacific	50,022	56,085	48,210	24,004	6,005	184,326	persons
Atlantic	28,820	11,337	13,929	20,103	14,160	88,349	persons
Central	3,241	1,187	333	120	0	4,881	persons
Total	82,083	68,609	62,472	44,227	20,165	277,556	persons
Panama metro, 2006						1,520,000	persons
Colon metro, 2006						245,000	persons
Consumption	***6***	***3***	***10***	***4***	***8***		***kw/pers./day***
Canal Area							
Pacific	300,132	168,255	482,100	96,016	48,040	1,094,543	kwh per day
Atlantic	172,920	34,011	139,290	80,412	113,280	539,913	kwh per day
Central	19,446	3,561	3,330	0	-	26,337	kwh per day
Total	492,498	205,827	624,720	176,428	161,320	1,660,793	kwh per day
Panama metro, 2006						9,120,000	kwh per day
Colon metro, 2006						1,470,000	kwh per day
			Grand Total			12,250,793	kwh per day
			Factor			1	
			Hours			24	
			Total Required			638	MW
Capacity/Generating Plants							
			Las Minas Bay	(Thermic)		120	kwh per day
			Las Minas Bay	(Thermic)		24	kwh per day
			Las Minas Bay	(Thermic)		160	kwh per day
			Estrella	(Hydraulic)		300	kwh per day
			Los Valles	(Hydraulic)		42	kwh per day
			Bayano	(Hydraulic)		46	kwh per day
			Copes	(Thermic)		150	kwh per day
			Panam	(Thermic)		42	kwh per day
			Petro Electric	(Thermic)		96	kwh per day
			Madden Hydro	(Hydraulic)		55	kwh per day
			Gatún	(Hydraulic)		36	
			Miraflores	(Thermic)		24	
			Grand Total			*1,095*	
				58% of installed capacity is required			

Table 5.10B Expected Energy Consumption—Scenario 2: Employment Generating Market

Community	Residential	Institutional	Commercial	Industrial	Tourism	Total	Unit
Population							
Canal Area							
Pacific	46,358	24,795	25,392	10,268	7,444	114,437	persons
Atlantic	28,820	4,105	7,290	7,845	10,496	58,556	persons
Central	3,241	528	306	49	-	4,124	persons
Total	78,419	29,608	32,988	18,162	17,940	177,117	persons
Panama metro, 2006						1,520,000	persons
Colon metro, 2006						245,000	persons
Consumption	***6***	***3***	***10***	***4***	***8***		***kw/pers./day***
Canal Area							
Pacific	278,148	74,925	253,920	41,072	59,552	707,617	kwh per day
Atlantic	172,920	12,315	72,900	31,380	83,968	373,483	kwh per day
Central	19,446	1,584	3,060	0	-	24,090	kwh per day
Total	470,514	88,824	329,880	72,452	143,520	1,105,190	kwh per day
Panama metro, 2006						9,120,000	kwh per day
Colon metro, 2006						1,470,000	kwh per day
			Grand Total			11,695,190	kwh per day
			Factor			1	
			Hours			24	
			Total Required			609	MW
Capacity/Generating Plants							
			Las Minas Bay	(Thermic)		120	kwh per day
			Las Minas Bay	(Thermic)		24	kwh per day
			Las Minas Bay	(Thermic)		160	kwh per day
			Estrella	(Hydraulic)		300	kwh per day
			Los Valles	(Hydraulic)		42	kwh per day
			Bayano	(Hydraulic)		46	kwh per day
			Copes	(Thermic)		150	kwh per day
			Panam	(Thermic)		42	kwh per day
			Petro Electric	(Thermic)		96	kwh per day
			Madden Hydro	(Hydraulic)		55	kwh per day
			Gatún	(Hydraulic)		36	
			Miraflores	(Thermic)		24	
			Grand Total			*1,095*	
				56% of installed capacity is required			

Table 5.10C Expected Energy Consumption—Scenario 3: Market + Governmental City

Community	Residential	Institutional	Commercial	Industrial	Tourism	Total	Unit
Population							
Canal Area							
Pacific	46,358	74,795	35,392	10,268	7,444	174,437	persons
Atlantic	28,820	4,105	7,290	7,845	10,496	58,556	persons
Central	3,241	528	306	49	-	4,124	persons
Total	78,419	79,608	42,988	18,162	17,940	237,117	persons
Panama metro, 2006						1,520,000	persons
Colon metro, 2006						245,000	persons
Consumption	***6***	***3***	***10***	***4***	***8***		***kw/pers./day***
Canal Area							
Pacific	278,148	224,925	353,920	41,072	59,552	957,617	kwh per day
Atlantic	172,920	12,315	72,900	31,380	83,968	373,483	kwh per day
Central	19,446	1,584	3,060	0	-	24,090	kwh per day
Total	470,514	238,824	429,880	72,452	143,520	1,355,190	kwh per day
Panama metro, 2006						9,120,000	kwh per day
Colon metro, 2006						1,470,000	kwh per day
			Grand Total			11,945,190	kwh per day
			Factor			1	
			Hours			24	
			Total Required			622	MW
Capacity/Generating Plants							
			Las Minas Bay	(Thermic)		120	kwh per day
			Las Minas Bay	(Thermic)		24	kwh per day
			Las Minas Bay	(Thermic)		160	kwh per day
			Estrella	(Hydraulic)		300	kwh per day
			Los Valles	(Hydraulic)		42	kwh per day
			Bayano	(Hydraulic)		46	kwh per day
			Copes	(Thermic)		150	kwh per day
			Panam	(Thermic)		42	kwh per day
			Petro Electric	(Thermic)		96	kwh per day
			Madden Hydro	(Hydraulic)		55	kwh per day
			Gatún	(Hydraulic)		36	
			Miraflores	(Thermic)		24	
			Grand Total			*1,095*	
				57% of installed capacity is required			

Table 5.11A Required Telephone Lines—Scenario 1: Spatial Planning Framework

Community	Residential	Institutional	Commercial	Industrial	Tourism	Total	Unit
Population							
Canal Area							
Pacific	50,022	56,085	48,210	24,004	6,005	184,326	persons
Atlantic	28,820	11,337	13,929	20,103	14,160	88,349	persons
Central	3,241	1,187	333	120	0	4,881	persons
Total	82,083	68,609	62,472	44,227	20,165	277,556	persons
Panama metro, 2006						1,520,000	persons
Colon metro, 2006						245,000	persons
Requirements	***300***	***100***	***80***	***80***	***300***		***lines/1,000 persons***
Canal Area							
Pacific	15.01	5.61	3.86	1.92	1.80	28.19	lines (,000)
Atlantic	8.65	1.13	1.11	1.61	4.25	16.75	lines (,000)
Central	0.97	6.86	5.00	3.54	6.05	46.07	lines (,000)
Total	*24.62*	*6.86*	*5.00*	*3.54*	*6.05*	*46.07*	lines (,000)
Panama in 2006						456	lines (,000)
Colon in 2006						74	lines (,000)
Grand Total						*576*	lines (,000)

Note: An average of 0.3 telephone lines per inhabitant was used to estimate the metropolitan requirements.

Table 5.11B Required Telephone Lines—Scenario 2: Employment Generating Market

Community	Residential	Institutional	Commercial	Industrial	Tourism	Total	Unit
Population							
Canal Area							
Pacific	46,358	24,975	25,392	10,268	7,444	114,437	persons
Atlantic	28,820	4,105	7,290	7,845	10,496	58,556	persons
Central	3,241	528	306	49	0	4,124	persons
Total	78,419	29,608	32,988	18,162	17,940	177,117	persons
Panama metro, 2006						1,520,000	persons
Colon metro, 2006						245,000	persons
Requirements	***300***	***100***	***80***	***80***	***300***		***lines/1,000 persons***
Canal Area							
Pacific	13.91	2.50	2.03	0.82	2.23	21.49	lines (,000)
Atlantic	8.65	0.41	0.58	0.63	3.15	13.42	lines (,000)
Central	0.97	0.05	0.02	0.00	0.00	1.05	lines (,000)
Total	*23.53*	*2.96*	*2.64*	*1.45*	*5.38*	*35.96*	lines (,000)
Panama in 2006						456	lines (,000)
Colon in 2006						74	lines (,000)
Grand Total						*565*	lines (,000)

Note: An average of 0.3 telephone lines per inhabitant was used to estimate the metropolitan requirements.

Table 5.11C Required Telephone Lines—Scenario 3: Market + Governmental City

Community	Residential	Institutional	Commercial	Industrial	Tourism	Total	Unit
Population							
Canal Area							
Pacific	46,358	74,975	35,392	10,268	7,444	174,437	persons
Atlantic	28,820	4,105	7,290	7,845	10,496	58,556	persons
Central	3,241	528	306	49	0	4,124	persons
Total	78,419	79,608	42,988	18,162	17,940	237,117	persons
Panama metro, 2006						1,520,000	persons
Colon metro, 2006						245,000	persons
Requirements	***300***	***100***	***80***	***80***	***300***		***lines/1,000 persons***
Canal Area							
Pacific	13.91	7.50	2.83	0.82	2.23	27.29	lines (,000)
Atlantic	8.65	0.41	0.58	0.63	3.15	13.42	lines (,000)
Central	0.97	0.05	0.02	0.00	0.00	1.05	lines (,000)
Total	*23.53*	*7.96*	*3.44*	*1.45*	*5.38*	*41.76*	lines (,000)
Panama in 2006						1456	lines (,000)
Colon in 2006						74	lines (,000)
Grand Total						*571*	lines (,000)

Note: An average of 0.3 telephone lines per inhabitant was used to estimate the metropolitan requirements.

6. Evaluation of Infrastructure Financing

To approach the topic of the financing a development institution such as the ARI, certain information must be obtained with respect to the different financing alternatives which might be encountered during elaboration of an infrastructure investment plan for the Canal area. However, this process also requires that certain work hypotheses be considered, as follows:

The need for a physical infrastructure must be evaluated according to financial cost/benefit criteria within a socio-economic context; that is to say, community welfare prevails over individual welfare.

It is assumed that the projects identified are of as much interest to the Municipality of Panama City as to the Municipality of Colon and other related government institutions. This is not an extreme hypothesis, considering that the challenge has been presented by the General Plan, which is Law of the Republic.

A third hypothesis refers to the design and cost of the physical infrastructure. It assumes that the designs are those which are necessary to resolve a need that has been felt, and contemplates a reasonable estimate of projection of demand in order to arrive at full capacity. As for costs, these are governed by the 2001 price level for consumables, equipment and other elements. An attempt will be made to cover the majority of the projects under consideration in as much detail as possible, in order to calculate costs for studies, design, construction and conservation.

Currently, the government, including the municipalities, is confronting some very uncomfortable financial situations. Access to financing capital for the development of public infrastructure is a difficult task, which is why new alternatives for financing public projects must be explored.

Throughout the world, long-used mechanisms for private financing of public projects are being reinvented. This initiative permits the public project, of its own accord, to generate sufficient cash to secure recovery of the investment and maintenance of the project in the hands of a private investor. This financing structure is made up of a complex chain of contractual relationships, adapted to the international financial market.

On this premise, an attempt is made to evaluate certain financing mechanisms, accompanied undoubtedly by ordinary budgeting and public credit, which are usually considered to be the program for development of public infrastructure.

6.1 Valorization

The law of valorization clearly states that valorization may be collected only for new projects, and that collection must be initiated within five years of project completion. Projects carried out under the concept of valorization contribution can be found in two governmental institutions, the MOP and the IDAAN.

In the MOP, the valorization contribution corresponds to those real-estate properties which benefit from the execution of public interest projects constructed by the nation, municipalities, and entities turned over to private enterprise, such as: The construction, opening, enlargement, paving and rectification of avenues, streets and roads; the construction, reconstruction or improvement of public plazas; the cleaning and channeling of streams and rivers; the construction of drainage and flood-control projects; the construction of risk projects, and the construction of urban renovation and rehabilitation projects.

The intent of the valorization contribution is to place a temporary obligation (payment is made up front, or during a minimum of one year and maximum of 20 years) on those properties which receive a real economic benefit from the execution of social interest projects for the development of different zones. The Valorization Commission has been created in the Ministry of Public Works, consisting of seven members from the following entities: MOP (presiding member), MIVI, MEF, CAPAC, SPIA, the Legislative Assembly and the Real Estate Owners Association.

The valorization contribution will be divided among those properties which benefit from the construction of a project, proportionate to the increased value these properties acquire or will acquire, within ten years of project completion. Distribution will be among all private properties benefited, excluding State properties with the exception of those belonging to the ARI, since the inter-oceanic area is State property only until transferred to private ownership, and is therefore subject to the valorization contribution.

The total or partial cost of the project will be divided among those properties which are found within the zone of influence, proportionate to the degree to which each property or lot is benefited. The steps which must be completed to carry out a project through valorization contribution are:

- Pre-feasibility study: This study is elaborated by the General Valorization Office of the MOP for the purpose of analyzing the economic and social factors encountered in the area of study, in order to determine the general payment capacity of the property owners and thereby guarantee recovery of the investment. The following points are considered during the development of this study: Project classification, survey of public opinion, basic information, socio-economic survey of the area, Government participation, and preliminary technical studies.
- Presentation to the Valorization Commission: Includes the feasibility study and the declaration of public interest projects.
- Notification to other administrative offices of the MOP
- Notification to the media
- Methodology for calculating the valorization tax
- Notification to property owners
- Collection

This method of financing has an annual budget of approximately US$4 million, identified in the investment budget of the MOP, which amounts to approximately US$200 million annually.

Presently, notable examples of projects carried out in Panama through valorization mechanisms are the Ricardo J. Alfaro Avenue, the widening of 50th Street and Porras Avenue, the Domingo Díaz Avenue, the Maestro community in Colon, and the channeling of Iguana River.

Several valorization projects are planned for the year 2001, such as pedestrian bridges, river channels and roads, to be paid for by merchants as well as property owners. With respect to the payment of the valorization contribution, contributor delinquency is widespread: only 11 percent of the nominal value of completed projects has been recovered.

In the opinion of the Valorization Director of the MOP, valorization has not had wide acceptance within the Panamanian community, as reflected in the high contributor delinquency rate. This same official feels that this form of financing can be applied to areas where greater purchasing power is required and available. Previously, the MOP has approached the ARI for consultation on matters of valorization, and has been told that given the prices paid by residents of the Canal Area, implementation of this financing method is not recommended at this time.

As for the use of valorization to finance potable water and sewer system projects, under Decree Law 2 of January 7, 1997, the regulatory framework of the IDAAN is established and authorization is given to apply valorization charges, in accordance with article 38 of said law, in which this faculty is defined.

The nature and cost of the project are determined by the community to receive the service, and, through a valorization study which is generally supported by the individual areas of the properties involved, distribution of the tax in proportion to said areas is established. This process is presented to the Board of Directors, which issues a resolution of approval. This resolution of approval is then submitted to the Regulatory Entity for Public Services, in order for a resolution to be emitted which instates the financing of the project through the valorization system; notification is then given to the press and in a public place for a period of 90 days, stating the terms for presentation of claims pertinent to the resolution on distribution of the valorization tax.

Contributors generally meet their obligation in one of five ways, varying from payment up front to payment by installments for up to 20 years. In the event of non-payment, judicial coercive action is applied which usually ends with an agreement between the parts; otherwise, public auction of the property is carried out.

Numerous examples of projects carried out under this system exist, such as the extension of 78th Street in Lefevre Park, and others in Chorrera, the Valley of Anton, the Las Tablas sewer system, David, Santiago and La Arena, in the Herrera Province.

In the inter-oceanic area, the IDAAN has invested in the construction of a 10-inch potable water pipeline for the National Stadium at a cost of US$349,989, which was charged to the IDAAN's budget.

No valorization projects have been budgeted for 2000 and 2001, while collection on previous projects has been set. One of the problems encountered is that no certificate of good fiscal standing is required for the sale or purchase of property.

In the Canal Area, mechanisms have not been established which would enable the IDAAN to apply valorization criteria to reverted sewer and potable water systems that present high maintenance costs due to their age. In addition, valorization charges are difficult to collect when considering the high price owners have paid for their properties.

The existence of this system in the IDAAN is advantageous, as it brings their experience in potable and waste water together with the dynamics taught by the valorization section in charge of applying the valorization system.

6.2 Trust

The trust is a juridic act by which a person called the fideicommissioner transfers properties to a person called the fiduciary, to be administered or disposed of in favor of a fideicommissary or beneficiary, who can be the same as the fideicommissioner.

Contrary to the majority of contracts involving only two parties (buyer and seller, renter and tenant, donor and beneficiary), in this figure there are four parties, which are:

- The constituent, fiduciant or fideicommissioner
- The fiduciary proprietor
- The beneficiary
- The fideicommissary

In a juridic act protected under Law 1 of 1994, which does not contemplate the participation of any public institution, this mechanism is considered to be a way to implement infrastructure projects.

Following is a description of the function of each of the parties involved:

The constituent or fiduciant is the person who, as the original proprietor, sets up the trust, transferring his property or domain, which then becomes a fiduciary domain.

The fiduciary proprietor is the person to whom dominion of the item (such as a piece of real estate) is transferred. However, unlike the recipient in a regular property transfer, the fiduciary proprietor is in reality an administrator of this property, from which he obtains no benefits other than the honoraries he might receive for his administrative services. This service is not carried out for his own benefit, but for the benefit of the third party in the trust, the beneficiary.

The beneficiary, as the name indicates, does not claim ownership of the property, but benefits from the income produced through exploitation of the same, after deduction of costs. Since he will be the one benefiting from the administration of the property for as long as the trust lasts, he has full power to demand that this administration be performed correctly, and to exercise control over the fiduciary proprietor. The beneficiary can be a third party, the constituent (who would hand over the property to be administered in his benefit) or the fideicommissary.

The fideicommissary is the person to whom, after a certain period of time or upon fulfillment of a specific condition, the fiduciary proprietor will transfer dominion of the property. For the

fideicommissary the transfer will be of full dominion, as opposed to the very restricted dominion of the fiduciary proprietor, who is merely an administrator with very special characteristics granted by law. It must be remembered that this institution is successive in its dealings, that is to say, it develops over time, which is why the fiduciary proprietor administers in benefit of the beneficiary for as long as the trust may last, and it is only when this ends that full dominion is transferred to the fideicommissary.

Another characteristic of this old-new figure is that it has a limited period of duration, which the law establishes as a maximum of 30 years or the lifetime of the beneficiary, should the latter be mentally incompetent.

With respect to the fiduciary proprietor, the trust creates a patrimony known as the "patrimony of affectation," which is separate from the patrimony of both the constituent and the fiduciary proprietor, and of the beneficiary and the fideicommissary. This means that the properties held in trust will not answer for the debts of anyone, and will be affected only to the extent of the purpose for which the trust was created, responding only for those expenses and debts derived from the administration of said properties. This provides great security to all parties involved in the figure, since, in principle, nothing can affect the development and achievement of the ends sought when the trust was established.

What purpose do trusts serve with respect to the ARI? The trust is applicable as a juridical financial instrument. In certain business transactions, is provides great security to the parties involved. An example: The ARI owns a piece of land and contracts a company for construction of a building on this land; in payment for the lot, the constructors will carry out certain public infrastructure projects.

To provide security to both parties, the owner of the lot transfers fiduciary dominion to a fiduciary proprietor, who, in return for compensation, assumes control of the project, and, once construction conditions are completed in the stipulated time period, confers the Regulations of co-propriety, and transfers to the constituent (original proprietor) the convened projects, and to the construction company, or to whomever the latter definitely indicates (by the buyers of the other units), title to the rest of the building. Meanwhile, neither bankruptcy nor insolvency of the original proprietor, the construction company or the fiduciary proprietor, will affect the objectives of the trust, since the debts of these individuals cannot be applied to the entrusted property. In this way, all parties are assured that the business transaction will move forward. What's more, the buyers, as future fideicommissaries (if so established in the contract) will also be safeguarded from the economic misfortunes of the proprietors, constructors, etc., facilitating their investment by reducing risk.

Even though the ARI has not defined this figure, in that it can only grant concessions, sell or rent, and place the funds thus acquired into a trust fund, the figure should be utilized from a different perspective, attempting to adapt it to the law which regulates ARI's actions.

6.3 Concession

Concession is applied to the construction, improvement, maintenance, conservation, restructuring and exploitation of infrastructures such as roads, highways and others which the Cabinet Council considers to be in the public interest. Only those projects which redound to the benefit and interest of the national collectivity, implying an improvement of a permanent nature and for public use, and which will be constructed on property belonging to the nation or to be expropriated or purchased by the nation, are considered to be in the public interest.

With respect to the law of concessions relative to public roads, only the MOP, which possesses the legal competence, is considered to be a conceding entity.

The objective of this section is to present the strengths and risks inherent in a concession contract, from the perspective of the state and of the concessionaire. The correct distribution of risks between a state which seeks the culmination of a socially and privately productive project, and private investors willing to carry out the project in return for certain benefits, is essential to the success of the concession.

The concession figure is the result of a shortage of state funds. What's more, the existence of a growing demand for, and dissatisfaction with, the use of fiscal funds assigned to projects of this nature, has determined the need to incorporate the private sector in infrastructure projects.

The concession is a contractual mechanism by which the state (conceder) confers to natural or juristic persons (concessionaires) the right to provide a good or service of a public nature, following approval by the Cabinet Council and adhering to the dictations of Law 5 of 1988, Articles 7–13.

One of the most common forms of participation by private enterprise in concession projects is that of build-operate-transfer (BOT), in which the government grants concession of projects that are carried out with the property and financing of the private sector, which in return receives the income generated by said projects during the term of the concession; once the concession expires, both ownership and operation are transferred to the state. Several variations on this system exist, such as build-lease-transfer (BLT) and rehabilitate-operate-transfer (ROT). Another method is that of build-own-operate (BOO), similar to BOT, except that ownership and operation remain in the hands of the investors for a period of time. This system was popular in Panama during the years 1993 and 1994, with concession of the North Corridor to the ICA Company and the South Corridor to the PICSA Company, yielding good results.

One of the main advantages in granting a concession contract centers on its capacity to artificially generate market competition for those projects or activities which present monopolistic traits.

Additionally, in cases where assets would be difficult to privatize, particularly when dealing with public space, concessions permit access by private agents for the provision of infrastructure and services, without compromising the ownership of the property.

It should also be mentioned that the concession contract is highly flexible, permitting interaction between private interests and the state, such as the participation of different financing agents,

which is in turn related to the development of the local capital market. In a concession program, three types of national financing agents are involved or are susceptible to becoming involved: a) private investment societies, b) banks and c) institutional investors (pension fund administrators, insurance companies and investment funds).

Pension Fund Administrators, in particular, have been intervening in infrastructure financing in Chile, Argentina and Colombia, through indirect investment mechanisms such as the acquisition of shares issued by the Investment Funds for Business Development (FIDE in Spanish) and of bonds or other public instruments issued directly by the conceding society and placed in public offering (infrastructure bonds).

The investment of pension funds in infrastructure assets could be considered to provide important benefits to these projects, such as a reduction in capital costs and political risk.

In a concession contract, it can be observed that diverse financing agents interconnect and new financing instruments are adopted, resulting in the development and energizing of capital markets.

The concessionaire, as a private investor who participates in concessions with the aim of maximizing his returns, confronts a variety of risks which can be classified as investment, operating, financial, income, systematic and institutional risks.

There are two kinds of **investment risks**: going over the budget and going over the allotted time (delays). In both instances, the investors must cover these risks. **Operating risks** will depend on the type of project, and are associated mainly with the flow of income. **Financial risks** can be related to variations in interest rates, type of exchange, the presence of inflation and the debt-capital structure which concessionary societies manage.

Income risks for the concessionaires are associated with quantity and price. In the case of road construction, the income risk is related to projections for demand, since income for a given period depends on the amount of traffic on the road.

On the other hand, **systematic risks** are those presented by the economy in its totality, and cannot be diversified. While it may be true that all economic activities are vulnerable to this type of risk, not all sectors experience the same degree of exposure. Finally, **institutional risk** is closely related to the subject of tributary changes or alterations in the regulatory framework. These create great uncertainty, thereby discouraging investors.

The state, upon conceding an infrastructure project, confronts the following types of risks: Social dis-investment, political, definition of the business, concessionaire failure, and concentration of the property of the concessions, among others.

The existence of a differential between private and social objectives, called **social dis-investment risk**, could introduce distortions in investment totals. In other words, to invest when it is privately but not socially profitable, or not to invest when it is socially but not privately profitable. **Political risk**, on the other hand, is mainly associated with the possibility that the concession system will not be validated by state counterparts, i.e., investors and users.

The incorrect organization of an infrastructure project can produce over or under-assessment of the guarantees offered or of the subsidies required. This is known as a **risk of error in the definition of the business**.

Finally, the **concentration of the property of the concessions** could place the competitiveness of public bidding at risk, canceling out one of the main strengths of concessions. At the same time, it could result in the concessionaire having excessive power in negotiations with the state.

In the matter of fiscal incentives, a series of benefits are granted to concessionaires, financing entities and shareholders, which usually assist concessionaires considerably in attracting investors.

6.4 Privatization

The goal of privatization is to satisfy the demand for public services, promoting the expansion, modernization and uninterrupted operation of services, and creating new services under the criteria of economic efficiency, financial viability, quality and reliability, as much for urban areas as for rural, while at the same time respecting the norms for environmental conservation.

The Legislative Body is responsible for approving legislation covering the respective services, and will entrust the power to grant concessions derived from these laws to the political commission of a regulatory entity, or to the Cabinet Council.

This procedure stems from the need to provide a service, to be presented for the consideration of the legislators of the Republic, who by law provide the specifications for the privatization of a service, the procedures to be carried out and to whom the privatization will be entrusted.

In the area of public physical infrastructure, privatization has been implemented in Panama for the sectors of electric power and telecommunications. It commenced in February of 1996 with privatization of telecommunications and in February of 1997 with the public electric power service. Telecommunications were handed over to Cable & Wireless, which improved on the previous system at the cost of increased rates.

In the case of electric power, distribution was awarded to two concessionaires: EDEMET EDECHI for the Western sector as far as Chiriqui, and Elektra Noreste for the metropolitan area. ETESA, which is state property, continues to be the only company providing transmission of electric power in Panama. However, the generation of electric energy remains, for the most part, in the hands of private companies.

A calm analysis of the advantages points to a series of reasons for continuing with privatization of State assets, that is to say, the sale of public companies, principally the monopolies.

First, privatization permits the introduction of competition in situations where state monopolies exist. In principle, where there is competition the consumer comes out ahead, since the companies which provide the services and products must be efficient, passing greater advantages on to their customers. With monopolies, the user or consumer must accept what is provided by the only company offering the product or service; no options exist for comparison shopping.

Upon transferring public companies to the private sector and breaking up monopolies—opening the market—new firms will appear on the scene to compete, revitalizing the national economy through increased job opportunities and a greater variety of products and services.

Also, once state-owned companies are sold and handed over to the private sector, they will be required to pay taxes. With more tax revenues, the state will have access to additional funds with which to meet its many obligations. All of these are costs which in the end will be paid by private enterprise, which always measures profitability when undertaking investments, therefore great care is taken when incurring expenses; if production or operating costs are too great, the company could be forced out of the market.

Another aspect worth mentioning refers to the agility or capability to stay on top of technological advances. State-owned companies have been known to lag behind in a world where globalization demands that they remain up to date.

This disparity has served to discourage international companies which come to investigate the possibility of setting up installations. When they find key services to be lagging behind or deficient and provided at very elevated costs—much higher than in other nations—these companies choose to locate elsewhere, denying the country the opportunity for additional wealth and employment.

6.5 Bonds

Bonds are instruments or credit documents issued to the bearer for the financing of projects. They must comply with the requirements established by law and use as their vehicle the Panamanian Stock Exchange, for which proof of the company's solvency in responding to the debt, as well as adequate credit references, are required.

The Stock Exchange is an anonymous society dedicated to the operation of a precise, safe and efficient system of custody, compensation and liquidation of securities, in order to promote the adoption and use of procedures regulated by international norms, such as integration with national and foreign securities centers.

The Security Exchange Commission (CNV) of the Ministry of Commerce and Industry authorizes the establishment of security houses and the stock exchange in Panama, at the same time promoting their entrance into the Securities Market Registry upon verification that they have been set up for the purpose contemplated in Decree Law 1 of June 8, 1999, which requires a minimum patrimony of US$10,000.

To date, the number of memberships issued is 154. It was founded in 1989 and began operations on June 26, 1990. On the other hand, the number of stock brokerage houses functioning in this market is 17, operating through 65 authorized stock brokerage agents.

The securities negotiated in the versatile Panamanian market are: public investments, state bonds, electrification, *agravios*, bank guarantees, urban renovation, provision of services, company bonds, commercial papers from different businesses.

In the Panamanian Stock Exchange, the securities negotiated are basically medium to long-term (bonds of 2- to 20-year duration), with a greater incidence of 5- and 10-year terms, a substantial number of which are guaranteed through the mortgage portfolio. Corporate bonds are also negotiated; nevertheless, state bonds exist related to the restructuring of the public debt, which were issued in 1990.

The Exchange has handled the issuance of bonds for the development of projects based on concessions (Hotel Decameron). To this effect, the concession is established as the guarantee, and proof of the company's solvency to respond to the debt, as well as adequate credit references, are required.

As a financial strategy, it is not recommended that shares be issued for companies that are initiating operations; in their absence, it is preferable to finance through bonds. The creation of a trust on the part of the issuer constitutes a back-up mechanism for repayment of a bond issuance.

Insurance companies are very important investors within the Exchange, as they possess available funds which are basically for investment in long-term bonds. In the future it will be both possible and viable to issue urban and municipal development bonds with State backing, subject to the reforms being carried out relative to Law 106, which governs municipal administration.

As a mechanism for infrastructure financing, the issuance of bonds must rely on a tributary incentive such as that employed by the Bern Company in the development of the Gamboa tourist project, for which Law 8 of June 14, 1994, creating tourism incentives, permitted fiscal exemptions of up to 50%, according to a transitory article which won out on January 1, 2000. In this way, they were able to place a 15-million-dollar issuance quickly and to the advantage of those who intervened in the process, and to the government, which obtained a tourism development capable of generating employment and tax income.

In this sense the state can also obtain income through the issuance of bonds. It is the competence of the Cabinet Council to organize public credit, acknowledge the national debt and arrange for its management, as established in clause 7 of article 195 of the Constitution of the Republic of Panama. By said virtue, it is the Cabinet Council's responsibility to authorize the title of public debt in order to organize public credit. For this reason, each issuance of public debt bonds is regulated through Executive Decrees which define the financial conditions of this instrument, which is generally characterized as a long-term document, usually with fixed rates and periodically-defined interest payments.

Among the most recent operations carried out by the national government is the acquisition, on the part of the Social Security Administration (CSS), of state bonds for a total of up to 130 million dollars, at a fixed annual interest rate of 8.5 percent, payable by semester and expiring in 12 years, by the favorable opinion of the Cabinet Council.

Also, at the start of the year 2000, the CSS, with funds from the Program for Incapacitation, Old Age and Death, acquired state bonds for up to US$235 million, "to finance public social-interest and human resource investments," after the Cabinet Council published Resolution No. 2 of January 5, 2000, in the Official Gazette, authorizing the initiative.

The following are among the advantages to be found in using bonds as a mechanism for financing infrastructure projects:

- They represent an excellent mechanism for obtaining resources of significant value, taking into consideration the need for funds which are managed in Panama to deal with insurance, reinsurance, handicapped, elderly and death programs, banking sector programs and foreign monies, which require reliable placement, for which reason the State needs to pass laws to provide incentive for this type of investment.
- The Panamanian Stock Exchange is equipped to carry out this type of transaction, which encourages interest on the part of international capital, because it is basically private in nature and adheres to the standard norms adopted by other exchanges worldwide.
- The success of the Bern Company in collecting money and investing in the Gamboa tourist complex is an example which gives credibility to the use of this mechanism for the development of other infrastructure projects in the reverted areas.

Among the disadvantages are:

- It is necessary for the bond issuer to have the trust of the community in order to achieve the necessary investments for development of the project.
- Investments carried out with collected monies generally do not produce medium-term credits. The development of the inter-oceanic area requires foreign investors or tourists, for which reason a parallel plan to attract them should be drawn up.
- It is an instrument that requires cash money, a situation that attracts undesirable money-laundering operations.

6.6 Private Development

The private development mechanism works by handing over a parcel of land to a private developer so that he can incorporate the needed infrastructure projects and carry out the permitted constructions, which he will then lease to third parties. After a pre-determined grace period, he must pay the ARI to lease the parcel of land, deducting at this time the value of the investment made in infrastructure.

This ARI/Private Contractor leasing contract is established for a deferrable period of from 20 to 40 years; therefore, the private developer must include as part of the management of the project's income-yielding potential, the delivery of the improvements constructed on the parcel of land, for which he has no right to retribution, with the exception of the retribution agreed upon for the investment made in infrastructure.

This procedure is carried out by the ARI in accord with the properties sold, conceded, leased or handed over by direct contract. All of these adapt to the modalities defined in Article 13, Numeral 4, of Law 5 of February 25, 1993, in which the modality for the method of disposition of the reverted property is established: Sale, concession, leasing or direct contract.

Each of these modalities for disposition of property must adapt itself to the specifications found in Law 56 of December 27, 1995, by which Public Contracting is regulated. Protected under the

situations contemplated in Law 56, with modifications in Executive Decree 18 of January 25, 1996, Law 56 of July 25, 1996, Decree Law 7 of July 2, 1997, the governmental instances of approval will correspond to the values according to the following types of contracts: Direct contracting, contracting through public acts, contracting of government loans (bonds, promissory notes and other state securities, rentals and donation).

The procedures are carried out in accordance with the value of the contract, taking into account Law 56 of December 27, 1995. An illustrative summary follows.

For minor contracts and price requests:

Value of Contract	Entity responsible for giving approval or acceptance
Less than US$10,000	Contracting entity, with final approval by a functionary of the Office of the Comptroller
Greater than US$10,000 and less than US$250,000	Contracting entity, with final approval by a functionary of the Office of the Comptroller

For public contracts:

Value of Contract	Entity responsible for giving approval or acceptance
From US$250,000	Ministry of Economy and Finance
Greater than US$250,000 but less than US$2 million	National Economic Council (CENA)
From US$2 million and over	Cabinet Council, with prior approval by CENA

A classic example of this modality is the operation carried out with Constructora Los Pueblos, S.A., through leasing contract #246-97, and Inmobiliaria Albrook, S.A., through contract #262-99. The first was contracted for construction of a Commercial Center designed for the provision of services and the sale of goods in both the national and export markets. The second contract is for the construction of the road sections needed for access to the Commercial Center and the Transportation Terminal.

6.7 National Budgeting through the Andean Development Corporation

In late 1997, a programming mission from the Andean Development Corporation (CAF) paid a visit to Panama, more specifically to the ARI, for the purpose of identifying the infrastructure investments required by the institution in accord with the guidelines of the General Plan for the Use, Conservation and Development of the Canal Area.

Technical consultation with the Ministry of Public Works (MOP) was also carried out. In view of the fact that this ministry is in charge of executing road projects, the ARI and the MOP make joint field visits to identify the projects to be considered for this program. For this reason, in addition to

the projects in the reverted areas, the program includes the rehabilitation of numerous streets in Panama City.

In January 1998, the Panamanian Cabinet Council approved the signing of a loan contract between the Republic of Panama and the CAF, in the amount of US$60 million. The objective of this loan is to carry out a Road Restructuring Program in the Inter-oceanic Corridor of Panama. Said loan will be for a period of ten years, including a grace period of three years and six months from the moment the contract enters into effect.

The fundamental objective of the Program is to provide support for the efforts made by the Panamanian Government to improve the road infrastructure needed for the efficient connection of the Multiple Inter-oceanic Corridor with the ports and airports located on the Pacific and Caribbean coasts of Panama (table 6.1).

Table 6.1 Projects of the Road Restructuring Program

Project	Total Cost (US$ thousands)	Status
New alignment of Omar Torrijos Ave.	2,225.25	Project completed
Omar Torrijos Ave. Interchange	30,837.75	Under construction
Construction of Albrook Corozal Section	5,179.87	Public bidding pending
Widening of Ascanio Arosemena Ave. (Roosevelt)	1,873.57	Under construction
Widening of Amistad Road	2,660.69	Public bidding pending
Phase II, Marginal Ave. to East Airport of Albrook	2,788.31	Public bidding pending
Rehabilitation of Randolph Ave. (Coco Solo Sector)	2,222.33	Constructed
Total	**32,200.00**	

Additionally, the program includes investments in the amount of US$27.8 million in contributions by the CAF for rehabilitation of the pavement of the streets of Panama City and Colon. To sum up, the program includes direct project costs, engineering costs, unforeseen expenses, pay scales, environmental budget and expenses incurred during the construction stage. The streets of Panama City and Colon were given execution priority, causing delays in the projects for the reverted areas.

Use of this mechanism is limited by the fact that it involves public debt; the authorities in charge of managing the nation's credit are interested in reducing indebtedness to zero in terms of fiscal debt, which is currently at 1 percent.

6.8 National Budgeting with the IDAAN

Investment projects for the Canal Area have not been carried out with the IDAAN. In meetings held with functionaries of this institution, it has been pointed out that the IDAAN confronts serious restrictions with regard to new investments for 2001. Consequently, the limited resources

available are designated for maintenance of the potable water systems and sewer systems of Panama City and Colon.

6.9 Development through Leasing or Concession (Impact Fee)

This mechanism was adopted by the ARI for the establishment of leasing or concession. The ARI receives base and variable income through the leasing of lots, and also exacts additional income to amortize the required infrastructure investment, for which the ARI endorsed a mortgage credit with the banking sector.

The ARI took the initiative in developing investments for the potable water system, sewer system and treatment plant of the Amador tourist project, through a financial operation with the National Bank of Panama. By this modality, each of the Amador area property owners pays a leasing or concession fee, including a sum of money which is applied to the cost of the physical infrastructure projects developed by the ARI for this tourist project, comprising the Naos, Perico and Flamenco Islands, among others.

The financing procedure described above is similar to the valorization mechanism, since each of the beneficiaries pays for improvements to the concession in proportion to the benefits they will receive from the infrastructure investment carried out by the ARI. This investment was distributed among the renters in proportion to the area of the lot received in lease or concession.

In the Amador tourist project, US$62 million was invested according to the respective contracts, in order to provide adequate infrastructure corresponding to 100 percent. This process had all of the characteristics for success; however, of the list of potential projects, only a small group of investors has complied with the agreement.

In spite of punitive clauses in the event of non-fulfillment, the guarantees agreed upon were very low in comparison with the opportunity cost of the money invested for infrastructure, leading to the current need to replace the investments which have withdrawn.

6.10 Annual Budgeting of the ARI

The prevailing situation in the country with respect to the rate of economic growth—that of two years ago and the projected rate—the limitations of the local market, as well as the deceleration of the principle world economies, among other factors, restricts the possibilities for designating resources for physical infrastructure investments in the Canal Area.

With this modality, the projects must be contemplated in the budget of the ARI, the entity to which they legally correspond; if the ARI does not incorporate a project into its budget, the project is no longer in effect for that year in particular. For this reason, lobbying at the different administrative levels is recommended in order to accomplish the required projects.

Among the additions made to the laws of the inter-oceanic area is Law 9 of January 22, 1998, by which administrative and economic measures are adopted in order to resolve urgent situations in the Canal Area. In Numeral 3 of this law, which modifies Numeral 2 of Article 1 of Law 20 of 1995, it is established that “Proceeds from sales conducted by the ARI, after deduction of a

portion which is to be applied to the operating costs of the Authority, the maintenance of reverted properties and investments in infrastructure, “will be determined and consigned annually in the Income and Expense Budget of the Institution.” By this means, it is established that the ARI may include physical infrastructure investments in its annual budget, duly approved in the Annual Budget Law issued by the state.

7. Technical Profiles by Infrastructure Sector

Based on the investigations and observations carried out by the study team, infrastructure sectors which are required for the advantageous use and economic development of the Canal Area are described: potable water, waste water, storm drainage, solid waste, roads, electric energy and telecommunications. The aspects covered below refer to existing conditions, current and programmed investments, and the present and future requirements for each infrastructure sector.

7.1 Potable Water

7.1.1 Current Conditions

There are two water treatment plants in the Canal Area: Miraflores, in the Pacific subregion, and Mount Hope in the Atlantic subregion, with their respective pumping stations, storage tanks, and adduction, conduction and distribution lines. Both treatment plants were constructed between the years 1913 and 1915.

The capacity of Miraflores was 20 million gallons a day (MGD) until it was enlarged, between 1945 and 1950, to increase capacity to a maximum of 41 MGD. Currently, it produces 47 MGD. This plant supplies Panama City and part of the district of Arraijan. The capacity of Mount Hope was 15 MGD in 1915; it was enlarged in 1982 to produce 20 MGD. Currently, it produces 23.4 MGD. This plant currently supplies the city of Colon and neighboring areas, as well as the reverted communities from Margarita to Sherman.

Raw water to be treated at the Miraflores plant is taken from the Canal in the area of Paraiso. There is an alternate intake in Gamboa, originally constructed along with the plant. The intake of raw water to be treated at Mount Hope is located on Lake Gatún (Fort Espinar) and reaches the plant by gravity. Following is the total daily production of potable water for the Miraflores plant for the year 1994, as well as the percentage per user. An estimate of the population served is included.

Table 7.1 Daily Water Production for the Miraflores Plant

User	Production (MGD)[a]	Percentage of Total	Population Served[b]
Panama and Arraijan	37,503	80	300,024
Canal Area	5,921	13	47,368
ACP	3,419	7	27,352
Total	**46,843**	**100**	**374,744**

a. Information provided by ACP maintenance personnel.

b. A per capita daily consumption of 125 gallons was used to estimate the population served by the Miraflores treatment plant, in accord with criteria established by the IDAAN.

The communities served by the Miraflores treatment plant are:

East Pacific Subregion: Amador, Ancon, Balboa, Clayton, Corozal, Curundu, Diablo Heights, Los Rios and Quarry Heights.

West Pacific Subregion: Cocoli, Rodman, Howard, Kobbe, Farfan, Arraijan and communities bordering the Pan-American Highway.

Central Subregion: Gamboa, Paraiso, Pedro Miguel and Summit.

Table 7.2 Daily Water Production for the Miraflores Plant, 1994

User	Production (MGD)[a]	Percentage of Total	Population Served[b]
Colon	20,339	86	162,712
Canal Area	1,549	7	12,392
ACP	1,549	7	12,200
Total	**23,413**	**100**	**187,304**

a. Information provided by ACP maintenance personnel.

b. A per capita daily consumption of 125 gallons was used to estimate the population served by the Mount Hope treatment plant, in accord with criteria established by the IDAAN.

Source: General Plan, Intercarib/Nathan Associates, Inc.

The communities served by the Mount Hope treatment plant are:

East Atlantic Subregion: Cristobal, Colon, Mount Hope, Arco Iris, Davis, Espinar, Gatun, Margarita, Coco Solo and Galeta Island.

West Atlantic Subregion: The system's only user is Fort Sherman.

Table 7.3 Aqueduct Network by Subregion and Pipe Diameter (km)

	Distribution pipes			Conduction pipes[a]			
Subregion	**6" Diam.**	**8" Diam.**	**10" Diam.**	**12" Diam.**	**16" Diam.**	**20" Diam.**	**30" Diam.**
East Pacific	69.40	41.28	10.87	29.46	17.84	11.67	36.41
West Pacific	23.72	22.14	6.83	30.67	4.18	–	–
East Central	13.20	3.08	1.05	0.43	2.55	–	–
East Atlantic	29.44	18.51	17.42	30.11	11.64	6.20	9.04
West Atlantic	6.44	9.06	–	2.26	–	–	–
Total	**142.2**	**94.07**	**36.17**	**92.93**	**36.21**	**17.87**	**45.45**

a. 30" adduction pipes proceed from the intakes of Gamboa and Paraiso (Pacific) and Espinar (Atlantic).

Source: ACP, General Plan, Intercarib/Nathan Associates, Inc.

Per capita consumption in the urban areas is 80–125 gallons per day per inhabitant, according to the IDAAN. In the suburban areas, consumption is approximately 60 gallons per day per inhabitant.

An analysis was made of the potable water storage tanks that exist in the Canal Area, taking capacity and location into account. The Pacific subregion possesses the greatest installed capacity with approximately 17.7 million gallons distributed among 18 tanks, representing 65 percent of the total number of tanks in the inter-oceanic area. Eighty percent of the Pacific subregion's storage capacity is located in the Eastern subregion, distributed among 12 tanks.

In the Canal Area there are 24 potable water pumping stations, eight of which are located in the East Atlantic subregion; the rest are distributed in the Central and Pacific subregions, where eight raw water pumps are also installed. In the Atlantic subregion the system functions by gravity.

The capacity of the potable water pumping system is around 84,500 gallons per minute; for the raw water pumps it is 64,400 gallons per minute.

Table 7.4 Potable Water Storage Tanks

Subregion	Sector	Quantity	Capacity (gal. x 10^6)	Total (gal. x 10^6)
West Atlantic	F. Sherman	2	0.8	1.5
	Subtotal	2		1.5
East Atlantic	Mount Hope	2	1.0	2.0
	Gatun	2	0.5	1.0
	F. Espinar	1	2.3	2.3
	F. Espinar	2	0.5	1.0
	Subtotal	7		6.3
East Pacific	Miraflores	1	0.3	0.3
	Miraflores	1	0.7	0.7
	Miraflores	1	0.8	0.8
	Clayton	1	0.8	0.8
	Cerro Ingenieros	2	1.5	3.0
	Albrook	1	0.8	0.8
	Balboa (Chorrillo)	2	2.4	4.9
	Balboa (Heights)	1	2.4	2.4
	Cardenas	2	0.3	0.5
	Subtotal	12		14.2
West Pacific	Cocoli	1	0.7	0.7
	Howard	1	0.7	0.7
	Howard	1	0.7	0.7
	Rodman	2	0.7	1.4
	Palo Seco	1	0.001	0
	Subtotal	6		3.5
Central	Gamboa	1	0.7	0.7
	Summit[a]	1	0.8	0.8
	Paraiso	1	0.3	0.3
	Subtotal	3		1.8
Total		**30**		**27.3**

a. This tank stores raw water proceding from the Gamboa water intake.

Source: ACP General Plan, Intercarib/Nathan Associates, Inc.

Table 7.5 Pumping Stations and their total capacity in the Canal Area

Subregion	Sector	Type	Number of pumps	Flow (gal/min)	Capacity (gal/min)	Destination
Atlantic	Mount Hope	Potable	2	1,900	3,800	Gatun
	Mount Hope	Potable	1	4,750	4,750	F. Espinar
	Mount Hope	Potable	2	4,000	8,000	Tanks, East and West Colon
	Mount Hope	Potable	2	5,000	10,000	Tanks, East and West Colon
	Mount Hope	Potable	1	4,750	4,750	Tanks, East and West Colon
	Subtotal		8		31,300	
Central	Paraiso	Potable	2	1,100	2,200	Gamboa, Paraiso
	Paraiso	Raw	2	7,500	15,000	Plant-Miraflores
	Paraiso	Raw	2	13,000	26,000	Plant-Miraflores
	Gamboa	Raw	1	4,200	4,200	Plant-Miraflores, Tank-Summit
	Gamboa	Raw	3	6,400	19,200	Plant-Miraflores, Tank-Summit
Pacific	Subtotal	Potable	2		2,200	
	Subtotal	Raw	8		64,400	
	Miraflores	Potable	1	4,300	4,300	Treatment Plant/Lavado
	Miraflores	Potable	2	3,000	6,000	Cocoli, Rodman, Howard
	Miraflores	Potable	1	3,500	3,500	Albrook, F. Espinar
	Miraflores	Potable	1	3,800	3,800	Cerro Ingeniero
	Balboa	Potable	1	4,750	4,750	Panama/Roosevelt
	Balboa	Potable	2	4,000	8,000	Panama/Roosevelt, Tan. Ing.
	Balboa	Potable	3	4,600	13,800	Tank Chorrillo, Balboa
	Balboa	Potable	1	1,400	1,400	Panama/Roosevelt
	Los Rios	Potable	1	3,000	3,000	Albrook, Cerro Ingeniero
	Los Rios	Potable	1	2,400	2,400	Albrook, Cerro Ingeniero
	Subtotal		14		50,950	
	Total	**Potable**	**24**		**84,450**	
		Raw	**8**		**64,400**	

7.1.2 Current and Programmed Investments

With the current capacity of the treatment plants and a normal per capita consumption, as well as system losses within a permissible range, the current population should have its needs adequately supplied. The deficit that exists in the Canal Area water supply is due to a lack of measurement, and of maintenance of the distribution network.

Following is a summary of the projects currently in the planning stage which could affect the different subregions of the Canal Area:

East Atlantic Subregion. The Sabanitas treatment plant located in this subregion supplies the communities of the Sabanitas area along the Transisthmic Road, as well as the communities along the road going towards Maria Chiquita. The Mount Hope and Sabanitas treatment plants are interconnected by a 16”-diameter pipeline which runs the length of the Transisthmic Road from Cuatro Altos to Sabanitas. This plant is being enlarged to produce 12 MGD in December of 2001, increasing total production for the Atlantic subregion to 36 MGD.

East Pacific Subregion. The IDAAN uses approximately 36 MGD of the total production of the Miraflores plant to supply certain areas of Panama City (El Chorrillo, San Felipe, Santa Ana, Calidonia, Curundu and Bella Vista), as well as the Canal Area communities, the port of Balboa and other installations administered by the government of Panama. Of this volume, some 8.3 MGD are designated for supply to the district of Arraijan. This is achieved by pumping water directly from the plant to the east shore of the Canal through a 24”-diameter pipeline, which divides into two 18”-diameter lines to cross the Canal, and then continues again along one 24”-diameter line until reaching the Arraijan overpass. The neighborhood of Bella Vista over to the area of Tocumen is supplied by the Chilibre treatment plant, which has a current production capacity of 122 MGD. The studies and plans for its enlargement have been prepared, with the intent to increase production to 135 MGD. Additional plants found in the East Pacific subregion are those of Cabra River, Mañanitas, Villalobos and Pacora, which supply part of Tocumen and Pacora.

The study made of the Amador tourist complex determined that 6 MGD are necessary to cover the needs of total occupancy. The complex would be supplied by the Miraflores treatment plant, based on improvements to the existing plant and the installation of new conduction pipes.

West Pacific Subregion. The treatment plant of Chorrera, located in this subregion, supplies the district of La Chorrera with a current production capacity of 8 MGD. This plant is being enlarged to produce 10 MGD. In addition, consideration has been given to the construction of a treatment plant in the Laguna Alta area, drawing water from Lake Gatun, to generate 15 MGD in the initial phase and a maximum of 20 MGD by the year 2015, in the second phase. This would provide a supply as far as the Arraijan area, interconnecting with the Miraflores and Chilibre plants, to achieve a grand production total of 219 MGD. These projects for plant enlargement are accompanied by increases in the storage tanks, conduction lines and new interconnections, with the goal of increasing flow in the different distribution points throughout the city.

Table 7.6 gives a summary of current treatment plant production, current production capacity, the capacity to which each plant will be increased and the operating year for enlarged plants.

Table 7.6 Current and Planned Capacity for Atlantic and Pacific Water Treatment Plants

Plant	Current Production (MGD)	Current Production Capacity (MGD)	Capacity after Enlargement (MGD)	Operating Year after Enlargement
Miraflores	48	48	70	2005
Chilibre	122	122	135	2005
Laguna Alta[a]	15	15	20	2004
Chorrera	8	8	10	2002
Villalobos	2	2	–	–
Mañanitas	2	2	–	–
Cabras	2	2	–	–
Pacora	2	2	–	–
Gatun	0.5	3	–	–
Sabanitas	6	6	12	2001
Mount Hope	22	22	–	–

a. Under construction.

Source: IDAAN

7.1.3 Conclusions

Enlargement of the adduction and conduction lines is required in order to increase treatment plant capacity. Enlargement is also needed for the raw water intakes, as well as for all of the plants' unitary potabilization processes. To achieve this, it must be determined whether sufficient physical space is available at the intakes and in the plants, and whether the cost of enlarging these old plants is sufficiently attractive, versus construction of new plants with modern systems.

The adduction lines have been in service for several decades: The lines from Gamboa to Miraflores and from Espinar to Mount Hope have been in service for 80 years, the line from Paraiso to Miraflores, 46 years. Most of the potable water conduction and distribution lines in the areas of civilian population within the area of study have been in service for 80 years.

Conduction pipes (10–30 inches in diameter) of both the Pacific and the Atlantic areas appear to be in good condition; incrustations have not been encountered during segment repairs. The valves, however, present operational problems in spite of receiving good maintenance, and are currently being replaced. The plan is for at least half of these to be replaced with butterfly valves.

Some potable water distribution pipes have presented incrustations when removed for repair, but they do not present capacity-related problems due to the fact that the soil uses (demand) have not changed substantially since their construction.

The pumping stations are in poor condition, due in part to inadequate maintenance by the IDAAN. Some of the pumps have been in service for more than 20 years.

The absence of water meters in the former military bases makes management of the system difficult. There are no meters in private homes, office buildings, workshops, barracks, clubs, airports, docks, etc. Installation of meters is complicated by the design of the entrances into buildings, making it necessary to divide the pipes internally in order to separate them according to physical distribution.

In the former military installations of both the Atlantic and Pacific subregions, the conduction and distribution lines do not lie within a uniform easement pattern, and cross green areas near buildings and restaurants, sometimes even passing beneath structures.

Most of the reverted systems, having been in service for more than 50 years, require periodic and intensive maintenance. These systems are designed to serve the areas as they are currently found. If soil uses change and greater demand is produced, it is quite possible that the aqueduct system will not have the capacity to supply this increased demand.

With respect to the billing of potable water, the IDAAN does not have the resources to assume responsibility for maintenance once it receives the new installations, nor has it identified financial sources for the enlargement of systems in the reverted areas. The IDAAN attends to its administrative, operational and maintenance obligations with resources originating from BID loans, a practice to which the bank is currently opposed. Presently, there is expectation concerning the approval of a new law which will reform the IDAAN, in order to be able to follow with approval of financing of the service. Billing only partially covers the operational and maintenance requirements, with total annual billing at US$400,000 a year, operation and maintenance costs over US$1,000,000 a year, and a delinquency list of 800 clients owing a total of US$10,000,000. The IDAAN does not have the necessary resources to execute an investment plan of either local or national scope, in spite of the fact that it has at its disposal the legal instruments to access funds collected through valorization. Sewer service is not currently billed, but in the near future this will be necessary in order to guarantee independent income for the provision of this service.

Water losses produced in Panama City and its suburbs are calculated at approximately 40 percent. The losses are caused by ruptures, fraudulent installations, communities created through invasion (where the government is obligated to supply communal water for the sake of public health), the lack of individual water meters in many neighborhoods, and consumption due to fires. The greatest losses registered are found in the city of Colon, where they are estimated to be near 50 percent, due to ruptures which are difficult to detect because of the existence of a very superficial phreatic layer. In the suburbs of Colon, losses are similar to those found in Panama City, and it would appear that in no instance are they inferior to 40 percent of the total volume produced.

With respect to the relationship between the ACP and the IDAAN in the matter of potable water, the ACP did not manifest any restriction to ceding more water for human consumption in the urban zones, but did express its disapproval of the lack of care given to the distribution networks, where waste caused by negligence in the operation of the secondary and tertiary networks is substantial. A counter-responsibility of the IDAAN is the maintenance of the potable water conduction and distribution pipelines, an obligation which the IDAAN has not satisfactorily fulfilled; in turn, the IDAAN complains of the lack of installations for sustaining an intensity of

maintenance equivalent to that received by the networks prior to reversion of the lands. The nonexistence of a master plan for development of the potable water sector has been identified by ACP as an obstacle. ACP sells to the IDAAN at $0.69 per thousand gallons of water, and the IDAAN in turn sells at a range of 35 price levels with the average being $1.15 per thousand gallons. Generally speaking, it is considered that the IDAAN is not prepared to install and administer the potable and waste water infrastructure required in the reverted areas.

7.2 Sanitary Sewer Systems

7.2.1 Current Conditions

The systems for the collection, treatment and disposal of waste water, referred to as sanitary sewer systems, are for the most part individual community systems, depending on the topography. With the exception of Howard Base, the communities do not have any sort of sewage treatment system, and where systems do exist, they are non-functioning. As a result, waste water is dumped untreated, part of it into the Canal and another part into the ocean at the points of exit from the Canal in both the Atlantic and the Pacific.

The waste water collection pipes with the smallest diameter (6, 8, 10 and even 12 inches) are made of vitrified clay, and those of larger diameter are made of simple or reinforced concrete. There are several pumping stations for waste water on the Pacific, in Balboa, Paraiso, Albrook, Clayton and Corozal.

Canal Area communities which have sanitary sewer systems are:

Atlantic subregion: Davis, Espinar, Gatun, Margarita, Arco Iris and Fort Sherman.

Pacific subregion: Amador, Albrook, Balboa, Ancon, Clayton, Corozal, Curundu, Diablo, Los Rios, Quarry Heights, Cocoli, Farfan, Howard, Kobbe, Rodman, Gamboa, Paraiso, Pedro Miguel and Summit.

The various networks for collection and disposal of waste water, together with their inspection chambers, have been grouped according to the diameter of the pipes which consisting the system and the sectors to which they belong. The network of pipes has a total length of 261 km, of which 53 percent corresponds to pipes with a diameter of 8 inches, 29 percent to pipes 6 inches in diameter, and 18 percent to pipes with a diameter of 10 to 24 inches. In addition, the system has 3,572 inspection chambers.

It is important to note that no interconnection exists between the sewer systems of the different communities, with the exception of those of Paraiso and Pedro Miguel, which have a common network that discharges at the Pedro Miguel pumping station, from where waste water is released into Lake Miraflores.

In the absence of an integrated system, each community must rely on its own system for disposal and treatment of waste water, among which can be found five Imhoff tanks (primary), five pumping stations (untreated), two package plants (secondary) and the Espinar plant, which is currently abandoned.

Table 7.7 shows the location and type of infrastructure for final disposal and treatment of waste water in the different Canal Area communities. Those communities which rely on septic tanks were not included in this inventory. Mention is made in this table of current infrastructure conditions, particularly the fact that the pumping stations of Balboa and Paraiso-Pedro Miguel are the only ones operating.

Table 7.7 Sewage Treatment Infrastructure

Subregion	Sector	Type of Treatment	Apparent Conditions
East Pacific	Curundu	Imhoff Tank (primary)	Abandoned
	Curundu	Pumping Station (untreated)	Abandoned
	Balboa	Pumping Station (untreated)	Operating Normally
West Pacific	Howard	Imhoff Tank (primary)	Operating Normally
	Rodman	Imhoff Tank (primary)	Operating Normally
	Rodman	(2) Package Plants (primary and secondary)	Operating Normally
Central	Paraiso	Pumping Station (untreated)	Poor
	Gamboa	Imhoff Tank (primary)	Abandoned
	Gamboa	Pumping Station (untreated)	Abandoned
East Atlantic	Espinar	Sedimentation, Digestion and Secondary Treatment	Good (Not operating)
	Margarita	Pumping Station (untreated)	Abandoned
	Arco Iris	Imhoff Tank (primary)	Abandoned

Source: Maintenance Division, ACP

Generally speaking, the reverted equipment is non-functioning due to inadequate maintenance on the part of the IDAAN.

The Canal Area sewer lines do not follow a regular easement pattern, with many of them located inside the new lots.

7.2.2 Current and Programmed Investments

East Atlantic Subregion: Medium-range plans exist for conducting a study of the sewer system's master plan, with the intent of determining the socio-economic and technical feasibility of an integral solution which would guarantee adequate service and efficiency in the collection, treatment and final disposal of waste water in the city of Colon, the Duty Free Zone and neighboring areas, including: Cativa, Sabanitas, Puerto Pilon, Rio Alejandro, Villa Alondra, the reverted areas of Margarita and Arco Iris, the urban developments in Puerto Escondido, and the area of France Field, where the Multimodal is planned. The port developments of Coco Solo are also included.

East Pacific Subregion: Panama City has serious problems with contamination in the bay, the shore of which is being developed for residential and commercial uses. Among the causes is the

lack of both residential and industrial waste water treatment, with untreated sewage emptying directly into the bay. The government is making medium-range plans for clean-up of the bay. For this to be achieved, sanitation projects must be undertaken for the collection, pumping and treatment of waste water before it is released into the ocean, or, in the absence of such projects, submerged discharge lines will have to be constructed to carry urban waste water to points where the marine current does not return it to the bay.

7.2.3 Conclusions

The sewer system pipelines are working well, with the exception of certain obstructions caused by tree roots. These systems have been in operation for 50–80 years, and in the areas served, soil use has remained for the most part unchanged.

Final disposal of waste water in the East Pacific sewer systems is carried out principally by pumping stations, which require operation and periodic maintenance.

Only one of the plant-based sewage treatment systems in the West Pacific subregion, located in Howard, is functioning. The rest are either non-functioning or abandoned.

Sanitary pipelines of a smaller diameter follow no regular easement pattern, as they were constructed according to the topography of the land near the buildings, crossing green areas between homes and following the shortest route to the collector. These systems are designed for serving the areas as they are currently found. If soil uses change and a greater volume of domestic and/or industrial waste water is produced, these systems will have to be partially or totally enlarged.

Legislation is needed with respect to industrial waste, requiring that it be treated before release into the bodies of water of the canal area and nearby regions.

In general terms, purification of all waste water proceeding from all regions of the Canal Area must be considered. Otherwise, superficial continental and marine water sources will become contaminated, causing severe harm to the flora and fauna of these aquifers, which will in turn have a negative impact on the quality of life for the region's inhabitants.

7.3 Storm Sewer Systems

7.3.1 Current Conditions

The systems for the collection and disposal of rainwater, known as storm sewer systems, are individual community systems consisting for the most part of paved or unpaved channels, section drains, reinforced or simple concrete pipes in the streets, catch basins and *cabezales*. All water collected in this manner is released into the nearest body of water.

The storm sewer network includes all existing structures and drainpipes; the system for collection and disposal of this water is divided between underground pipelines and paved open ditches. Table 7.8 presents the storm sewer networks, broken down by subregion.

Table 7.8 Storm Sewer Network

Subregion	Pipes (meters)	Paved Ditches (meters)	Catch Basins	Inspection Chambers	Sewers
East Pacific	90,891	85,379	1,462	1,111	281
West Pacific	12,005	30,153	245	98	181
East Central	7,088	9,565	64	118	10
East Atlantic	27,270	18,745	602	281	40
West Atlantic	2,796	826	82	3	31
Total	140,050	144,668	2,455	1,611	543

Source: ACP; General Plan, Intercarib/Nathan Associates

7.3.2 Current and Programmed Investments

Channeling of the Abajo, Juan Diaz and Tapia rivers is being designed to resolve the problem of periodic flooding in these zones on the outskirts of Panama City. In previous years channeling of the Mataznillo River and some of its tributaries was carried out.

A Storm Drainage Study has been done for the Maria Salas River and the Barrios Creek in the area of Albrook, in order to find a solution to flooding near the airport and eliminate areas that served to control flooding.

7.3.3 Conclusions

The storm drainage systems operate fairly well in spite of being in service from 50 to 80 years. Some pipes are made of corrugated steel, which, in conditions near the ocean, have a shorter lifespan than concrete pipes.

There are pipes as small as 12 inches in diameter, implying that very rigorous and continuous maintenance is needed, since large amounts of sand and clay are washed into the drains with the torrential downpours common in this region, thereby reducing their capacity and causing blockage.

The design norms applied in Panama by the Ministry of Public Works do not permit the use of pipes with a diameter of less than 18 inches, and pipes of this diameter are only allowed in the initial segments of the system.

To date, the volumes of the original design have not varied, since no modifications have been made with regard to conditions such as green areas, soil use and increases in areas of pavement and roofing, among others. If these conditions were to change, or if population density were to increase with an accompanying decrease in green areas, the current system would need to have its capacity increased to deal with the diminishing areas of absorption and the consequent increase in the runoff coefficient. This would reduce the concentration times, causing greater flows of rainwater that could not be managed with the current system of pipelines.

In the Pacific and Atlantic areas, the storm drainage systems, whether underground or open, are installed across lots according to the topography, being found near homes or buildings and without established easement.

7.4 Solid Waste Management

7.4.1 Current Conditions

Metropolitan Area of Panama. The Metropolitan Area of Panama encompasses the districts of Panama and San Miguelito, where the country's greatest urban conglomeration is found, as well as the greatest volume and mass of solid waste. The territory of the subdistrict of Ancon, which forms part of the district of Panama, constitutes the Pacific Region of the Canal Area.

Solid waste is normally disposed of in plastic bags, but rigid plastic or metal receptacles are also used, including whole or half 55-gallon drums.[2] Since service is not provided daily and is performed irregularly, the inhabitants put out their trash at any hour of the day and in inappropriate places. These places are usually *tinaqueras*—elevated metal trash bins or paths located a certain distance from their homes, in spite of the fact that trash collection is door-to-door. There is also no habit of separating reusable materials.

The district of Panama has a road system which, in general terms, is adequate for the transit of medium-sized trucks such as garbage trucks. The regular topography of the urbanized area is also favorable to the transit of these vehicles.

The district of San Miguelito has transit hubs which experience intense traffic throughout the day, and narrow roads for access to the urbanized zones on the hillsides. The schedule for trash collection is further complicated by the topography of the district and the structure of the storm drainage system of deep ditches alongside the roads, making maneuverability of the garbage trucks difficult. Many homes are inaccessible to vehicular traffic, and are therefore serviced by sidewalks and stairways.

The final disposal of municipal solid waste produced in the districts of Panama and San Miguelito takes place at the sanitary landfill of Cerro Patacon. This landfill replaced the old dump located in Old Panama City in 1985, as an appropriate area for receiving and disposing of municipal solid waste from the Metropolitan Area of Panama. Its design period is for 20 years, with two stages of development.

Metropolitan Area of Colon. The Province of Colon encompasses ten subdistricts within the district of Colon. The territory of the Cristobal subdistrict constitutes the Atlantic Region of the Canal Area.

As with Panama and San Miguelito, trash is normally collected in plastic bags, but rigid plastic or metal receptacles are also used, including whole or half 55-gallon drums. Since service is not

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[2] Many of the observations in this chapter have as their source the Master Plan, characterization of assets and evaluation of alternatives for the participation of the private sector in the management of solid waste, for the metropolitan area of Panama, Colon, Reverted Areas and West Panama, Jobefra-Saniplan.

provided daily and is performed irregularly, the inhabitants put out their trash at any hour of the day and in inappropriate places. There is also no habit of separating reusable materials.

The municipality provides this service on a very irregular basis and divides it into two shifts.

The solid waste produced in the area of Colon continues to be deposited in the sanitary landfill of Mount Hope in spite of the fact that the landfill's useful life has expired and there is no cover material. This landfill initiated operations in the year 1941 and according to the Torrijos-Carter treaties, should have been substituted by another location for final disposal in the year 1996. The former Canal Commission (now the Panama Canal Authority) was in charge of operations. This institution billed the national government, through the former DIMA (Metropolitan Sanitation Commission), for the amount of US$17.00/metric ton of waste deposited in the sanitary landfill.

In June 1999, the Panama Canal Commission transferred operation of this sanitary landfill to the DIMA, including the existing installations and mechanical equipment, which had been poorly maintained.

As of January 2000, operations are carried out in a 10-hectare area which has been capacitated but also lacks cover material. The useful life of this landfill expired several years ago and the need for a substitute is urgent. To this end, a complete project exists for the construction of a new sanitary landfill in Davis, district and province of Colon.

It only remains for the institutions concerned to make a decision: the Authority of the Inter-oceanic Region, (responsible for the land), the Municipality of Colon (responsible for the management of solid waste) and the Ministry of Health (governing entity).

7.4.2 Current and Programmed Investments

In Panama, several international organizations donated a variety of equipment which began to provide service during 2000. The donation consisted of equipment and utensils, consumable materials and articles, assorted machinery, and funds for equipment maintenance and labor payroll. In addition, investments are programmed for street-sweeping and trash-collection equipment, and for institutional development in the administrative and commercial areas.

Currently, no investment is being made in the sector of solid waste management in Colon; only those expenditures required for minimum systems operation are made. No new investments are programmed for the future.

7.4.3 Current and Future Requirements

Following are the most urgent requirements for the Metropolitan Area of Panama:

- Development of various projects for the recovery of Phase 1 of the sanitary landfill (landscape project, slope stabilization, system for rainwater collection and evacuation, leaching control system, and a system for management and use of bio-gas).
- Extension of the landfill's useful life over the next 20 years.
- Industrial sanitary landfill.

In Colon, an area of land is needed for the construction of a new sanitary landfill, in addition to new equipment for waste collection and disposal.

For satisfactory operations in both municipalities, the following technical needs can be included: Training of personnel, planning structure, control and execution of services with adequate technology and efficiency, and sufficient infrastructure for equipment maintenance and logistical support.

7.5 Road Network

In order to present the current road system in the Canal Area, the geographical division adopted by the General Plan has been used, which recognizes the following subregions:

East Atlantic: Gatún, Davis, Espinar, Margarita, Arco Iris, external roads

West Atlantic: Sherman, external roads

East Central: Gamboa, Pedro Miguel, Paraiso, external roads

West Central: external roads

East Pacific: Clayton, Albrook, Curundu, Diablo, Los Rios, Corozal, Balboa, Quarry Heights, Ancon, Amador, external roads

West Pacific: Rodman, Cocoli, Howard, Kobbe, Farfan, external roads

The external roads constitute the portion of the road network which is not part of any of the local communities, but serves to connect them and provide access to Panama City.

7.5.1 Current Conditions

The total extension of the road network within the areas of the former Canal Zone, according to subregion, sector and type of road, is 592 km, of which 128 km (22 percent) are found in the Atlantic subregion and 320 km (54 percent) in the Pacific subregion. The remaining 24 percent (143.0 km) is found in the Central subregion.

Following is a list, by hierarchy and region, of the main roads of the existing road network in the subregions of the East Pacific, West Pacific, East Atlantic, West Atlantic and the Central Region of the Canal Area:

East Pacific Subregion

- Highways: Panama–Colon Highway, North Corridor
- Main Roads: Gaillard Avenue, Avenue of the Martyrs, Ascanio Arosemena Avenue, Balboa Avenue
- Secondary Roads: Central Avenue of Clayton, Clayton–Curundu Street, East Marginal Road, Amistad Road, Ascanio Villalaz Avenue, Juan Pablo II Avenue, Patacon Road, Amador Street, Soberania Avenue–Amador Causeway

West Pacific Subregion

- Main Roads: Bruja Road, Road to Veracruz, Beard Road, Andrews Boulevard, Lamb Avenue, Brayant Avenue, Mulvehill Avenue
- Secondary Roads: San Juan Road, Harder Road

East Central Subregion

- Main Roads: Gaillard Road
- Secondary Roads: Chivo-Chivo Road

East Atlantic Subregion

- Main Roads: Randolph Avenue, Bolivar Road, Boyd–Roosevelt Road

West Atlantic Subregion

- Secondary Roads: Gatún–Sherman Road

Based on the inventory and evaluation of the transportation system in the Canal Area (General Plan), principal conclusions with respect to the capacity to sustain future development in the region are presented:

The road system is structured to support the internal services of the military reserve areas, with very little interconnection with the rest of the regional road network. Connections are present in only a few intersections, and their capacity is very limited. These limited interconnections have functioned until now due to the low rate of traffic between the military areas and the rest of the region. To achieve integration, it will be necessary to design a system of interconnection with a greater capacity.

The system within the former military areas consists of two- lane roads, with the exception of Andrews Boulevard in Howard, preventing its use for high volumes of traffic. In the areas where changes in soil use have been programmed or the closed functional concept of the bases has been modified, widening of principle roads will be needed to create transit hubs which permit management of large flows of traffic. Most of the roads outside the military bases are also two-lane. There are a few three- and four-lane stretches, but their overall capacity is very limited when compared to the use potential of the region they serve. An important example is the Bridge of the Americas, which, after widening, continues to function at maximum capacity, indicating the urgent need for a new Canal crossing. Another limitation to road capacity can be found in the low service levels of countless intersections of main Canal Area roads, especially during peak hours.

The concrete pavement observed on some of the main roads consists of cement slabs laid directly over a layer of thin, non-draining material. This structure, together with the age of the pavement, presents a clear limitation to the capacity to bear heavy, high-frequency loads. The changes in soil use which accompany load management will require an integral reinforcement of the pavement structure. Evidence of this situation can be found in the rapid deterioration of the reverted roads which have been subjected to heavy, frequent loads.

7.5.2 Current and Programmed Investments

The original program presented in 1997 by Nathan Associates Inc. for investment in road infrastructure in Panama, financed by the Andean Development Corporation (CAF), covers 378.0 km of road infrastructure, of which 84 percent is found in the Pacific Region and the rest in the Atlantic Region. Table 7.9 shows the projects that are a part of the program.

Table 7.9 Road Infrastructure Investment Program, 1997

Region	Name of project	Longitude (km)	Cost (US$ millions)
Atlantic	Rehabilitation of Bolivar Road	4.0	3.3
	Rehabilitation of Randolph Avenue[a]	2.3	4.5
	Construction of Cuatro Altos Intersection	0.0	5.6
	Rehabilitation of streets of Colon	53.6	4.3
	Subtotal	59.9	17.7
Pacific	Widening of Ascanio Arosemena Avenue (Roosevelt)	1.0	1.7
	Widening of Ascanio Villalaz Avenue	2.4	5.0
	Widening of Amistad Road	1.5	2.4
	Widening of Gaillard Avenue and intersections	4.4	14.9
	Widening of Juan Pablo II Avenue	1.5	2.7
	East Marginal Avenue of Albrook	3.0	5.0
	Rehabilitation of Simon Bolivar Road (Transisthmic section)[b]	8.9	5.2
	Connecting road between Minter Avenue and Godfrey Street	0.7	0.8
	Rehabilitation of streets of Panama City	294.6	29.5
	Subtotal	318.1	67.3
	Total	**378.0**	**85.0**

a. Coco Solo sector.

b. From Gaillard Avenue to the San Miguelito overpass, including the widening of 5th Street to Brasil Avenue.

Source: Program for Road Infrastructure Investments prepared by the ARI for the CAF, 1997; and the Program for Rehabilitation of the Cities of Panama and Colon: Economic Feasibility Report, MOP, August 1997.

The investment projects include rehabilitation and widening of roads, construction of intersections, and construction of new roads in the Albrook sector (East Marginal Avenue of Albrook and connection between Minter and Godfrey Roads).

The Ministry of Public Works, together with the Authority of the Inter-oceanic Region and the Andean Development Corporation, is currently carrying out a series of road projects contemplated in the investment program of the General Plan for the Use, Conservation and Development of the Canal Area. The main projects selected for this program, and which are

currently in process or programmed by the Ministry of Public Works in their investment plan, are shown in Table 7.10.

Table 7.10 Projects Programmed and in Process in the Pacific and East Atlantic

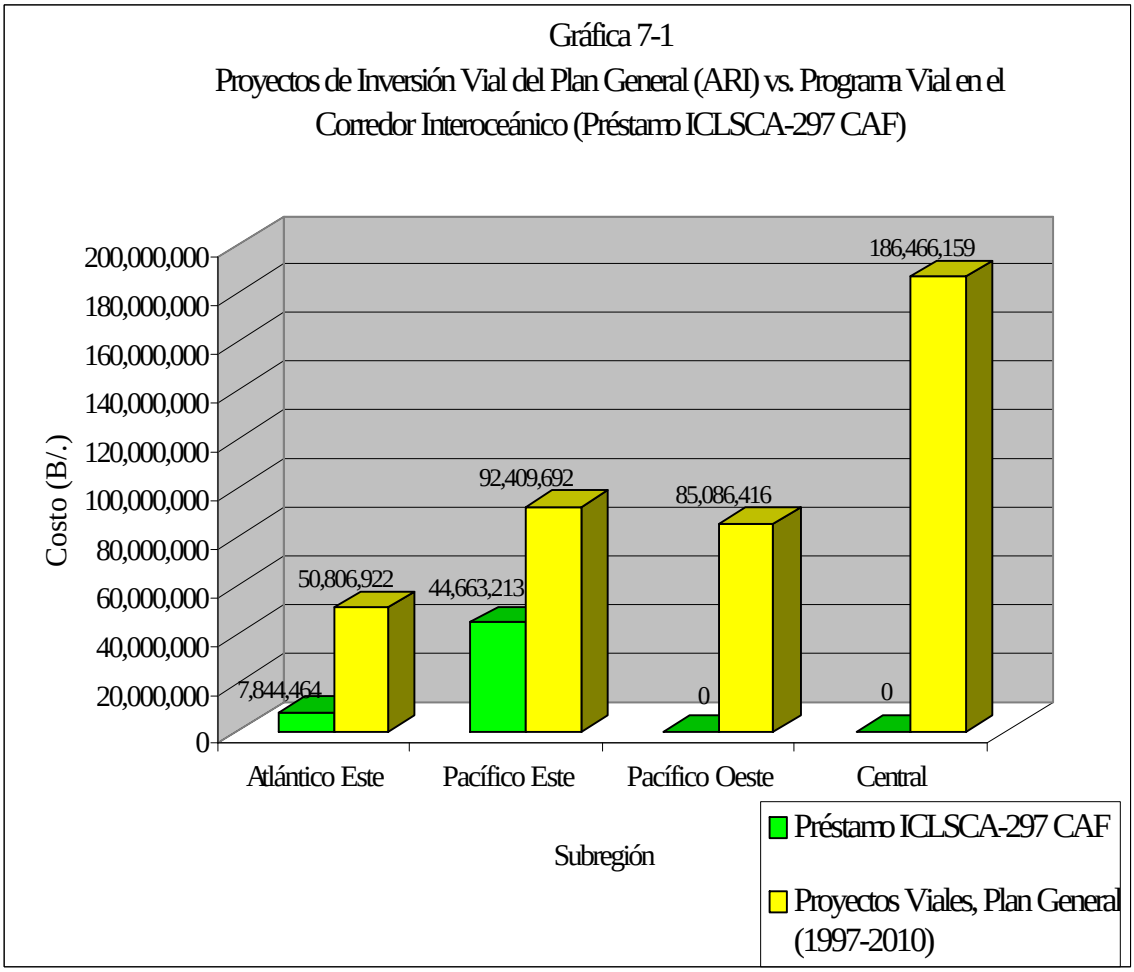
Code	Name of Project	Cost (US$)	Status
PE-V1 (T1)	New alignment of Gaillard Avenue (Section 1)	2,079,673.00	Under construction (90%)
PE-V1 (T2)	New alignment of Gaillard Avenue (Section 2) and widening of Ascanio Arosemena Avenue	4,271,739.60	Processing of order to proceed
PE-V4 (P1)	Construction of East Marginal Avenue of Albrook	5,032,568	Constructed
PE-V5 (I1)	Intersection Gaillard Avenue-North Corridor-Ascanio Arosemena Avenue (Intersection 1)	30,618,542.20	In process of contract development
PE-V5 (P1)	Widening of Amistad Road	2,660,690.00	Programmed
AE-V1 (T2)	Rehabilitation of Randolph Avenue	2,222,264.14	Under construction (94%)
AE-V3	Construction of 4 Altos Intersection (between Randolph Ave. and Transisthmic Ave.)	5,622,200.00	Programmed
	Total	**52,507,676.94**	

Source: Program for Road Infrastructure in the Inter-oceanic Corridor (Loan ICLSCA-297 CAF)

Currently, a plan is moving ahead for expansion of the road network, consisting of pavement rehabilitation as well as construction of overpass intersections.

On comparative analysis of the programming of Investment Projects for the Road Sector developed by the General Plan for the period 1997–2010, and the projects currently being carried out by the Ministry of Public Works within the Canal Area, financed in part by Loan ICLSCA-297 CAF, it can be observed that it is in the East Pacific subregion where the greater part of investment in Canal Area road infrastructure has been made, due to the recent growth in commercial, institutional, port and service activities experienced by this subregion. According to information obtained from the General Plan (ARI) as well as from the Ministry of Public Works, in the East Pacific subregion, the percentage of road projects with financing which have been executed or are in process of being carried out is 48.30 percent with respect to the programming of investments for the road sector in this subregion for 1997–2010.

Besides the East Pacific subregion, the East Atlantic is the only other subregion which has been contemplated by the MOP and the ARI within the investments programmed for Loan ICLSCA-297 CAF. In the East Atlantic subregion, the percentage of road projects with financing which have been executed or are in process of being carried out is 15.4 percent with respect to the programming of investments for the road sector in this subregion for the 1997–2010 Period.



7.5.3 Current and Future Requirements

To satisfy the soil-use demands projected for the Canal areas within the 1997-2010 horizon, the General Plan prepared a profile for each infrastructure project, including a description, general location, stages, justification, potential participants, investment and periodic costs, possible sources for financing, and institutional and environmental considerations. Table 7.11 presents a list by subregion for each of the proposed road system projects, and an estimate of total investment costs for each one.

Table 7.11 Road Infrastructure Investment Program of the General Plan, 1997-2010

Subregion	Code	Project	Cost (US$ thousands)
East Atlantic	AE-V1	Reconstruction and widening of Randolph Avenue	18,726.3
	AE-V2	Reconstruction and widening of Bolivar Road	14,588.3
	AE-V3	Construction of interchange on Randolph Avenue and the Transisthmic Road	3,250.5
	AE-V4	Construction of Los Lagos Road to Randolph Avenue	16,323.6

	AE-V5	Rehabilitation and widening of Harmon Avenue	15,626.3
West Central	CO-V1	Construction of Road and bridge, Panama- Arraijan (West)	95,760.0
East Central	CE-V1	Construction of highway and bridge, Panama- Arraijan (East)	91,131.2
West Pacific	PO-V1	Rehabilitation and widening of coastal Road/Veracruz	24,740.8
	PO-V2	Howard road system—Stage 1 (Howard transversal avenue/Road)	31,381.6
	PO-V3	Howard road system—Stage 2 (West Howard transversal avenue/InterAmerican highway)	28,964.0
East Pacific	PE-V1	Rehabilitation and widening of Gaillard Avenue	16,936.8
	PE-V2	Construction of new National Transportation Center	7,500.0
	PE-V3	Construction, widening and improvements to Clayton road system	9,186.1
	PE-V4	Construction, widening and improvements to Albrook road system	44,220.7
	PE-V5	Intersections and integration with primary urban network	15,816.1
		Total	**434,152.3**

Source: Intercarib S.A./Nathan Associates Inc.

Presently, capacity restriction and a low level of service have been detected in the intersections:

- North Corridor—Gaillard Avenue
- Ascanio Villalaz Ave.—Amistad Road
- Juan Pablo II Ave.—Ascanio Villalaz Avenue
- Ascanio Villalaz Ave.—New Boulevard
- Ascanio Villalaz Ave.—Gaillard Ave.

Roads which require rehabilitation in the medium term are: Gaillard Avenue, Avenue of the Martyrs, Ascanio Arosemena Avenue, Balboa Street, intersection of Juan Pablo II Avenue with Ascanio Villalaz Avenue and with the cross street that connects residential areas along Curundu River. In the West Pacific, the Bruja Road, the Road to Veracruz and the secondary Harder road towards Rodman need rehabilitation.

7.6 Electric Energy

7.6.1 Current Conditions

Generation of electric energy in the Republic of Panama is in the hands of independent, private generating companies. The most important of these are the following:

Table 7. 12 Electric Power Generators in Panama

Generator	Type	Installed Power
Fortuna	Hydraulic	300 MW

Estrella	Hydraulic	42 MW
Los Valles	Hydraulic	48 MW
Bayano	Hydraulic	150 MW
Bahía las Minas	Thermic	304 MW
COPESA	Thermic	42 MW
PANAM	Thermic	96 MW
Petro Eléctrica	Thermic	55 MW
ACP	Hydro	36 MW Madden
	Hydro	24 MW Gatún
	Thermic	100 MW Miraflores

This capacity is sufficient to cover energy needs in the foreseeable future, therefore no deficit in generation is expected for the next five years. Currently, the Regulating Entity has conceded licenses for the construction of hydroelectric plants throughout the country, assuring that there will be no deficit in the generation of electric energy in the foreseeable future.

Table 7.13 Concessions and Licenses for New Plants

Plant	Capacity
AES Panama	Hydro Guasquitas 81 MW Canjilones 38 MW
ACP	Hydro North Cocle: 150 MW Indio I: 25 MW; Indio II: 25 MW
Pana Energy Group	Thermic- 94.5 MW
Teribe Hydrologic	Hydro - 10 MW
Latin American Power Partners	293.3 MW
Pedregal Power Company	51 MW

The Pacific Sector of the Canal Area is served by EDEMET from different substations of the Panama Canal Authority. In this way, the Clayton sector is served from Miraflores. Albrook, Diablo and Corozal are taken care of from the Diablo substation. The communities to the west of the Canal, including Howard, Cocoli, Rodman, Kobbe and Farfan, are served from the installations of the ACP in Miraflores and from a 44 kV line which begins at Miraflores and extends to Howard. Currently, this capacity is sufficiently ample to cover the energy needs of the interoceanic area.

Gamboa and Summit, as well as other communities on the shores of the Canal, and Barro Colorado Island are served using the ACP's 44 kV trunk line through 12 kV reducing substations.

The 12 kV feeders belong to EDEMET. ELEKTRA must pay toll charges for use of ACP lines in the future.

In Gamboa and other nearby communities, energy is supplied as a remnant of the Type B Exchange that the IRHE had with the Panama Canal Commission, which is now expired.

Through the Type B Exchange, the ACP had a monopoly on energy supply to these communities, but in the future, any of the generators recognized by the Regulating Entity of the Republic of Panama can sell the required energy to these same communities, to be contracted through public bidding.

EDEMET is in the process of preparing documents to present for public bidding, for the provision of energy to said communities through the mechanisms and procedures established by the Regulating Entity of Public Services (ERSP).

When the Gamboa Forest Resort was constructed in Gamboa, EDEMET had no difficulty in serving the area with existing installations. EDEMET welcomes new service requests and, where they are merited, will carry out the necessary expansion to cover the demand.

Any and all information supplied by the ARI for projection of future growth will help greatly in elaborating specific plans. This information will be taken into consideration, and will be substantiated as the plans and projects of the ARI materialize.

In addition, EDEMET has been able to cover the demands presented by the new container port installations in the Pacific sector without any difficulty, through extensions from the Marañon substation in 13.2 kV.

The Atlantic Sector is served by ELEKTRA from the Mount Hope substation, which originally belonged to the Canal Commission (CCP). The double-circuit (401 and 402) 44 kV line coming from the ACP plant in Gatun is currently disconnected and said substation receives energy through another 44 kV line coming from the Bahia Las Minas Thermic Powerhouse (ENRON). The distribution voltage is 12 kV through two 10/12.5 MVA transformers, and 2.4 kV through two 7.5/9.13 MVA transformers.

Current capacity is sufficiently ample to cover the needs of the reverted areas, Espinar (F. Gulick), Jose D. Bazan (Davis) and Telfers Island.

With the exception of the Fort Sherman area, all the electric energy needs of the Atlantic sector are covered by ELEKTRA lines from the Mount Hope substation and by lines from the Colon system (Paseo Gorgas, Cristobal, Arco Iris and others).

An exception, by decision of the Panama Canal Authority (ACP), is the community of Nuevo Gatun on the shore of the Canal. There, electric infrastructure continues to be the property of the ACP, but with energy supplied by ELEKTRA. In the future, ELEKTRA will have to pay a toll for the use of ACP lines.

In Sherman, the energy supply is a remnant of the Type B Exchange which the IRHE had with the Panama Canal Commission, and which has since expired.

With the Type B Exchange, the ACP had a monopoly on the energy supplied to Fort Sherman, but in the future any of the generators recognized by the Regulating Entity of the Republic of Panama will be able to sell the energy required by Sherman, to be contracted through public bidding.

ELEKTRA is in the process of preparing documents to call for bidding on the supply of energy to Sherman, through the mechanisms and procedures established by the Regulating Entity of Public Services (ERSP).

Currently, ELEKTRA is not aware of any important energy needs in Fort Sherman, and for the time being, has no plans for expansion of capacity in this sector. When merited, the necessary expansions to cover energy demand will be carried out.

Any and all information supplied by the ARI for projection of future growth will help greatly in elaborating specific plans. This information will be taken into consideration, and will be substantiated as the plans and projects of the ARI materialize.

In addition, ELEKTRA has been able to cover the demands presented by the new container port installations in the Atlantic sector without any difficulty.

7.6.2 Current and Programmed Investments

EDEMET, of its own initiative, has prepared a medium-range expansion plan. Obviously, this will be improved upon as the ARI provides additional specific information on energy needs, in accordance with the five-year plan to be prepared. The exchange of information should be of a permanent nature in order to obtain better results and achieve dynamic optimization of the expansion plan.

The electric companies have the obligation to plan the development of their distribution systems in such a way that a deficit in supply will not occur at any time, and that the levels of technical quality established by the Regulating Entity will be maintained.

In the Pacific sector, EDEMET has programmed the extension of 13.2 kV lines to serve the different charges which have recently been added. The magnitude of said charges will determine the moment when expansion of the 115 kV lines will be required.

7.6.3 Current and Future Requirements

Pacific Sector

The current distribution systems in the reverted areas do not present deficits in the capacity of transformers or feeders, and comply with the requirements established by the Regulating Entity.

EDEMET estimates that it will be able to provide electric energy service to the Canal Area for some time to come, through either the expansion of existing systems in Panama City or negotiations with the ACP.

Currently, EDEMET has the capacity to continue providing the quantity and quality of service required by the population, which consists principally of residential consumption, a few industrial establishments, commercial establishments such a the Grand Transport Terminal in Albrook, schools, hospitals, and a few areas for recreation, sports, entertainment and social activities.

The extension of feeders to new locations on the outskirts of Panama City will be the easiest way to provide service from individual substations and distribution systems.

In the future, electric energy must be supplied by the distribution company EDEMET. Energy needs will depend on the growth of the current population and the use of the areas.

The ARI must supply EDEMET with all possible information concerning the development programs for each area, in order for these to be taken into consideration in the planning of the company's future investments.

Atlantic Sector

The current Canal Area distribution systems do not present deficits in transformer capacity or feeders, and comply with the requirements established by the Regulating Body.

ELEKTRA estimates that it will be able to provide electric energy service to the reverted areas for some time to come with the amplitude provided by the new substation in France Field, which has a capacity of 100MVA, whereas current needs do not exceed 30 MVA.. France Field receives energy by means of a new 115 kV line which was recently completed, with voltage reduction of 115 kV - 7.62/13.2 kV.

Currently, ELEKTRA has the capacity to continue providing the quantity and quality of service required by the population, which consists principally of residential consumption, a few industrial establishments (Industrial Division of the ACP), commercial establishments (with very few exceptions), schools, hospitals, and a few areas for recreation, sports, entertainment and social activities.

In the future, electric energy must be supplied by the distribution company ELEKTRA. Energy needs will depend on the growth of the current population and the use of the areas.

The ARI must supply ELEKTRA with all possible information concerning development programs for each area, to be taken into account in the planning of the company's future investments.

Annex D is mentioned in the concession contract, referring to expansion programs planned by the IRHE before privatization and which ELEKTRA promised to carry out as part of its obligations.

In the Atlantic sector, ELEKTRA has programmed the extension of 115 kV lines to serve the Mount Hope area, where the Panamanian government intends to establish exportation processing zones (Telfers Island, Davis, etc.).

The study team has not drawn up profiles of electric energy projects because it considers that the private concessionaires are capable of responding to the demand through the profiling, preparation and execution of the investments required in this sector.

7.7 Telecommunications

7.7.1 Current Conditions

Stationary and cellular telephone services are provided by the companies Cable & Wireless and Bell South, respectively.

C&W provides service throughout national territory in accordance with their policy of extending the network to wherever there may be customers. The installed capacity of telephone lines is known, but there are no maps which show spatial distribution. The company wants the ARI to clearly define the reverted areas where development will be promoted, in order to install service where the investment can be recovered more quickly.

The network within communities is in average condition, and lines are not always installed along public easements.

7.7.2 Current and Programmed Investments

C&W considers that the investments it has carried out in the reverted areas surpass development expectations, and is willing to continue extension of service to wherever it may be required. For this reason, the company requests that the competence to provide the service be determined for certain sectors where the ACP is also present.

The study team has not drawn up profiles of telecommunications projects because it considers that the private concessionaires are capable of responding to the demand through the profiling, preparation and execution of the investments required in this sector.

7.8 Infrastructure Analysis Conclusions

The analysis of existing infrastructure reveals, in general terms, both the positive aspects and the limitations present in the regional infrastructure networks, as well as the activity in each infrastructure sector when examined separately.

7.8.1 Conclusions Common to the Infrastructure Networks

Many networks do not extend along road easements—The nature of the primitive soil uses in the now-reverted areas originated an extension of networks with minimum-cost criteria for lands which did not have private property delimitations. Under these conditions, the criteria of minimum cost resulted in network designs that travel the shortest distance possible, without regard for building setbacks, to the point that in some cases they actually run underneath buildings. There is also no consistent pattern of zones for passage of public service networks. The advantage to this type of layout is that the majority of networks pass through green areas, facilitating maintenance and preserving road pavement, but the disadvantages with respect to operation, repositioning and maintenance are evident when the land is subdivided for transfer of ownership to private parties.

The networks require significant expansion to cover foreseen development—The densities of the original uses were very low in comparison with the densities which these territories may achieve with more intensive use from a demographic and economic perspective. And although the public service networks were sufficient for these demands, they will begin to feel their limitations when the intensity of use gradually increases over time.

The networks require complete and permanent maintenance—The provision of reliable service requires that the public service networks receive maintenance in an intense and permanent fashion, especially when dealing with networks of an advanced age and those that require significant repositioning when they present limitations in capacity or resistance due to external agents such as water, salt or soil.

7.8.2 Potable Water

Water loss in distribution networks—In general terms, there is sufficient production of potable water, but breaks in service occur in some urban sectors due to water loss in the secondary and tertiary networks. Water losses produced in Panama City and its suburbs are calculated at approximately 30 percent. The greatest water losses registered occur in the city of Colon and are estimated to be near 50 percent; of the 15 MGD supplied by the plant at Mount Hope, it is calculated that 7 MGD are lost due to breakages which are difficult to detect due to the existence of a very superficial phreatic layer. In the rest of Colon's suburbs, the water-loss situation is similar to that of Panama City.

The losses are caused by multiple factors: Breakage in distribution networks, fraudulent installations, unauthorized conduction to marginal communities, and the lack of individual meters in some neighborhoods, which is conducive to waste. The networks have also deteriorated through corrosion caused by prolonged exposure to soil which in many cases is a saline medium, due to the intrusion of the sea in the past or interaction with a subjacent aquifer in zones which were previously coastal mangrove swamps.

Lack of meters for final users—The lack of meters in the former military base buildings and reverted areas complicates system management. In the buildings of the former military or civilian installations, both in the Atlantic and Pacific subregions, water meters are non-existent in residences, office buildings, workshops, barracks, clubs, aiports, docks, etc.

Expansion of water production and conduction is needed—The expansion of water production will be carried out by enlarging certain water treatment plants and bringing into service the new plant in Laguna Alta, designated to serve the West Pacific. A new conduction line will also be laid out to service the East Pacific, in the Tocumen sector.

These potable water treatment plants, in order to increase their capacity, require expansion of adduction and conduction lines. They also require expansion of raw-water intakes as well as of all unitary plant processes. To achieve this, it will be necessary to analyse whether sufficient physical space exists in the intakes and plants, and whether the costs are sufficiently attractive to undertake expansion of old plants versus construction of new plants with modern systems.

The adduction lines have been in service for several decades: The lines from Gamboa to Miraflores and from Espinar to Mount Hope have been in service for 80 years; the line from Paraiso to Miraflores, 46 years. Most of the conduction and distribution lines in the areas of civilian population of the study area have been in service for 80 years.

In both the Pacific and Atlantic sectors, conduction pipes with 10 to 30-inch diameters appear to be in good condition. Incrustations have not been found when making sectional repairs. However,

the valves, in spite of proper maintenance, present operational problems and are currently being replaced. It has been programmed for at least half of them to be replaced with butterfly-type valves.

Some potable-water distribution pipes present incrustations when removed for repair, but they do not present capacity problems due to the fact that the soil uses (demand) remain unchanged.

The potable-water pumping stations are in perfect condition due to proper periodic maintenance. The only original part of some of these pumps is the outer shell, since the entire system has been replaced with new parts. Some pumps have been in service for more than 20 years.

Most of the reverted systems, which have been in service for more than 50 years, require periodic and intensive maintenance. These systems are designed to serve the areas as they are currently found. If soil uses change and greater demands are produced, it is quite probable that the aqueduct system will not have the capacity to supply this increase in demand.

Easements are not along public roads—In the former military installations of both the Atlantic and Pacific subregions, the feeder and conduction pipes do not follow a uniform easement pattern, and cross green areas near buildings and homes, in some cases even passing beneath structures.

7.8.3 Waste Water

The networks work well in spite of their advanced age—The sanitary sewer systems are functioning well, except for certain obstructions caused by tree roots. These systems have been in service from 50–80 years, and the soil uses of the areas served remain unchanged.

Many pumping systems are non-functioning due to lack of maintenance—The majority of sanitary sewer systems in the areas of interest function through pumping stations for final disposal, necessitating their operation and periodic maintenance. Many of these pumps, however, are non-functioning due to lack of maintenance, causing spillover which results in the deterioration of bodies of water nearest populated areas.

The IDAAN took charge of the operation and maintenance of the Balboa waste water pumping station when it reverted to Panama. Within a year, the station ceased to function for lack of periodic intensive maintenance.

Waste water is dumped untreated—The few existing primary treatment systems which have reverted, both in the Pacific and Atlantic subregions, are non- functioning and in a state of total abandonment. Examples of this are the Imhoff tank in Curundu, the Imhoff tank in Arcoiris, and the Imhoff tank and pumping station in Gamboa.

Networks do not follow a uniform easement pattern—In the former military installations of the Pacific and Atlantic subregions, the sewer drains of lesser diameter do not follow a regular easement pattern, having been constructed in accord with the topography of the terrain. Lines pass near buildings and cross green areas between homes, following the shortest route to the collector. These systems are designed to serve the areas as they are currently found. If soil uses change and greater volumes of waste water are produced, both domestic and industrial, partial or total reconstruction will be necessary.

In general terms, purification of all waste water proceeding from all Canal Area regions needs to be considered. Otherwise, sources of superficial continental and marine water will become contaminated, causing great harm to the flora and fauna of these aquifers and consequently having a negative impact on the quality of life for the inhabitants of these regions.

7.8.4 Drainage

Lack of maintenance and cleaning in the network and neighboring zones—Road drainage is the responsibility of the MOP, but adequate maintenance service is not being provided, giving cause for complaint on the part of users and the ACP.

Insufficient capacity for current use—Urban drainage is the responsibility of the IDAAN, but areas reseved for flood control have been occupied, as is the case in Albrook, causing flooding of urban roads.

Most of the storm drainage pipes have a diameter of 12 inches or less, implying the need for a rigorous and permanent program of cleaning and maintenance; the torrential rains common in this region wash out a lot of sand and clay, producing drain blockage and a reduction in cross-section and capacity.

The design norms applied in Panama do not permit the use of drainpipes with a diameter of less than 18 inches, and this diameter is allowed only in the initial segments of the network.

The water volumes of the original design have not varied to date, as there has been no modification of conditions such as green areas, soil use or increase in areas of pavement and roofing, among others. Should these conditions change, or should there be an increase in population density with the resulting decrease in green areas, the current system will need to be changed almost entirely, as absorption areas will diminish, increasing the runoff coefficient. This will decrease concentration time, causing greater flows of rainwater through drainpipes or sewers, a situation which cannot be handled by the current system of pipelines.

Lack of control of setbacks along natural waterways—In the former military bases of the Pacific and Atlantic, the storm drainage systems, whether underground or open, are installed across any area with a topography adequate for layout, often located near homes or buildings and not along road easements. Additionally, control has eased with respect to the required distance between buildings and natural waterways or public service easements.

7.8.5 Solid Waste

Conflict over the location of the sanitary landfill on the Atlantic—The Mount Hope landfill has capacity for approximately two more years of operation. As the result of a feasibility study carried out to determine the best location for the establishment of a sanitary landfill in the province of Colon, municipal authorities have asked the Authority of the Interoceanic Region for a parcel of land in the Davis sector. This request has not been granted, and an acceptable solution for the new sanitary landfill in the Atlantic region has yet to be found.

Cover material is lacking in the Cerro Patacon sanitary landfill—In the Pacific sector, the sanitary landfill of Cerro Patacon receives solid waste from the cities of Panama and Arraijan. In

Arraijan, collection has been conceded to a private operator. A recently presented study requests that additional terrains be incorporated in order to obtain cover material to extend the useful life of the Cerro Patacon landfill. The method for disposing of toxic waste in this landfill needs to be clarified, so that control of potential adverse consequences caused by these materials can be maintained.

7.8.6 Roads

Insufficient road network, lack of connection between communities—The road system is designed to support the internal services of the former military reserve areas, with very little connection to the rest of the region's road network. Connections are present at only a few intersections, and their capacity is very limited. These limited interconnections function because of the low volume of traffic between the military areas and the rest of the region. For their integration, it will be necessary to design an interconnecting system with a greater capacity.

Insufficient road capacity—The system within the former military areas consists of two-lane roads, with the exception of Andrews Boulevard in Howard, prohibiting their use for high volumes of traffic. In areas where changes in soil use have been programmed or the closed functional concept of the bases has been modified, expansion of main roads will be needed to create transit hubs which permit management of high volumes. Most of the roads outside the military bases are also two-lane. A few three and four-lane stretches exist, but their overall capacity is very limited when compared to the potential use of the region they serve. An important case at hand is the Bridge of the Americas, which, after widening, continues to function at full capacity, indicating the urgent need for a new Canal crossing.

Pavement in poor condition—The concrete pavement found on some of the main roads consists of cement slabs laid directly over a layer of fine, non-draining material. This structure, together with the age of the pavement, presents a clear limitation to the capacity to bear heavy, frequent loads. The changes in soil use which accompany load management will require the integral reinforcement of the pavement structure. Evidence of this situation can be found in the rapid deterioration of the reverted roads which have been subjected to heavy, frequent loads.

7.8.7 Electric Energy

Expansion programs are well defined—Generation of energy is carried out by the ACP (HidroGatun, HidroMadden and TermoMiraflores) and by other plants in the national territory, which are governed by Law 6 of January 3, 1997. The ACP transports energy along its own lines to the interconnected national system.

The country's total generation is sufficient in the medium term, but extension of the 13.2 kV and 115kV lines is needed in the Pacific sector, and of the 115 kV lines over to Mount Hope, Telfers and Davis in the Atlantic sector.

The ARI transferred the systems to EDEMET (Pacific) and ELEKTRA (Atlantic), and the reverted areas are incorporated into the concession areas.

Usually, service is provided wherever demand exists—Operators encounter difficulties in replacing lines found within the easements of private buildings, and undertake expansion only as needed, but with sufficient speed to attend urbanizers' demands in a timely fashion.

7.8.8 Telecommunications

Clarity is needed in the delimitation of C&W's and ACP's jurisdictions of coverage—Operation of stationary telecommunications corresponds to the concession granted to Cable & Wireless, but the ACP provides a small amount of competition in seven communities.

The provision of service could be compromised—C&W has the policy that "Wherever there is a new client, the network is extended," but it asks that the ARI be more rigorous in the definition of areas with greater and faster urban or economic development in order to coordinate its technical and economic interests. Apparently, C&W's investments are ahead of development activities in the reverted areas, and the company would like for renovation costs incurred before transfer of the properties to private ownership to be shared.

8. Infrastructure Investment Plan for the Canal Area, 2002–06

This chapter presents the project portfolio which constitutes the nucleus of the Infrastructure Investment Plan. Identified according to the guidelines discussed in Chapter 4 of this report, the projects in the portfolio focus principally on areas of current and potential economic development: North Coco Solo/France Field, Telfers, Espinar, Industrial Balboa, Balboa, Albrook, Howard, Rodman and Amador. These are priority infrastructure projects for facilitating and enabling the development of industrial, commercial, institutional, tourism and residential activities in the various communities.

The portfolio is divided into two parts: Road network projects (table 8.1), representing a total investment of US$205.0 million, and environmental infrastructure projects (table 8.2), which total around US$33.5 million. The grand total for the portfolio is US$238.5 million.

Road network investments dominate the infrastructure portfolio proposed for the inter-oceanic area. Given the lack of integration among former military bases and civilian communities, a legacy of the fragmented institutional framework of the US Military forces which developed them, it is not surprising that, generally speaking, what is most needed to encourage future development of the Canal Area is access to, and interconnection between, the current and future zones of growth and investment.

Encouraging investment in "economic projects" and real estate also requires potable water and sewer systems. In spite of the modest investment total, the environmental infrastructure projects (potable water, sewer and storm drainage systems, and solid waste management) are essential for achieving sustainable development which will preserve and enhance the environment of the Canal Area and its hydrographic basin.

In the following pages, the projects are divided by subregion and a description is given of the way in which these projects interact spatially to improve the quality of future developments. Profiles of these projects are presented in Annex B.

8.1 East Pacific

Projects for the East Pacific subregion are:

Albrook

- PE-V4 (P1-T2) Extension of the East Marginal Avenue over to Amistad Road
- Extension to connect Minter/Godfrey (part of PE V4)
- PE-V5 (I3) Overpass intersection Amistad/Ascanio Villalaz V4
- Repositioning of Sewers
- María Salas River and Barrios Creek: Improvement of channels, new storm sewers and drainage maintenance (part of PE V4)

Balboa

- Widening of Ascanio Arosemena Avenue
- PE-V7 Widening of Arnulfo Arias Ave. from 3 to 4 lanes
- PE-V6 La Boca-Amador Coastway and widening to four lanes of existing section.
- Integral drainage in La Boca and Balboa: Addition and relocation of storm drainage pipes.

The purpose of the majority of the projects is to improve the connection between communities and correct current infrastructure deficits, since this subregion is, in general terms, the one which presents the greatest need for networks, connections and services. Several of the road network projects combine together to improve the secondary network in Balboa by widening the streets which circumvallate the main commercial centers and connecting them to Amador through Industrial Balboa (Ascanio Arosemena, Arnulfo Arias, and La Boca-Amador Coastway).

The investments are justified in the following manner:

Albrook

Road System. Connection of the East Marginal over to Amistad Road: the East Marginal is a route proposed in the General Plan which currently originates at the National Transportation Terminal. It joins Canfield Avenue in the community of Albrook in order to establish an adequate connection with Amistad Road by means of an overpass which crosses Ascanio Villalaz Avenue. This marginal route and its connection with Amistad Road will permit interconnection with the city's road system and residential and economic sectors, by means of several lanes, representing a faster option for moving traffic between the city and the economic sectors in process of development in the East Pacific subregion.

Storm Drainage. Maria Salas River and Barrios Creek: Improvements to existing channels and the consideration of new storm sewer systems, as well as the maintenance of drains located near the end of the Albrook Airport runway, will serve to avoid flooding in these sectors and recover terrain which can be developed.

Sanitary Sewer System and Potable Water. Los Pueblos Group housing: The residential development of Los Pueblos Group was not able to independently resolve the evacuation method for storm and sewer drains. By not foreseeing this problem, the solution found was to connect new systems with existing ones in the community of Albrook The search for a solution to this problem and to future development is justified, since the current system is operating at maximum capacity.

Repositioning of the potable water and sanitary sewer networks: Maintenance of these systems is needed. Repositioning is expected to be difficult and costly; however, this matter needs to be addressed, in light of the need to repair breaks in the system or replace old sections with new.

Balboa

Road System. Widening of Ascanio Arosemena Avenue: Widening of this avenue from two to four lanes is necessary in order to complete the road system which circumvallates the Balboa sector and is complemented by the Avenue of the Martyrs and Arnulfo Arias M. Avenue. Traffic on this road will increase considerably with the partial closure of the road which crosses the port

area and the development of the Transportation Terminal in Albrook, therefore requiring the expansion of this and other roads in the Balboa area.

Widening of Arnulfo Arias M. Avenue: Widening from three to four lanes would be carried out between the Avenue of the Martyrs and Soberania Avenue (former Amador Avenue). This widening is necessary in order for the avenue to have a uniform width along its entire length, and because of its importance within the Canal Area road system.

La Boca-Amador Coastway and widening of E. Vergara Avenue: The Coastway is a stretch which would unite Emanuel Vergara Avenue with the Amador Tourist Project. Widening of E. Vergara Avenue, between the intersection of Ascanio Arosemena Avenue and Arnulfo Arias M. Avenue, and initiation of the Coastway, is needed in order to improve the flow of traffic heading towards Amador and port-related traffic in Industrial Balboa. Justification for the Coastway is that it would create a second connection to the Amador Tourist Project and provide access to important ocean-front properties along the coastal area of La Boca. The initial proposal is for a two-lane road, which is the same width as the road it would connect with in Amador.

Storm Drainage. Integral Drainage in La Boca and Balboa, Addition and Relocation of Storm Drains: These projects are required to eliminate areas which coincide with main roads and are subject to flooding during the rainy season.

8.2 West Pacific

Projects identified for this subregion are:

Howard/Farfan/Kobbe

- PO-V3 Construction of West Howard Road
- PO-V2 (T1) Rehabilitation and widening of Beard Road-Andrews Boulevard
- PO-V1 Widening of Veracruz coastal road
- River to the west: Maintenance of river bed

The projects focus more on the capacitation and improvement of the Howard/Farfan/Kobbe sector, than on providing a connection within the subregion as a whole. Nevertheless, there are important road projects destined to connect the West and East regions, and which will have significant impact on them.

The investments are justified in the following way:

Road System. Widening of Veracruz coastal road PO-V1: The importance of this project is based on the fact that the physical condition and load capacity of this road will limit development of coastal areas suited to urban tourism activities, and, on the west side, areas of industrial commercial activities directed towards exportation.

Widening of central road PO-V2: This project is of great importance owing to the fact that Howard, Farfan and Kobbe contain a large number of areas of medium-range development. As a result, the road will become a restrictive factor to the achievement of proposed development for

this area. Analysis of the connection to the Pan-American highway should also be carried out in this project.

Construction of East Howard Road PO-V3: This project is justified by the need to access lands surrounding the Howard airport runway, permitting their use for activities which complement those of the airport. Additionally, this road will help to improve traffic flow and capacity by connecting with the main artery—the Pan-American highway—and reducing vehicular pressure on Andrews Road. Analysis of the connection to the Pan-American highway should also be carried out in this project.

8.3 East Atlantic

Projects identified for this subregion are:

North Coco Solo/France Field
- AE-V3 Cuatro Altos Intersection
- AE-V4 Road AE-V4 Los Lagos-Randolph Ave. with intersection (a 2 km section is outside the Canal Area)
- PL-AE11 Paved drainage channels

Espinar
- AE-V5 Rehabilitation of Harmond Road and Espinar Street
- PL AE 6 Box sewers in Espinar Street

Telfers
- Improvement of access road to Dock 16
- Telfers Central Avenue from Bolivar Road to Manzanillo
- Peripheral road to Telfers
- Extension of Espinar Road over to Telfers Central
- Widening of networks which serve Manzanillo (specify range and location)

The projects in this subregion are noted for their role in enhancing communication and connection among the different communities, principally through road projects. Almost all the proposed projects extend beyond individual community boundaries and involve several at the same time, most likely due to the fact that the communities in this region are small and in close proximity to each other.

The investments are justified in the following way:

North Coco Solo/France Field
Road System. Cuatro Altos Intersection: This project is justified by the need to improve efficiency in traffic flow, especially for the cargo transfer routes which connect the ports to the national and international market.

Road AE-V4 Los Lagos-Randolph Ave. with intersection: The importance of this road is that it will enable the ARI and Duty Free Zone to develop the lands to the west of this road and

capitalize on the location of the existing airport for development of economic activities directed towards exportation.

Storm Drainage. Paved drainage channels: Improvements to these systems will help to channel rainwater to the ocean in an orderly manner and permit development of the available spaces, without danger of flooding in these or other locations surrounding the area.

Espinar
Road System. Tread cover on Harmond Road and recovery of pavement: Currently, Harmond Road is used in the residential sector of Puerto Escondido, while the section which continues on to Espinar is in disuse. For this reason, only the Puerto Escondido section has been rehabilitated, with two lanes of asphalt. However, due to the convenience of having an alternative access route to Espinar and neighboring areas, Harmond Road should be put into use in its totality. Harmond Road has an approved easement of 25 meters along the section which passes through the community of Escondido Port, and from that point until Espinar, the easement varies to 30 meters. The presence of residential structures along Harmond Road in the aforementioned community explains the reduction of the easement in this area, and will hinder the desired expansion of the road from two to four lanes.

Widening of Espinar (Blatchford) Street from two to four lanes, and recovery of pavement: Two elements exist to explain this: Espinar's communication with the other areas is carried out through Espinar (Blatchford) Street, and the development of Espinar in terms of tourism, commerce and residency has increased the use this road, causing the deterioration of the existing pavement.

Storm Drainage. Box sewers in Espinar (Blatchford) Street, on private land: Due to the high precipitation rate on the Atlantic coast, those areas having roads with malfunctioning storm sewers experience flooding along certain stretches, causing backups in vehicular traffic during the rainy season. This situation is felt most strongly along Espinar Street, which, as the only access road to Espinar, is the most traveled.

Telfers
Road System. Improvement of the access road to Dock 16: The physical condition of the road to Dock 16 and its load capacity will hinder the development of areas alongside. The road requires improvement in its entirety in order to be able to take advantage of the available properties and at the same time obtain the greatest economic benefit from said improvements.

Telfers Central Avenue from Bolivar Road to Manzanillo: This project would help to improve the road network connections of the East Atlantic sector, as well as providing access to undeveloped lands parallel to this road.

Telfers peripheral road: This project, like the previous ones, will permit access to a greater area of available, undeveloped land on Telfers Island.

Potable Water System. Expansion of networks which supply Manzanillo: This project is directed towards improving and increasing potable water conduction capacity, to meet future demands in

undeveloped areas such as those bordering the ports, which will be put on the market in the mid-future.

8.4 West Atlantic

Projects identified for this subregion are the following:

Sherman

- Variant in access road (including cover where it crosses the stream)
- Repaving of access to Fort San Lorenzo
- Road connection circumvallating the lagoon
- Repaving and improvement of drainage along access road in front of barracks
- AO-AP2 New potable water conduction along access variant
- AO-AR1 Repositioning and extension of sewer system
- Independent system for solid waste disposal
- AO-PL4 Improvement and extension of paved channels

Only one community has been identified as having priority for development. Therefore, most of the infrastructure projects are designed to improve the internal functions of said community, with the exception of improvements to the road to Fort San Lorenzo for the purpose of benefiting tourism development in the subregion as a whole.

Investments are justified in the following manner:

Road System. Variant in access road: A detour is necessary in order to take better advantage of the areas which can be given in concession, and provide a better main access to the Sherman tourism complex.

Repaving of access to Fort San Lorenzo: Improvement of the road will facilitate access to this important historical site. The objective is to improve the condition of the road so that it will be safer and easier for travel of all types of vehicles.

Road connection circumvallating the lagoon: Connection between two existing roads which would allow better advantage to be taken of the shores of the lagoon, which is destined for tourism and recreational uses. Its importance is due to the need to improve the morphology of an area with enormous development potential.

Storm Drainage. Improvement of Sturgis Street drainage: Currently, this road experiences flooding due to deficient drainage of the asphalt layer. This road provides the only land access to the barracks (installations of great importance for tourism development in Sherman), and therefore improvements are essential.

Improvement and extension of paved channels: Projects necessary for the prevention of possible floods and improvement of drainage speed, in view of the tourism development foreseen for this area.

Potable Water System. New potable water lines: Placement of new pipes which will permit improvement and completion of the existing network, in order to provide **potable water service to the Sherman Tourism Complex.**

Sanitary Sewer System. Repositioning and extension of sanitary sewer network: The current network is insufficient and very deteriorated, requiring the replacement of old pipes and the laying down of new ones where none are currently found, in order to guarantee transportation of waste water from the entire urban area of Sherman to the future treatment plant.

Solid Waste Collection System. Independent system for disposal of solid waste: It will be necessary to resolve the solid waste collection and management situation, in view of the fact that the urban area is isolated from other developments, and poor management could do serious harm to tourism development.

8.5 Regional

Regional projects which do not belong to any specific community are the following:

Roads

- PO V5 Widening of the Pan-American Highway
- PE-V3 (T1 y T2) Widening from two to four lanes of the central access road to Clayton
- PE-V1 (T3) Widening of Gaillard Avenue between Corozal and Clayton
- PE-V4 (P2-T1) Widening from two to four lanes of Ascanio Villalaz Avenue between Amistad Road and Juan Pablo II.
- PE-V5 (P1) Widening from two to four lanes of Amistad Road
- AE-V1 Widening of Randolph Avenue from two to four lanes and improvement of drainage
- AE-V2 y AE-V2(R) Repaving of east and west branches of Bolivar Road in Arco Iris
- Drainage in two flood areas, one on Bolivar Road and the other on Randolph

Waste water treatment plants (PTAR)

- AO-AR3 Sherman PTAR I
- AO-AR5 Sherman PTAR II
- AE-AR8 Espinar PTAR
- AE-AR12 France Field PTAR
- AE-AR Telfers PTAR I
- AE-AR Margarita/Arco Iris PTAR
- AE-AR Davis PTAR
- PO-AR Rodman Rehabilitation of the PTAR I
- PO-AR Rodman Docks PTAR II
- PO-AR Cocoli PTAR
- PE-AR Albrook/Curundu/Los Rios/Diablo/Corozal PTAR
- PE-AR Clayton/Cardenas/Pedro Miguel/Paraiso PTAR
- PE-AR Balboa/La Boca/Ancon

Solid waste (RS in Spanish)

- PE-R1 Expansion and improvements to sanitary landfill in Cerro Patacon (Howard transfer station)
- PO-R1 New sanitary landfill in La Chorrera
- AE-R1 Construction of new sanitary landfill for Colon (Espinar transfer station)

It should be noted that waste water treatment plants (PTAR) are classified as projects of regional incidence, in spite of being located in a specific community, due to the magnitude of their impact on the environment.

8.6 Other Measures Critical to Future Development of the Canal Area

Some of the actions refer more to measures which should be taken than to direct execution of physical projects by request of the ARI. These measures and general projects can be classified in the following manner:

- Promote a social awareness campaign regarding garbage collection in Espinar.
- Request that the electric energy distribution companies improve current stability in the supply to final users.
- Request that whoever takes the Telfers concession present a master plan for sewer systems and waste water treatment.
- Define, in conjunction with the railroad concessionaire, the ACP, and the Howard concessionaire, the easements required for an eventual extension of rail service to the West Pacific.
- Advise the Sherman concessionaire of the need to enlarge the Sherman dock in order to handle the influx of tourists from the cruise ship port in Colon, in accord with the operative methods used there.
- Discuss with Hotel Melia Panama the possibility of enlarging their parking area in order to free up traffic in public areas surrounding the hotel.
- Discuss with port concessionaires, especially in the case of Industrial Balboa, the need to treat waste water before depositing it in any body of water.
- Promote control of potable water loss from IDAAN's distribution network and an increase in production at the Sabanitas treatment plant.
- Discuss the extension of networks which should be carried out by the user in France Field from the main conduction lines which reach to Cuatro Altos; the same applies for the sewer system network.
- Discuss the extension of networks which should be made by the user in Telfers from the main conduction lines that pass by Bolivar Road; the same applies for the sewer system network.
- Discuss the extension of networks which should be made by the urban developer in Espinar from the main conduction lines which pass by Bolivar Road; the same applies for the sewer system network.
- Discuss the solution for drains in Colon and Margarita with covers that will be located on private lands which reverted during the initial phases of the Torrijos-Carter Treaty enactment.
- Advise the Howard concessionaire of the need to install and operate a station for solid waste transfer.

8.7 Preliminary Analysis of Environmental Impact

The projects foreseen will have both positive and negative effects on the environment. The elaboration of engineering projects must include the identification of said impact and, wherever and whenever the project is feasible, recommend the measures needed to mitigate or compensate this impact in such a way that environmental requirements and those of the ANAM are satisfied. This is applicable both to transitory impact generated during the construction phase, and to permanent impact resulting from the operative phase of these projects.

In this pre-feasibility stage, certain preliminary appraisals of the possible environmental impact produced by the investments identified for each subregion should be noted.

East Pacific—The road projects in this subregion will increase runoff, causing soil erosion. However, the gutters which are planned for in these same projects will help to mitigate this potential negative environmental impact. Improvements to channeling of the Maria Salas River and Barrios Creek will reduce flooding and help to eliminate mosquito breeding grounds in these zones. Expansion of the Cerro Patacon sanitary landfill will reduce contamination of the soil and aquifer associated with future development of the East Pacific.

West Pacific—The majority of the projects in the West Pacific deal with improvements in road access to this zone of priority economic development. The actual construction of the roads will have little environmental impact (some increase in runoff and the possibility of erosion); in contrast, the territorial development stimulated by the infrastructure investments through the opening of access to zones of little development, could have important environmental impacts which should be studied during the feasibility analysis for each project. Rehabilitation of the Rodman treatment plant will have a positive impact on the quality of the water of the Canal, into which waste water is directly dumped.

East Atlantic—The construction and repositioning of waste water treatment plants in Espinar, Telfers and Davis, will reduce the biological contamination dumped into bodies of water such as Lake Gatun and the mouth of the Canal to safe and acceptable levels. Investments in connecting roads throughout the subregion will increase runoff, possibly causing soil erosion. The paved drainage ditches in North Coco Solo will help to channel rainwater to the ocean in an orderly fashion. Other investments in rainwater drainage in Espinar will reduce flooding and mosquito breeding grounds.

West Atlantic—The new treatment plant in Sherman will reduce the biological contamination dumped into the Caribbean to acceptable levels. The repositioning of the sewer system network will assure that a larger volume of waste water makes it to the plant. The new system for collection and disposal of solid waste will minimize aquifer contamination resulting from the higher rate of soil occupancy associated with foreseen tourism development. It is possible that the new road to Fort San Lorenzo will result in higher levels of encroachment on the forest, which could negatively affect the flora and fauna of the national park.

Table 8.1 Road Investment Program, 2002–06 (US$)

Community	Code	Project	2002	2003	2004	2005	2006	Total
Regional Roads								
Several	PO-V5	PAH (Arraijan Bridge of the Americas)			20,164,349			20,164,349
Several	PE-V1 (T3)	Gaillard Road (Corozal-Clayton Section)	3,474,208					3,474,208
Several	PE-V3 (T1-T2)	Central Streets of Clayton, and Clayton-Curundu		9,186,111				9,186,111
Several	PE-V5 (P1)	Amistad Road	3,085,000					3,085,000
Several	PE-V5 (P2)	Amplification of Juan Pablo II Avenue	2,722,250					2,722,250
Several	PE-V4 (P2-T1)	Ascanio Villalaz Avenue (Section 1)	1,567,250					1,567,250
Several	CE-V3	Rehab. Access to Second Canal Bridge		14,353,000				14,353,000
Several	AE-V1	Randolph Avenue	15,723,090					15,723,090
Several	AE-V2	Bolivar Road and Branch in Arcoiris	6,409,000					6,409,000
East Pacific								
Albrook	PE-V4 (P1-T2)	East Marginal Avenue over to Amistad Road	3,485,391					3,485,391
Albrook	PE-V5 (I3)	Interchange A. Villalaz Ave.-Amistad Road	6,858,313					6,858,313
La Boca, Amador	PE-V6	La Boca-Amador Coastal Road			1,854,890	2,412,243		4,267,133
Balboa	PE-V7	Amplification of Arnulfo Arias Avenue		2,468,480				2,468,480
San Francisco Valley	PE-V8	Circumvallation of San Francisco Valley		8,100,000				8,100,000
West Pacific								
Howard, Farfan, Kobbe	PO-V1 (F1)	Veracruz Coastal Road		7,962,450				7,962,450
Howard, Farfan, Kobbe	PO-V1 (F2)	Veracruz Coastal Road		17,278,347				17,278,347
Howard, Farfan, Kobbe	PO-V2 (T1)	Beard Road – Andrews Boulevard	11,168,694					11,168,694
Howard, Farfan, Kobbe	PO-V3	Construction West Howard Road			28,964,030			28,964,030
East Atlantic								
Coco Solo, France F.	AE-V3	Interchange Randolph Ave.-Transisthmic (4 altos)	5,590,920					5,590,920
Coco Solo, France F.	AE-V4	Los Lagos Road – Randolph Ave.		9,648,975				9,648,975

Espinar, Margarita	AE-V5	Harmon Road and Espinar Street		2,252,419			2,252,419
Telfers	AE-V6 (F1)	Rehab. Road to Dock 16			1,239,000		1,239,000
Telfers	AE-V6 (F2)	Telfers Road System				14,747,395	14,747,395
West Atlantic							
Sherman	AO-V1	Improvements to Sherman Road System	1,704,937				1,704,937
Sherman	AO-V2	Rehab. Sherman-San Lorenzo Road			2,591,000		2,591,000
Total			61,789,053	71,249,782	54,813,269	17,159,638	205,011,742

Table 8.2 Program for Environmental Infrastructure Investments, 2002–06 (US$)

Num.	Community	Code	Project	2002	2003	2004	2005	2006	Total
1	Coco Solo	AE-AP13	Potable water distribution		200,000	250,000			450,000
2	Telfers	AE-AP17	Potable water distribution				200,000	120,000	320,000
3	Margarita	AE-AP19	Water pipe replacement			100,000	100,000		200,000
4	Espinar	AE-AP9	Repos. and ext. of aqueducts		100,000	160,000			260,000
5	Coco Solo	AE-AR14	New sanitary sewer system				1,500,000	1,000,000	2,500,000
6	Espinar	AE-AR10	Repositioning of sewer networks		100,000	50,000			150,000
7	Coco Solo	AE-AR12	Treatment plant	650,000	200,000				850,000
8	Telfers	AE-AR16	Treatment plant				600,000	300,000	900,000
9	Telfers	AE-AR18	New sanitary sewer system					450,000	450,000
10	Arco Iris	AE-AR20	Treatment plant		400,000				400,000
11	Arco Iris	AE-AR22	Conduction pipeline and pumping station	280,000	100,000				380,000
12	Espinar	AE-AR8	Treatment plant	280,000					280,000
13	Davis	AE-PL7	Sewers and pipelines		450,000	200,000			650,000
14	Coco Solo	AE-PL11	Enlarg. and pave. of channels and new sewers			800,000	600,000	600,000	2,000,000
15	Telfers	AE-PL15	Storm drain pipes and channels			800,000	800,000	800,000	2,400,000
16	Arco Iris	AE-PL21	New storm drain pipes			380,000			380,000
17	Margarita	AE-PL6	Channels and pipelines		450,000	400,000			850,000
18	Espinar	AE-R1	New sanitary landfill in Colon			800,000	243,000		1,043,000
19	Sherman	AO-AP2	New aqueduct pipeline		56,000				56,000
20	Sherman	AO-AR1	Pressure and distribution pipeline		157,000				157,000
21	Sherman	AO-AR3	Treatment plant		260,000				260,000
22	Sherman	AO-AR5	Treatment plant			120,000			120,000
23	Sherman	AO-PL4	Channels		112,000				112,000

Num.	Community	Code	Project	2002	2003	2004	2005	2006	Total
24	La Boca	PE-AR35	Treatment plant			1,000,000	500,000	500,000	2,000,000
25	Albrook	PE-AR30	Treatment plant			1,800,000	1,000,000		2,800,000
26	Albrook	PE-AR31	Sewer conduction line			250,000			250,000
27	Clayton	PE-AR33	Treatment plant	750,000	550,000				1,300,000
28	Clayton	PE-AR34	Sewer collection line			400,000			400,000
29	Balboa	PE-AR36	Sewer collection line			500,000	350,000		850,000
30	Albrook	PE-PL32	Sewer system and channels	1,000,000	800,000	400,000			2,200,000
31	Rodman	PO-AP27	New potable water pipes				250,000		250,000
32	Rodman	PO-AR23	Rehabilitation of treatment plant	100,000					100,000
33	Rodman	PO-AR24	Sanitary collector				340,000		340,000
34	Rodman	PO-AR25	Sanitary collector				180,000	100,000	280,000
35	General	PO-AR28	Treatment plant		200,000	90,000			290,000
36	General	PO-AR29	Sewer conduction line		120,000				120,000
37	Rodman	PO-PL26	Channels and pipes				250,000	100,000	350,000
38	Howard	PE-R1	Expansion of Cerro Patacon sanitary landfill		1,700,000	386,200			2,086,200
39	Arco Iris	AE-PL37	Storm sewer system		240,000				240,000
40	Rodman	PO-AP38	Conduction pipeline from Cocoli			500,000			500,000
41	Davis	AE-AR39	Treatment plant				400,000		400,000
42	Davis	AE-AR40	Pumping station			80,000			80,000
43	West Pac.	PO-R1	Sanitary landfill - West Pacific			3,481,600			3,481,600
			TOTAL	**3,060,000**	**6,195,000**	**12,947,800**	**7,313,000**	**3,970,000**	**33,485,800**

Chart 8.1

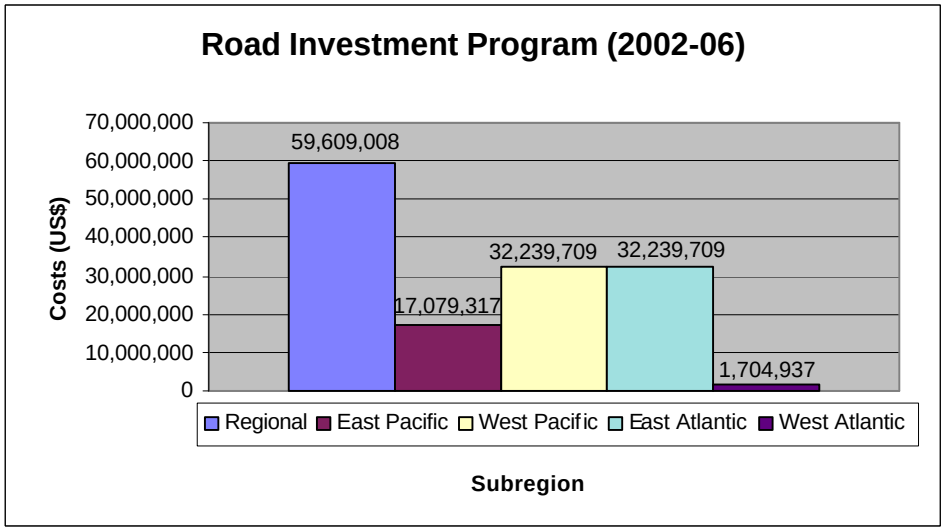
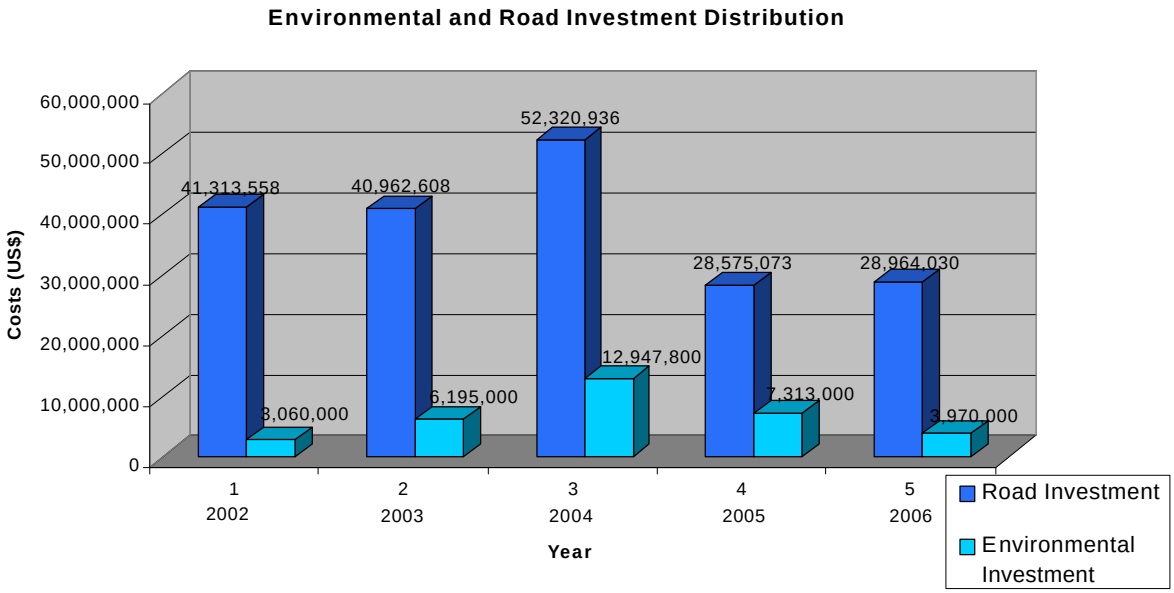


Chart 8.2



9. Financing and Execution Strategy

The strategy for Financing and Execution of the Five-Year Plan for Infrastructure Investments during 2002–06, is developed under the premises and conditions set forth in the General Plan document entitled "Evaluation of Alternative Strategies for development of the Canal Area."

Consequently, a brief review of the three development strategies already identified in this study is opportune. The first of these corresponds to an "accelerated development" strategy based on rapid growth of income and employment in a short period of time, which in turn will result in the intensive use of reverted installations for commercial activities.

The second strategy of "controlled development" gives greater emphasis to maintenance of the reverted areas within the framework of controlled, or sustainable, development.

The third and last strategy is that recommended in the General Plan as supposed economic, by which the territorial ordering of the Canal Area is established. Specifically, this deals with the strategy of "balanced development," which contains elements from the previous two strategies but combines them under the principle that it is possible to design a maximization of income subject to certain restrictions in soil uses based on the distribution of public properties.

It is equally important to note within this proposal that the use of reverted installations depends not only on the quality and quantity of the lands offered, but primarily on the demand for these lands, which results from their commercial potential as perceived by national and foreign investors. This potential, in turn, depends on external conditions of the national economy.

In other words, the financing strategy must regard new tendencies in globalization and the opening of markets as significant elements in institutional financial strategies, by which the financial resources necessary for the success of the Five-Year Plan for Investments during the 2002–06 period are mobilized.

9.1 Institutional Management of the Financing Strategy

Given the nature of investment management in Panama, on many occasions the investors interested in financing infrastructure projects must obtain approval from several ministries or government agencies. Depending on the nature of the project, approval is frequently required from the ARI, the Panama Canal Authority, the National Environmental Authority, the Ministry of Public Works, etc. It is possible that approval by the Cabinet Council, the Legislative Assembly and, in some cases, even the municipal governments, will also be required. In this sense, the expenditures in time and money required by Panamanian bureaucracy serve as a deterrent to potential investors, necessitating greater coordination among state institutions if investors are to be to attracted.

Due to the mostly fractious efforts to have international organizations channel financial resources towards the Canal Area, it is necessary to strengthen institutional ties between the Authority of

the Interoceanic Region and the rest of the public institutions in charge of soliciting financing for execution of new projects.

In this sense, the Central Government at the Executive Level, together with the Ministry of Economy and Finance, must secure with the ARI the implementation of public investment projects in those infrastructure sectors which by their nature are in the hands of the State.

9.2 Project Priority

The projects presented in Table 9.1 correspond to a group of priority projects which should be carried out within the 2002–06 period and are distinguished by the following characteristics, among others:

- They are packages of priority projects which will complement the development of other private capital investments in the country's diverse strategic sectors.
- They correspond to short-term projects which will have great impact on the development of the reverted areas.
- The projects can be organized by packages or by segments, such as "service distribution," in order to make them more attractive to participation by the private sector. This could be applied in the case of potable water service in the reverted areas.

9.3 Potential Financing Sources

A variety of financing sources exist which can be adapted to the different types of infrastructure projects, depending on the characteristics of the project to be managed. Application of a tariff system, for example, could be a way of covering investment, operation and maintenance costs , and generating interest on the part of the private sector to participate in the execution of said project and to operate it by concession or privatization.

Other variables that can influence the source or origin of financial resources are the following:

- Ability to generate income
- Total amount of financial resources required to construct the project
- Length of time needed for execution or construction of the project
- Technical, political and financial risks involved in the construction and administration of the project

Infrastructures with great income potential, such as energy and telecommunications, have been privatized through companies such as Cable & Wireless, reflecting the strong interest on the part of international finance capital to position their investment resources in this infrastructure field.

The presence in Panama of an international banking center encourages the interest of some credit agencies in financing projects in the reverted areas. In the case of the Amador Tourist Project, the physical infrastructure projects have been financed through a loan from the National Bank of Panama. Likewise, representatives of the international private banking industry located in Panama

have approached the Authority of the Inter-oceanic Region to establish possible financing mechanisms for the execution of physical infrastructure projects in the reverted areas.

It is important to point out that the presence of a Panamanian economy based on the use of the dollar as its currency in financial transactions, is an element which favors participation by international capital in the privatization of public services.

The principle infrastructure systems to be analyzed from the angle of financing strategy are: potable water, waste water, storm sewers, solid waste, roads, energy and telecommunications. A discussion of financing perspectives for projects from each one of these sectors follows.

9.3.1 Potable Water, Waste Water and Storm Sewers

This infrastructures contained in this package possess similar criteria for application, with respect to the institutional policies applied by the Panamanian State through the National Institute of Aqueducts and Sewers (IDAAN). It also deals with sectors which are experiencing financing problems and difficulties due to the fact that in the view of the country's public-service culture, these are services which the State should provide and for which tariffs do not exist. An exception is potable water, but the tariff does not cover the costs incurred during the process of investment, operation and maintenance of this service.

Potable water service is currently the responsibility of the State through the IDAAN, which provides the service principally to users in the cities of Panama and Colon. Nonetheless, it should be added that the Panama Canal Authority sells to the IDAAN potable water proceeding from the Miraflores treatment plant. The IDAAN then uses this water to provide service to the Pacific Sector of the Reverted Areas and to part of Panama City as well. In the case of the Atlantic sector of the Reverted Areas, the service is provided through the Mount Hope treatment plant.

Waste water service is also currently being provided by the Panamanian State through the IDAAN; nevertheless, it is an activity in which the private sector could participate through the mechanism of privatization (or delegation to the private sector).

With respect to storm sewers, the financial resources for construction of networks for this infrastructure are also provided by the National Government. In the future, these projects could also be the object of privatization, involving participation by the national or foreign business sector. Naturally, this would be imply the need to pay for these services by means of user tariffs; however, it would be necessary to modify traditional attitudes which assume that these are public services which should be provided by the Panamanian State.

In order to improve long-range performance in the water and sewer sectors, it is recommended that a program be carried out to commercialize the IDAAN—including restructuring of its financial administration with a view to recovering costs and generating additional resources for financing new investments—or that the service be delegated to the private sector through concession or some other form of public/private association. It should be noted that neither the commercialization nor the concession of these services involves privatization: In both cases, the service continues to be public, and the State continues as owner of the works.

Although desirable, these are not the most indicated alternatives for accomplishing the potable water and sewer projects included in the Investment Plan for the Canal Area. To begin with, the political orientation of the current government with respect to provision of public services does not favor either commercialization or concession of these services. Given the short time period of the Investment Plan (only five years), it is preferable to focus on direct financing by the IDAAN, using secondary financing mechanisms such as valorization. Secondly, the catalyzing force behind reforms in this sector should not be the needs of the Canal Area, but rather an overall evaluation of the role of the IDAAN and of the potable water and sewer needs not only of the metropolitan areas of Panama and Colon, but of the rest of the country as well. In other words, reforms to the water and sewer sectors reach beyond the geographic and temporal focus of this Investment Plan.

9.3.2 Solid Waste

Solid Waste produced in the reverted areas is currently collected by the Municipality of Panama City in the Pacific Sector, and by the Municipality of Colon in the Atlantic Sector; in other words, the State is in charge of providing this service. However, it is an activity which could also be delegated to the private sector through service or administrative contracts. In some cities around the country, this activity is handled by the private sector, as is the case in David, Arraijan and Chorrera.

9.3.3 Roads

Although financing of this activity has traditionally been the responsibility of the National Government, certain roads have, in the past, been constructed through the process of concession. Nevertheless, adoption of this mechanism as a financing strategy for the Canal Area would not appear to be adequate, in light of the short distances between communities in this region of the country.

In the case of the new bridge spanning the Panama Canal, construction cannot be carried out through valorization, as the bridge will cross areas of protected forest land which constitute the area of influence. However, the concession option could be applied by the private sector as a source of financing for this project, with the establishment of tariffs on vehicular movement attracted by the connection.

9.3.4 Energy

The issue of energy distribution has been resolved by turning it over to the private sector; demand for this service is guaranteed through the offering companies, ETESA, EDEMET EDECHI and ELECTRA NORESTE, which supply the service on a regional/national level.

With respect to requirements in the reverted areas, no problems in supplying the service are expected, since the aforementioned companies have financial resources at their disposal for development of their respective investments. Nevertheless, it should be noted that in the case of the reverted areas, the Canal Authority generates the electric energy needed for its operations; financing is autonomous and therefore participation by the companies mentioned above is not required.

9.3.5 Telecommunications

Provision of this service has also been resolved through privatization; with respect to financing strategy, it is up to the private sector to carry out the investments needed to guarantee service in the reverted areas. In some sectors of the Canal Area, however, this service is the responsibility of the ACP.

Limitations are not foreseen for this sector with regard to the availability of the resources needed for development of the respective investments.

Generally speaking, the financing strategy for the inter-oceanic area does not differ from the financial conditions required by the rest of the country.

9.4 Financing Mechanisms

Financing mechanisms and instruments provide a variety of alternatives similar to those of financing sources, offering multiple financing tools for use in the Canal Area. A key element in the selection of an adequate combination of financing instruments and mechanisms is the assurance that each project is adequately designed and grouped to offer potential investors financial benefits which will compensate for the risk they assume. The following mechanisms and instruments for financing infrastructure projects are recommended:

- Public/private association
- Valorization
- Concession
- National Budgeting through loans with the Andean Development Corporation (CAF)
- National Budgeting (IDAAN and MOP)
- Annual Budgeting of the ARI
- Bonds
- Privatization

Details with respect to previous applications of these instruments is presented in Chapter 6 of this document. Recommendations for their application in carrying out the 2002-2006 Plan for Investments are given below.

Public/private association. Cooperation between the ARI and private developers on specific development projects, could produce an appropriate and fructuous division of risk and return among both parties. The ARI manages strategic terrains with great economic development potential for the near and mid-future, but lacks adequate funds for the infrastructure investments required to unleash this development. In contrast, private developers are capable of mobilizing funds and building infrastructure, but possess neither a global vision of development potential nor, in many cases, access to the primary raw material: Land. With a combined vision of future development of a community or parcel of land, the two parties could negotiate and carry out an exchange of infrastructure investments and lands which would conform to the criteria of both the ARI and the private developers.

There are, for example, communities or zones in the Canal Area which possess great potential for maritime or industrial development, but which lack access roads, potable water and/or waste water treatment projects. The ARI could negotiate a contract with a private developer in which the developer constructs primary and secondary infrastructure projects for the entire zone and carries out the territorial subdivision according to a development plan. In return, the developer would receive a pre-determined parcel of land in the zone. The other terrains would continue to be at the ARI's disposal, possibly to be sold to other parties by public act.

Both the current high land value and the appreciation in value produced by infrastructure investments, are factors which make such an operation feasible. It would be necessary to estimate the appreciation generated by each project based on a pre-feasibility study, the cost of which would be shared with the private sector.

If appreciation in value is also generated on lands belonging to individuals in areas neighboring on the projects executed by means of this mechanism, it would be prudent to quantify the higher value generated on these properties, in order to apply the mechanism of valorization (on a legal basis) to these properties as well; the charges could be added to the funds available for execution of the project under consideration, or the ARI could use them in the execution or assistance of other Canal Area projects. Private individuals should not be enriched without requiring something in return. This is the basis of the law of valorization.

This type of public/private association can be carried out by direct contract or by means of a trust. As described in Chapter 6, the trust is not a financing mechanism, but a means of offering better guarantees on the part of the developer, who mobilizes the funds and executes the investments necessary to achieving the development foreseen for the zone.

Valorization. Recommended for the construction of infrastructure, especially in the areas of Potable Water, Waste Water, storm Drainage and Roads, which benefit predetermined locations which are in the hands of numerous owners.

For the purpose of waste water treatment plants and potable water and/or storm sewer networks, any area which contributes to the determination of the system's dimensions should be included as a benefited area.

Use of the valorization system can be made under existing laws and regulations, without the need to create new laws or modify existing ones. It should be clarified that only one entity or organism may govern the application of this system, since the formation of additional regulating entities for this system is not contemplated in the legislation governing the execution of projects required by the IDAAN. Instead, it details the execution by this organism of the required projects, using the valorization system for recovery of the investments required for adequate provision of the service.

Problems with very low collection rates due to permissive policies on the part of public administration are common in many developing countries. The recommended corrective measure is to transfer collection to non-governmental agencies or individuals, who will receive a percentage of the monies collected in payment for their services. These entities would assume responsibility for all activities necessary for successful collection, such as providing information to

the contributor, advertising the project, establishing facilities for payment (time limits, collection offices, etc.) and collecting the juridic tax. While the latter is not transferable to the private agency, the agency could handle all of the necessary paperwork and require only **the signature** of the competent government official, authorizing the agency to carry out the process. The agency's interest in this tax relates exclusively to the percentage of the amount collected that it will receive in retribution. And in order to safeguard government monies, the accounts through which collection is managed should be jointly indorsed by the collection agency and the government in order to make withdrawals or transfers.

As an additional burden placed on the contributor, the valorization system is not generally well received. However, adequate distribution of the obligation in proportion to the benefits that will be received and to the payment capacity of contributors by sector and individually, aided by the monetary contribution of the government or related entities—if necessary—and by the execution of **all** public infrastructure projects through the valorization system, would create the proper atmosphere for enlisting the cooperation of those individuals who benefit from the execution or improvement of the infrastructure, specifically with respect to its application within the Canal Area.

Concesión. Recommended for express transit projects between areas which possess an alternative road connection; retribution is provided through the charging of tolls. In the Canal area, this is recommended exclusively for transit across the second bridge over the Panama Canal and the access roads leading to it.

Concession is also recommended for the provision of solid waste management services, with the possibility of reverting the constructed projects to the state after an agreed-upon period of time. Concession of this service provides assurance that at the end of the period, the government will receive the land and the sanitary landfill, which must be protected from improper use and sanitary overflows of soil or sub-soil inadequate for human beings.

Finally, concession constitutes a powerful mechanism for carrying out improvements to the potable water system in the Canal Area. As previously indicated, the intensification of urban uses in the area will create the need for substantial improvements in the treatment and distribution of potable water. If the IDAAN delegates responsibility for providing this service to a private company for a specific period of time, it will be possible to negotiate new tariffs for the Canal Area which permit execution of the required investments. The high socio-economic profile of many of the inter-oceanic area's inhabitants enhances the feasibility of such an initiative.

It should be pointed out that a concession does not imply privatization of the service. Potable water will continue to be the responsibility of the IDAAN. It is simply a question of delegating the service to a private company for a limited period of time in order to take advantage of their financial resources and technical and administrative innovations.

It would be necessary for the entity responsible for this sector to manage waste water and storm water as well, with billing of these services placed on the same statement, based on tariffs and fixed charges. The construction of infrastructure needed for initial development could be carried out through a combination of rationalized tariffs and a system of valorization employed by the

concessionaire. The public sector would be the owner of both the pre-existing projects and the new ones, and at the end of the contracted period, if no extension is granted, all of the projects would revert to the IDAAN.

CAF. This will serve to round out the infrastructure investment budgets of the National Budget. Properly speaking, the CAF is not a financing mechanism in itself, but a means of collecting funds for employing one of the proposed financing mechanisms.

National Budgeting through the IDAAN. To be applied exclusively to the operation of the Potable Water, Waste Water and Storm Water systems; investment in the construction of projects must be made by other mechanisms.

National Budgeting of the ARI. Used for construction of infrastructure projects in any area, although the collection or posterior financing of some of these may be carried out through the valorization mechanism (if the owners are separate from the ARI; to the contrary, the ARI acts as a developer, since it would be charging the costs of capacitation to the future buyers or renters). Budgeting of the ARI is used specifically for the development of priority areas which are to be placed in the hands of small or medium-sized private parties and which are not sufficiently attractive to larger investors.

Bonds. These will serve as a way to fill up the coffers for construction of ambitious projects carried out through the mechanism of public/private association, trust, concession or direct investment by the public sector. Properly speaking, bonds are not a financing mechanism in themselves, but a means of collecting funds for employing one of the proposed financing mechanisms.

Privatización. Used for the provision of energy and telecommunications services; it can also be employed in a sectoral manner in the Canal Area for the provision of waste water treatment services and, eventually, potable water supply, provided that this does not go against governmental policies.

Table 9.1 Project Portfolio with Preliminary Cost and Recommended Financing Mechanism

No.	Project	Sector	Code	Community	% Cost	Recommended Financing	Alternative Financing	Cost (US$000)
1	Reposition and Extension of Aqueducts	A	AE-AP9	Espinar	100.00	Valorization	Own Resources	260
2	Potable Water Distribution	A	AE-AP13	Coco Solo	100.00	Developer	Valorization	450
3	Potable Water Distribution	A	AE-AP17	Telfers	100.00	Developer	Valorization	320
4	Replacement of Water Pipes	A	AE-AP19	Margarita	100.00	Valorization	Own Resources	200
5	Treatment Plant	S	AE-AR8	Espinar	100.00	Valorization	Own Resources	280
6	Reposition. Of Sewer System Networks	S	AE-AR10	Espinar	100.00	Valorization	Own Resources	150
7	Treatment Plant	S	AE-AR12	Coco Solo	100.00	Valorization	Own Resources	850
8	New Sanitary Sewer System	S	AE-AR14	Coco Solo	100.00	Valorization	Developer	2,500
9	Treatment Plant	S	AE-AR16	Telfers	100.00	Developer	Own Resources	900
10	New Sanitary Sewer System	S	AE-AR18	Telfers	100.00	Valorization	Developer	450
11	Treatment Plant	S	AE-AR20	Arco Iris	100.00	Valorization	Own Resources	400
12	Conduction Pipes and Pumping Stations	S	AE-AR22	Arco Iris	100.00	Valorization	Own Resources	380
13	Pumping Station	A	AE-AR40	Davis	100.00	Valorization	Own Resources	80
14	Treatment Plant	A	AE-AR49	Davis	100.00	Valorization	Own Resources	400
15	Channels and Pipes	P	AE-PL6	Margarita	100.00	Valorization	Own Resources	850
16	Sewers and Pipes	P	AE-PL 7	Davis	100.00	Valorization	Own Resources	650
17	Amplification/Paving of Channels	P	AE-PL11	Coco Solo	100.00	Valorization	Developer	2,000
18	Storm Drain Pipes and Channels	P	AE-PL15	Telfers	100.00	Developer	Own Resources	2,400
19	New Storm Drain Pipes	P	AE-PL21	Arco Iris	100.00	Valorization	Own Resources	380
20	Randolph Avenue Storm Drainage	P	AE-PL37	Arco Iris	100.00	Valorization	Own Resources	240.00
21	New Sanitary Landfill in Colon	R	AE-R1	Espinar	100.00	Concession	Own Resources	1,043
22	Randolph Avenue	V	AE-V1	general	100.00	Valorization	Own Resources	15,723
23	Bolivar Road and Branch in Arco Iris	V	AE-V2	general	100.00	Valorization	Own Resources	6,409
24	Randolph Ave.-Transisthmic Interchange	V	AE-V3	Campo Francia	100.00	Valorization	Own Resources	5,591

No.	Project	Sector	Code	Community	% Cost	Recommended Financing	Alternative Financing	Cost (US$000)
25	Los Lagos Road-Randolph Avenue	V	AE-V4	Campo Francia	100.00	Valorization	Own Resources	9,649
26	Los Lagos Road-Randolph Avenue	V	AE-V5	Espinar	100.00	Valorization	Own Resources	2,252
27	Rehab. Of Road to Dock 16	V	AE-V6 (F1)	Telfers	100.00	Valorization	Own Resources	1,239
28	Telfers Road System	V	AE-V6 (F2)	Telfers	100.00	Valorization	Own Resources	14,747
29	Aqueduct Pipeline	A	AO-AP2	Sherman	100.00	Developer	Own Resources	56
30	Pressure and Distribution Pipelines	P	AO-AR1	Sherman	100.00	Developer	Own Resources	157
31	Treatment Plant	S	AO-AR3	Sherman	100.00	Developer	Own Resources	260
32	Treatment Plant	S	AO-AR5	Sherman	100.00	Developer	Own Resources	120
33	Channels	P	AO-PL4	Sherman	100.00	Developer	Own Resources	112
34	Improvements to Road System	V	AO-V1	Sherman	100.00	Developer	Own Resources	1,705
35	Rehab. Sherman-San Lorenzo Road	V	AO-V2	Sherman	100.00	Developer	Own Resources	2,591
36	Rehab. Access to Second Canal Bridge	V	CE-V3	general	100.00	Concession	Own Resources	14,353
37	Treatment Plant	S	PE-AR35	La Boca	100.00	Valorization	Own Resources	2,000
38	Treatment Plant	S	PE-AR30	Albrook	100.00	Valorization	Own Resources	2,800
39	Sewer Conduction Line	S	PE-AR31	Albrook	100.00	Valorization	Own Resources	250
40	Treatment Plant	S	PE-AR33	Clayton	100.00	Valorization	Own Resources	1,300
41	Sanitary Collector Line	S	PE-AR34	Clayton	100.00	Valorization	Own Resources	400
42	Sanitary Collector Line	S	PE-AR36	Balboa	100.00	Valorization	Own Resources	850
43	Sewer and Channels	P	PE-PL32	Albrook	100.00	Valorization	Own Resources	2,200
44	Expansion of Cerro Patacon Landfill	R	PE-R1	Valle S.F.	100.00	Concession	Own Resources	2,086
45	Gaillard Road (Corozal-Clayton Section)	V	PE-V1 (T3)	Clayton	100.00	Valorization	Own Resources	3,474
46	Amplification Central Street of Clayton	V	PE-V3 (T1-T2)	Clayton	100.00	Valorization	Own Resources	9,186
47	Ascanio Villalaz Ave. (Section 1)	V	PE-V4 (P2-T1)	Curundu	100.00	Valorization	Own Resources	1,567
48	East Marginal Ave. Over to Amistad Road	V	PE-V4 (P1-T2)	Albrook	100.00	Valorization	Own Resources	3,485
49	A. Villalaz Ave.-Amistad Road Interchange	V	PE-V5 (I3)	Albrook	100.00	Valorization	Own Resources	6,858
50	Amistad Road	V	PE-V5 (P1)	Curundu	100.00	Own Resources	Own Resources	3,085

No.	Project	Sector	Code	Community	% Cost	Recommended Financing	Alternative Financing	Cost (US$000)
51	Amplification of Juan Pablo II Ave.	V	PE-V5 (P2)	general	100.00	Valorization	Own Resources	2,722
52	La Boca-Amador Coastal Road	V	PE-V6	La Boca	100.00	Valorization	Own Resources	4,267
53	Amplification of Arnulfo Arias Avenue	V	PE-V7	Balboa	100.00	Own Resources	Valorization	2,468
54	Circumvallation of San Francisco Valley	V	PE-V8	Valle S.F.	100.00	Valorization	Own Resources	8,100
55	New Potable Water Pipes	A	PO-AP27	Rodman	100.00	Developer	Concession	250
56	Potable Water Pipes	A	PO-AP38	Rodman	100.00	Developer	Concession	500
57	Rehab. Of Treatment Plant	S	PO-AR23	Rodman	100.00	Developer	Own Resources	100
58	Treatment Plant	S	PO-AR24	Rodman	100.00	Developer	Own Resources	340
59	Sanitary Collector	S	PO-AR25	Rodman	100.00	Developer	Own Resources	280
60	Treatment Plant	S	PO-AR28	Howard	100.00	Developer	Own Resources	290
61	Sewer Conduction Line	S	PO-AR29	Howard	100.00	Developer	Own Resources	120
62	Sewer Conduction Line	P	PO-PL26	Rodman	100.00	Developer	Own Resources	350
63	Construction of Sanitary Landfill	R	PO-R1	Chorrera	100.00	Concession	Own Resources	3,482
64	Veracruz Coastal Road	V	PO-V1 (F1)	Howard	100.00	Own Resources	Own Resources	7,962
65	Veracruz Coastal Road	V	PO-V1 (F2)	Howard	100.00	Own Resources	Own Resources	17,278
66	Beard Road-Andrews Boulevard	V	PO-V2 (T1)	Howard	100.00	Developer	Own Resources	11,169
67	Construction West Howard Road	V	PO-V3	Howard	100.00	Developer	Own Resources	28,964
68	PAH (Arraijan Bridge of the Americas)	VN	PO-V5	General	100.00	Own Resources	Own Resources	20,164
	Total				**67.00**			**238,497**

Calculation Sheet for Tables 9.2–9.5

No.	Project	Sector	Code	Community	% Cost	Recommended Financing	Alternative Financing	Cost (US$000)	Partial Cost (US$000)	Location
1	Reposition. and Extens. of Aqueducts	A	AE-AP9	Espinar	100	Valorization	Own Resources	260	260	AE
2	Potable Water Distribution	A	AE-AP13	Coco Solo	100	Developer	Valorization	450	450	AE
3	Potable Water Distribution	A	AE-AP17	Telfers	100	Developer	Valorization	320	320	AE
4	Replacement of Water Pipes	A	AE-AP19	Margarita	100	Valorization	Own Resources	200	200	AE
5	Treatment Plant	S	AE-AR8	Espinar	100	Valorization	Own Resources	280	280	AE
6	Reposition. Of Sewer System Networks	S	AE-AR10	Espinar	100	Valorization	Own Resources	150	150	AE
7	Treatment Plant	S	AE-AR12	Coco Solo	100	Valorization	Own Resources	850	850	AE
8	New Sanitary Sewer System	S	AE-AR14	Coco Solo	100	Valorization	Developer	2500	2,500	AE
9	Treatment Plant	S	AE-AR16	Telfers	100	Developer	Own Resources	900	900	AE
10	New Sanitary Sewer System	S	AE-AR18	Telfers	100	Valorization	Developer	450	450	AE
11	Treatment Plant	S	AE-AR20	Arco Iris	100	Valorization	Own Resources	400	400	AE
12	Conduction Pipes and Pumping Stations	S	AE-AR22	Arco Iris	100	Valorization	Own Resources	380	380	AE
13	Pumping Station	A	AE-AR40	Davis	100	Valorization	Own Resources	80	80	AE
14	Treatment Plant	A	AE-AR49	Davis	100	Valorization	Own Resources	400	400	AE
15	Channels and Pipes	P	AE-PL6	Margarita	100	Valorization	Own Resources	850	850	AE
16	Sewers and Pipes	P	AE-PL 7	Davis	100	Valorization	Own Resources	650	650	AE
17	Amplification/Paving of Channels	P	AE-PL11	Coco Solo	100	Valorization	Developer	2000	2,000	AE
18	Storm Drain Pipes and Channels	P	AE-PL15	Telfers	100	Developer	Own Resources	2400	2,400	AE
19	New Storm Drain Pipes	P	AE-PL21	Arco Iris	100	Valorization	Own Resources	380	380	AE
20	Randolph Avenue Storm Drainage	P	AE-PL37	Arco Iris	100	Valorization	Own Resources	240	240	AE
21	New Sanitary Landfill in Colon	R	AE-R1	Espinar	100	Concession	Own Resources	1043	1,043	AE
22	Randolph Avenue	V	AE-V1	France Field	25.00	Valorization	Own Resources	15723.09	3,931	AE
22	Randolph Avenue	V	AE-V1	Coco Solo	55.00	Valorization	Own Resources	15,723	8,648	AE
22	Randolph Avenue	V	AE-V1	Arco Iris	13.00	Valorization	Own Resources	15,723	2,044	AE

No.	Project	Sector	Code	Community	% Cost	Recommended Financing	Alternative Financing	Cost (US$000)	Partial Cost (US$000)	Location
22	Randolph Avenue	V	AE-V1	Espinar	7.00	Valorization	Own Resources	15,723	1,101	AE
23	Bolivar Road and Branch in Arco Iris	V	AE-V2	Margarita	10.00	Valorization	Own Resources	6409	641	AE
23	Bolivar Road and Branch in Arco Iris	V	AE-V2	Brazos	15.00	Valorization	Own Resources	6409	961	AE
23	Bolivar Road and Branch in Arco Iris	V	AE-V2	Mindi	15.00	Valorization	Own Resources	6409	961	AE
23	Bolivar Road and Branch in Arco Iris	V	AE-V2	Telfers	25.00	Valorization	Own Resources	6409	1,602	AE
23	Bolivar Road and Branch in Arco Iris	V	AE-V2	Davis	20.00	Valorization	Own Resources	6409	1,282	AE
23	Bolivar Road and Branch in Arco Iris	V	AE-V2	Gatún	5.00	Valorization	Own Resources	6409	320	AE
23	Bolivar Road and Branch in Arco Iris	V	AE-V2	Arco Iris	10.00	Valorization	Own Resources	6409	641	AE
24	Randolph Ave.-Transisthmic Interchange	V	AE-V3	France Field	100	Valorization	Own Resources	5590.92	5,591	AE
25	Los Lagos Road-Randolph Avenue	V	AE-V4	France Field	100	Valorization	Own Resources	9648.975	9,649	AE
26	Harmon Road and Espinar Street	V	AE-V5	Espinar	100	Valorization	Own Resources	2252.419	2,252	AE
27	Rehab. Of Road to Dock 16	V	AE-V6 (F1)	Telfers	100	Valorization	Own Resources	1239	1,239	AE
28	Telfers Road System	V	AE-V6 (F2)	Telfers	100	Valorization	Own Resources	14747.395	14,747	AE
29	Aqueduct Pipeline	A	AO-AP2	Sherman	100	Developer	Own Resources	56	56	AO
30	Pressure and Distribution Pipelines	P	AO-AR1	Sherman	100	Developer	Own Resources	157	157	AO
31	Treatment Plant	S	AO-AR3	Sherman	100	Developer	Own Resources	260	260	AO
32	Treatment Plant	S	AO-AR5	Sherman	100	Developer	Own Resources	120	120	AO
33	Channels	P	AO-PL4	Sherman	100	Developer	Own Resources	112	112	AO
34	Improvements to Road System	V	AO-V1	Sherman	100	Developer	Own Resources	1704.937	1,705	AO
35	Rehab. Sherman-San Lorenzo Road	V	AO-V2	Sherman	100	Developer	Own Resources	2590.898	2,591	AO
36	Rehab. Access to Second Canal Bridge	V	CE-V3	general	100	Concession	Own Resources	14353	14,353	CE
37	Treatment Plant	S	PE-AR35	La Boca	100	Valorization	Own Resources	2000	2,000	PE
38	Treatment Plant	S	PE-AR30	Albrook	100	Valorization	Own Resources	2800	2,800	PE
39	Sewer Conduction Line	S	PE-AR31	Albrook	100	Valorization	Own Resources	250	250	PE
40	Treatment Plant	S	PE-AR33	Clayton	100	Valorization	Own Resources	1300	1,300	PE

No.	Project	Sector	Code	Community	% Cost	Recommended Financing	Alternative Financing	Cost (US$000)	Partial Cost (US$000)	Location
41	Sanitary Collector Line	S	PE-AR34	Clayton	100	Valorization	Own Resources	400	400	PE
42	Sanitary Collector Line	S	PE-AR36	Balboa	100	Valorization	Own Resources	850	850	PE
43	Sewer and Channels	P	PE-PL32	Albrook	100	Valorization	Own Resources	2200	2,200	PE
44	Expansion of Cerro Patacon Landfill	R	PE-R1	S.F. Valley	100	Concession	Own Resources	2086	2,086	PE
45	Gaillard Road (Corozal-Clayton Section)	V	PE-V1 (T3)	Clayton	50.00	Valorization	Own Resources	3474.208	1,737	PE
45	Gaillard Road (Corozal-Clayton Section)	V	PE-V1 (T3)	Corozál	50.00	Valorization	Own Resources	3,474	1,737	PE
46	Amplification Central Street of Clayton	V	PE-V3 (T1 y T2)	Clayton	90.00	Valorization	Own Resources	9186.111	8,267	PE
46	Amplification Central Street of Clayton	V	PE-V3 (T1 y T2)	Cárdenas	10.00	Valorization	Own Resources	9,186	919	PE
47	Ascanio Villalaz Ave. (Section 1)	V	PE-V4 (P2-T1)	Curundu	100	Valorization	Own Resources	1567.25	1567.25	PE
48	East Marginal Ave. Over to Amistad Road	V	PE-V4 (P1-T2)	Albrook	100	Valorization	Own Resources	3485.391	3485.391	PE
49	A. Villalaz Ave.-Amistad Road Interchange	V	PE-V5 (I3)	Albrook	100	Valorization	Own Resources	6858.313	6858.313	PE
50	Amistad Road	V	PE-V5 (P1)	Curundu	20.00	Own Resources	Own Resources	3085	617	PE
50	Amistad Road	V	PE-V5 (P1)	Albrook	80.00	Own Resources	Own Resources	3085	2,468	PE
51	Amplification of Juan Pablo II Ave.	V	PE-V5 (P2)	general	100	Valorization	Own Resources	2722.25	2,722	PE
52	La Boca-Amador Coastal Road	V	PE-V6	La Boca	100	Valorization	Own Resources	4267.133	4267.133	PE
53	Amplification of Arnulfo Arias Avenue	V	PE-V7	Balboa	100	Own Resources	Valorization	2468.48	2468.48	PE
54	Circumvallation of San Francisco Valley	V	PE-V8	S.F. Valley	100	Valorization	Own Resources	8100	8,100	PE
55	New Potable Water Pipes	A	PO-AP27	Rodman	100	Developer	Concession	250	250	PO
56	Potable Water Pipes	A	PO-AP38	Rodman	100	Developer	Concession	500	500	PO
57	Rehab. Of Treatment Plant	S	PO-AR23	Rodman	100	Developer	Own Resources	100	100	PO
58	Treatment Plant	S	PO-AR24	Rodman	100	Developer	Own Resources	340	340	PO
59	Sanitary Collector	S	PO-AR25	Rodman	100	Developer	Own Resources	280	280	PO
60	Treatment Plant	S	PO-AR28	Howard	100	Developer	Own Resources	290	290	PO
61	Sewer Conduction Line	S	PO-AR29	Howard	100	Developer	Own Resources	120	120	PO
62	Channels and Pipes	P	PO-PL26	Rodman	100	Developer	Own Resources	350	350	PO

No.	Project	Sector	Code	Community	% Cost	Recommended Financing	Alternative Financing	Cost (US$000)	Partial Cost (US$000)	Location
63	Construction of Sanitary Landfill	R	PO-R1	Chorrera	100	Concession	Own Resources	3481.6	3,482	PO
64	Veracruz Coastal Road	V	PO-V1 (F1)	Howard	100	Own Resources	Own Resources	7962.45	7,962	PO
65	Veracruz Coastal Road	V	PO-V1 (F2)	Howard	100	Own Resources	Own Resources	17278.347	17278.347	PO
66	Beard Road-Andrews Boulevard	V	PO-V2 (T1)	Howard	100	Developer	Own Resources	11168.694	11168.694	PO
67	Construction West Howard Road	V	PO-V3	Howard	100	Developer	Own Resources	28964.03	28964.03	PO
68	PAH (Arraijan Bridge of the Americas)	VN	PO-V5	General	100	Own Resources	Own Resources	20164.349	20164.349	PO
	Total							**238497.24**	**238,497**	

Table 9.2 Distribution of Investments by Technical Sector

Sector	Cost (US$000)	Percentage Distribution
Roads	184,847	77.5
National Roads	20,164	8.5
Potable Water	2,516	1.1
Waste Water	15,020	6.3
Storm Water	9,339	3.9
Solid Waste	6,611	2.8
Total	238,497	100.0
Environmental Subtotal	33,486	14.0
Non-environmental Subtotal	205,011	86.0

Table 9.3 Distribution of Investments by Community

Community/Subregion	Number of Projects*	Cost (US$000)	Percentage Distribution
Albrook	6	18,062	7.5
Arco Iris	6	4,085	7.5
Balboa	2	3,318	2.5
France Field	3	19,171	3.8
Clayton	4	11,705	5.0
Coco Solo	5	14,448	6.3
Davis	4	2,412	5.0
Espinar	6	5,086	7.5
general	3	37,240	3.8
Howard	6	65,784	7.5
La Boca	2	6,267	2.5
Margarita	3	1,691	3.8
Rodman	6	1,820	7.5
Curundu	2	2,184	2.5
Gatún	1	320	1.3
Mindi	1	961	1.3
Cárdenas	1	919	1.3
Brazos	1	961	1.3
Corozál	1	1,737	1.3
Sherman	7	5,001	8.8
Telfers	7	21,659	8.8
S.F. Valley	2	10,186	2.5
Chorrera	1	3,482	1.3
Total	80	238,499	100.0

*includes partial projects (which are carried out in more than one community)

Table 9.4 Distribution of Investments by Recommended Financing Mechanism

Financing Mechanism	No. of Projects	Amount Financed (US$000)	Percentage Distribution
Valorization	38	115,141	48.3
Concession	4	20,964	8.8
Developer	21	51,434	21.6
Own Resources	5	50,959	21.4
Total	68	238,498	100.0

Table 9.5 Distribution of Investments by Alternative Financing Mechanism

Financing Mechanism	No. of Projects	Amount Financed (US$000)	Percentage Distribution
Valorization	3	3,238	1.4
Concession	2	750	0.3
Developer	3	4,950	2.1
Own Resources	60	229,559	96.3
Total	68	238,497	100.0

Annex A. Projections

Scenario 1: Spatial Planning Framework

Sub-region	Community/ Zone	Use	Area (hectares)			Pop. Area B, 2000	Saturation Population				Year of Saturation	Pop. Area B+C, 2006	Total	Pop Sum, B+C 2006				
			A*	B	C		B	C	B+C	B+C (per hectare)				Residential	Institutional	Commercial	Industrial	Tourist
Pacific																		
East	Albrook	Residential	0.00	58.41	17.61	2340	7301	2201	9502	125	2015	3801		3801	0	0	0	0
East	Albrook	Institutional	0.00	4.29	0.00	107	1286	0	1286	300	2001	1286		0	1286	0	0	0
East	Albrook	Commercial	0.00	46.31	29.12	1382	11578	7279	18857	250	2015	7543		0	0	7543	0	0
East	Albrook	Industrial	0.00	0.00	0.00	0	0	0	0	150		0		0	0	0	0	0
East	Albrook	Total	248.00	109.01	46.72	3829	20165	9480	29645			12630	12630	0	0	0	0	0
East	Amador	Residential	15.87	13.00	2.87	150	7800	1722	9522	600	2010	5713		5713	0	0	0	0
East	Amador	Institutional	0.00	5.89	0.00	350	1767	0	1767	300	2020	530		0	530	0	0	0
East	Amador	Commercial	0.00	15.20	20.00	125	3040	4000	7040	200	2015	2816		0	0	2816	0	0
East	Amador	Industrial	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0
East	Amador	Tourist	0.00	0.00	38.00	0	0	9500	9500	250	2010	5700		0	0	0	0	5700
East	Amador	Total	164.43	34.09	60.87	625	12607	15222	27829			14759	14759	0	0	0	0	0
East	Balboa-Ancón	Residential	238.81	200.00	38.81	4500	16000	3105	19105	80	2020	5731		5731	0	0	0	0
East	Balboa-Ancón	Institutional	58.00	46.00	12.00	10062	13800	3600	17400	300	2010	10440		0	10440	0	0	0
East	Balboa-Ancón	Commercial	44.35	24.00	20.35	6000	6000	5088	11088	250	2020	3326		0	0	3326	0	0
East	Balboa-Ancón	Industrial	0.00	0.00	0.00	0	0	0	0	200		0		0	0	0	0	0
East	Balboa-Ancón	Total	341.16	270.00	71.16	20562	35800	11792	47592			19498	19498	0	0	0	0	0
East	Balboa Industrial	Residential	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0
East	Balboa Industrial	Institutional	94.70	90.00	4.70	2737	28125	1468	29593	312	2015	11837		0	11837	0	0	0
East	Balboa Industrial	Commercial	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0

Sub-region	Community/ Zone	Use	Area (hectares)			Pop. Area B, 2000	Saturation Population				Year of Saturation	Pop. Area B+C, 2006	Total	Pop Sum, B+C 2006				
			A*	B	C		B	C	B+C	B+C (per hectare)				Residential	Institutional	Commercial	Industrial	Tourist
East	Balboa Industrial	Industrial	120.50	78.50	42.00	3485	3925	2100	6025	50	2015	2410		0	0	0	2410	0
East	Balboa Industrial	Total	215.20	140.00	75.20	6222	45569	10801	56370			14247	14247	0	0	0	0	0
East	Cárdenas	Residential	0.00	22.98	51.30	735	3447	7694	11141	150	2006	2205		2205	0	0	0	0
East	Cárdenas	Institutional	0.00	10.04	10.04	0	3011	3011	6021	300	2004	6021		0	6021	0	0	0
East	Cárdenas	Commercial	0.00	0.00	0.00	0	0	0	0	250		0		0	0	0	0	0
East	Cárdenas	Industrial	0.00	3.23	3.23	0	484	484	969	150	2004	969		0	0	0	969	0
East	Cárdenas	Total	197.00	36.24	64.56	735	6942	11189	18131			9195	9195	0	0	0	0	0
East	Clayton	Residential	100.26	42.70	57.56	5130	13664	24520	38184	250	2025	9164		9164	0	0	0	0
East	Clayton	Institutional	10.29	0.50	9.79	170	170	2937	3107	302	2008	2330		0	2330	0	0	0
East	Clayton	Commercial	186.72	130.80	55.92	58860	32700	13980	46680	250	2025	5000		0	0	5000	0	0
East	Clayton	Industrial	10.00	0.00	10.00	0	0	500	500	50	2005	500		0	0	0	500	0
East	Clayton	Total	307.27	174.00	133.27	64160	46534	41937	88471			16994	16994	0	0	0	0	0
East	Corozal	Residential	0.00	14.10	0.00	415	2114	0	2114	150	2010	1269		1269	0	0	0	0
East	East/West Corozal	Institutional	0.00	31.73	0.00	504	6346	0	6346	200	2010	3807		0	3807	0	0	0
East	East/West Corozal	Commercial	0.00	3.90	0.60	297	975	149	1124	250	2008	843		0	0	843	0	0
East	East/West Corozal	Industrial	0.00	17.70	53.80	2655	2655	8070	10725	150	2025	2574		0	0	0	2574	0
East	East/West Corozal	Total	61.00	49.73	0.60	3871	12090	8219	20309			8493	8493	0	0	0	0	0
East	Curundú Industrial	Residential	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0
East	Curundú Industrial	Institutional	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0
East	Curundú Industrial	Commercial	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0
East	Curundú Industrial	Industrial	60.00	55.00	5.00	9750	10500	800	11300	188	2015	4520		0	0	0	4520	0
East	Curundú Industrial	Total	60.00	55.00	5.00	9750	10500	800	11300	188		4520	4520	0	0	0	0	0
East	Altos de Curundú	Residential	11.00	6.40	4.60	594	960	690	1650	150	2005	1980		1980	0	0	0	0
East	Altos de Curundú	Institutional	2.05	2.05	0.00	260	615	0	615	300	2000	260		0	260	0	0	0
East	Altos de Curundú	Commercial	1.03	0.00	1.03	0	0	258	258	250	2005	370		0	0	370	0	0

Sub-region	Community/ Zone	Use	Area (hectares)			Pop. Area B, 2000	Saturation Population				Year of Saturation	Pop. Area B+C, 2006	Total	Pop Sum, B+C 2006				
			A*	B	C		B	C	B+C	B+C (per hectare)				Residential	Institutional	Commercial	Industrial	Tourist
East	Altos de Curundú	Industrial	1.07	1.07	0.00	88	0	0	0	150	2000	88		0	0	0	88	0
East	Altos de Curundú	Total	15.15	9.52	5.63	942	1575	948	2523			2698	2698	0	0	0	0	0
East	Llanos de Curundú	Residential	40.00	25.00	15.00	1380	3750	2250	6000	150	2015	2400		2400	0	0	0	0
East	Llanos de Curundú	Institutional	10.00	10.00	0.00	1500	2500	0	2500	250	2015	3000		0	3000	0	0	0
East	Llanos de Curundú	Commercial	8.00	6.00	2.00	1800	1500	500	2000	250	2020	600		0	0	600	0	0
East	Llanos de Curundú	Industrial	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0
East	Llanos de Curundú	Total	58.00	41.00	17.00	4680	7750	2750	10500			6000	6000	0	0	0	0	0
East	Quarry Heights	Residential	19.80	19.40	0.40	301	388	8	396	20	2002	396		396	0	0	0	0
East	Quarry Heights	Institutional	0.00	0.60	0.00	331	150	0	150	250	2002	150		0	150	0	0	0
East	Quarry Heights	Commercial	0.00	0.50	0.00	276	125	0	125	250	2002	125		0	0	125	0	0
East	Quarry Heights	Industrial	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0
East	Quarry Heights	Total	19.80	20.50	0.40	908	663	8	671			671	671	0	0	0	0	0
West	Diablo	Residential	0.00	29.99	0.00	1710	2999	0	2999	100	2005	2999		2999	0	0	0	0
West	Diablo	Institutional	0.00	4.00	0.00	280	1199	0	1199	300	2005	1199		0	1199	0	0	0
West	Diablo	Commercial	0.00	1.99	0.00	227	498	0	498	250	2005	498		0	0	498	0	0
West	Diablo	Industrial	0.00	0.00	0.00	0	0	0	0	20		0		0	0	0	0	0
West	Diablo	Total	41.00	35.98	0.00	2217	4697	0	4697			4697	4697	0	0	0	0	0
West	Howard Central	Residential	0.00	137.87	0.00	0	6894	0	6894	50	2005	2500		2500	0	0	0	0
West	Howard Central	Institutional	0.00	14.39	0.00	0	2878	0	2878	200	2005	2878		0	2878	0	0	0
West	Howard Central	Commercial	0.00	96.63	533.92	1296	7247	40044	47291	75	2025	11350		0	0	11350	0	0
West	Howard Central	Industrial	0.00	337.92	1047.98	3505	6758	20960	27718	20	2025	6652		0	0	0	6652	0
West	Howard Central	Tourist	0.00	1.09	195.87	0	55	250	305	50	2006	305		0	0	0	0	305
West	Howard Central	Total	2382.17	587.90	1777.77	4801	23832	61254	85085			23685	23685	0	0	0	0	0
East	Los Ríos	Residential	0.00	18.68	0.00	715	1868	0	1868	100	2010	1868		1868	0	0	0	0
East	Los Ríos	Institutional	0.00	1.31	0.00	95	460	0	460	350	2005	460		0	460	0	0	0

Sub-region	Community/ Zone	Use	Area (hectares)			Pop. Area B, 2000	Saturation Population				Year of Saturation	Pop. Area B+C, 2006	Total	Pop Sum, B+C 2006				
			A*	B	C		B	C	B+C	B+C (per hectare)				Residential	Institutional	Commercial	Industrial	Tourist
East	Los Ríos	Commercial	0.00	0.00	0.00	0	0	0	0	250		0		0	0	0	0	0
East	Los Ríos	Industrial	0.00	0.00	0.00	0	0	0	0	150		0		0	0	0	0	0
East	Los Ríos	Total	28.00	19.99	0.00	810	2328	0	2328			2328	2328	0	0	0	0	0
East	San Francisco Valley	Residential	0.00	43.00	480.25	3200	4300	48025	52325	100	2035	8970		8970	0	0	0	0
East	San Francisco Valley	Institutional	0.00	80.60	44.10	5398	12090	6615	18705	150	2030	3741		0	3741	0	0	0
East	San Francisco Valley	Commercial	0.00	5.10	339.30	350	1275	84825	86100	250	2050	10332		0	0	10332	0	0
East	San Francisco Valley	Industrial	0.00	44.00	100.65	300	6600	15098	21698	150	2030	4340		0	0	0	4340	0
East	San Francisco Valley	Total	1137.00	172.70	964.30	9248	24265	154563	178828			27383	27383	0	0	0	0	0
West	Rodman	Residential	0.00	20.52	0.00	0	1026	0	1026	50	2005	1026		1026	0	0	0	0
West	Rodman	Institutional	0.00	40.72	0.00	0	8144	0	8144	200	2005	8144		0	8144	0	0	0
West	Rodman	Commercial	0.00	180.00	120.36	2152	13500	9027	22527	75	2025	5406		0	0	5406	0	0
West	Rodman	Industrial	0.00	86.47	320.09	2798	1729	6402	8131	20	2025	1952		0	0	0	1952	0
West	Rodman	Total	950.00	405.90	440.45	4950	24399	15429	39828			16528	16528	0	0	0	0	0
Atlantic																		
East	France Field	Residential		0.00	0.00	0	0	0	0	150	2015	0		0	0	0	0	0
East	France Field	Institutional		0.00	0.00	0	0	0	0					0	0	0	0	0
East	France Field	Commercial		0.00	42.64	0	0	8528	8528	200	2015	3411		0	0	3411	0	0
East	France Field	Industrial		86.47	315.00	0	1729	6300	8029	20	2015	3212		0	0	0	3212	0
East	France Field	Tourist		0.00	32.00	0	0	1600	1600	50	2015	640		0	0	0	0	640
East	France Field	Total	1040.06	86.47	389.64	0	1729	16428	18157		2015	7263	7263	0	0	0	0	0
East	North Coco Solo	Residential	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0
East	North Coco Solo	Institutional	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0

Sub-region	Community/ Zone	Use	Area (hectares)			Pop. Area B, 2000	Saturation Population				Year of Saturation	Pop. Area B+C, 2006	Total	Pop Sum, B+C 2006				
			A*	B	C		B	C	B+C	B+C (per hectare)				Residential	Institutional	Commercial	Industrial	Tourist
East	North Coco Solo	Commercial	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0
East	North Coco Solo	Industrial	179.54	179.54	0	0	3591	0	3591	20	2000	3591		0	0	0	3591	0
East	North Coco Solo	Total	179.54	179.54	0.00	0	3591	0	3591			3591	3591	0	0	0	0	0
East	Arco Iris	Residential	78.80	67.20	11.60	1455	13440	2320	15760	200	2015	1800		1800	0	0	0	0
East	Arco Iris	Institutional	0.00	19.60	0.00	4388	5488	0	5488	280	2002	5488		0	5488	0	0	0
East	Arco Iris	Commercial	0.00	5.20	0.00	2871	1560	0	1560	300	2005	1560		0	0	1560	0	0
East	Arco Iris	Industrial	0.00	4.50	0.00	1013	450	0	450	100	2002	450		0	0	0	450	0
East	Arco Iris	Total	103.60	96.50	11.60	9727	24529	2320	26849			9298	9298	0	0	0	0	0
East	Telfer	Residential	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0
East	Telfer	Institutional	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0
East	Telfer	Commercial	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0
East	Telfer	Industrial	439.63	0.00	439.63	0	0	8793	8793	20	2015	3517		0	0	0	3517	0
East	Telfer	Total	439.63	0.00	439.63	0	0	8793	8793			3517	3517	0	0	0	0	0
East	Mindi	Residential	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0
East	Mindi	Institutional	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0
East	Mindi	Commercial		0.00	50.00	0	0	10000	10000	200	2025	2400		0	0	2400	0	0
East	Mindi	Industrial		0.00	107.00	0	0	16050	16050	150	2025	3852		0	0	0	3852	0
East	Mindi	Total	157.00	0.00	157.00	0	0	34843	34843			6252	6252	0	0	0	0	0
East	Margarita	Residential	41.85	39.75	2.10	1800	3378	178	3556	125	2006	2500		2500	0	0	0	0
East	Margarita	Institutional	19.80	16.00	3.80	650	5000	1187	6187	312	2020	1856		0	1856	0	0	0
East	Margarita	Commercial	1.35	0.30	1.05	45	150	525	675	350	2010	405		0	0	405	0	0
East	Margarita	Industrial	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0
East	Margarita	Total	63.00	56.05	6.95	2495	8528	1890	10418			4761	4761	0	0	0	0	0
East	Espinar	Residential	419.00	113.40	305.50	1655	11340	30550	41890	100	2030	4000		4000	0	0	0	0
East	Espinar	Institutional	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0

Sub-region	Community/ Zone	Use	Area (hectares)			Pop. Area B, 2000	Saturation Population				Year of Saturation	Pop. Area B+C, 2006	Total	Pop Sum, B+C 2006				
			A*	B	C		B	C	B+C	B+C (per hectare)				Residential	Institutional	Commercial	Industrial	Tourist
East	Espinar	Commercial	0.00	6.00	0.00	3313	1800	0	1800	300	2010	1080		0	0	1080	0	0
East	Espinar	Industrial	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0
East	Espinar	Tourist	0.00	51.00	39.00	28161	2550	1950	4500	50	2010	2700		0	0	0	0	2700
East	Espinar	Total	419.00	170.40	344.50	33129	15690	32500	48190			7780	7780	0	0	0	0	0
East	Davis	Residential	0.00	60.97	350.41	600	6097	35041	41138	100	2020	3500		3500	0	0	0	0
East	Davis	Institutional	0.00	14.00	19.04	725	4200	5712	9912	300	2025	2379		0	2379	0	0	0
East	Davis	Commercial	0.00	2.50	48.53	50	500	9706	10206	200	2030	2041		0	0	2041	0	0
East	Davis	Industrial	0.00	11.04	171.66	300	1656	25749	27405	150	2030	5481		0	0	0	5481	0
East	Davis	Total	678.15	88.51	589.64	1675	12453	76208	88661			13401	13401	0	0	0	0	0
East	Other areas	Residential										15020		15020				
East	Other areas	Institutional																
East	Other areas	Commercial																
East	Other areas	Industrial																
East	Other areas	Tourist																
East	Other areas	Total										15020	15020					
West	Sherman Urban	Residential	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0
West	Sherman Urban	Institutional	0.70	0.70	0.00	10	30	0	30	43	2004	30		0	30	0	0	0
West	Sherman Urban	Commercial	18.99	18.99	0.00	700	1400	0	1400	74	2005	1400		0	0	1400	0	0
West	Sherman Urban	Industrial	0.00	0.00	0.00	0	0	0	0		0	0		0	0	0	0	0
West	Sherman Urban	Tourist	134.01	35.00	99.01	2000	3000	14850	17850	133	2025	6500		0	0	0	0	6500
West	Sherman Urban	Total	153.70	54.69	99.01	2710	4430	14850	19280			7930	7930	0	0	0	0	0
East	Gamboa	Residential	56.40	145.80	70.70	900	10935	5303	16238	75	2008	2000		2000	0	0	0	0
East	Gamboa	Institutional	0.00	8.80	0.00	4859	2640	0	2640	300	2010	1584		0	1584	0	0	0
East	Gamboa	Commercial	0.00	27.20	0.00	15019	6800	0	6800	250	2025	1632		0	0	1632	0	0
East	Gamboa	Industrial	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0

Sub-region	Community/ Zone	Use	Area (hectares)			Pop. Area B, 2000	Saturation Population				Year of Saturation	Pop. Area B+C, 2006	Total	Pop Sum, B+C 2006				
			A*	B	C		B	C	B+C	B+C (per hectare)				Residential	Institutional	Commercial	Industrial	Tourist
East	Gamboa	Tourist	0.00	100.00	8.00	55218	10000	800	10800	100	2015	4320		0	0	0	0	4320
East	Gamboa	Total	56.40	281.80	78.70	75997	30375	6103	36478			9536	9536	0	0	0	0	0
Central																		
East	Paraiso	Residential	54.80	16.10	38.80	1415	2415	5820	8235	150	2008	2000		2000	0	0	0	0
East	Paraiso	Institutional	0.00	3.00	0.00	1657	900	0	900	300	2005	900		0	900	0	0	0
East	Paraiso	Commercial	0.00	1.00	0.00	552	250	0	250	250	2005	250		0	0	250	0	0
East	Paraiso	Industrial	0.00	0.00	0.00	0	0	0	0			0		0	0	0	0	0
East	Paraiso	Total	54.80	20.10	38.80	3624	3565	5820	9385			3150	3150	0	0	0	0	0
East	Pedro Miguel	Residential	20.68	15.68	5.00	1006	941	300	1241	60	2020	1241		1241	0	0	0	0
East	Pedro Miguel	Institutional	1.91	1.41	0.50	327	353	125	478	250	2010	287		0	287	0	0	0
East	Pedro Miguel	Commercial	0.33	0.00	0.33	0	0	83	83	250	2006	83		0	0	83	0	0
East	Pedro Miguel	Industrial	1.50	0.00	1.50	0	0	300	300	200	2015	120		0	0	0	120	0
East	Pedro Miguel	Total	24.47	17.09	7.33	1333	1293	808	2101			1730	1730	0	0	0	0	0

Pop. 2006	Pop. Sum					
Pacific	184,325	50,022	56,085	48,210	24,004	6,005
Atlantic	88,349	28,820	11,337	13,929	20,103	14,160
Central	4,880	3,241	1,187	333	120	-
Total B+C	277,554	82,083	68,608	62,472	44,227	20,165

Notes:

1. Howard includes Farfan, Kobbe and Arraijan Tanks.
2. Rodman includes Cocolí.
3. North Coco Solo includes Margarita Island.
4. Telfer includes Brazo Brooks, Mount Hope and Cristóbal Port.
5. France Field includes Gold Hill.
6. Area A = surface area of the community within the area of the Infrastructure Investment Plan.
7. Area B = developed surface area within Area A.
8. Area C = developable surface area within Area A, which has not yet been developed.

Scenario 2: Employment Generating Market

Sub-region	Community/ Zone	Use	Area (ha.)			Population Area B 2000	Saturation Population				Year of Saturation	Population, Area B+C 2006	Pop. Sum					
			A*	B	C		B	C	B+C	B+C (per hectare)			Total	Residential	Institutional	Commercial	Industrial	Tourist
Pacific																		
East	Albrook	Residential	-	58.41	17.61	2340	7301	2201	9502	125		3801	-	0	0	0	0	0
East	Albrook	Institutional	-	4.29	-	107	1286	-	1286	300		573	-	0	0	0	0	0
East	Albrook	Commercial	-	46.31	29.12	1382	11578	7279	18857	250		6747	-	0	0	0	0	0
East	Albrook	Industrial	-	-	-	-	-	-	-	150		-	-	0	0	0	0	0
East	Albrook	Total	248.00	109.01	46.72	3829	20165	9480	29645	0		11120	11120	0	0	0	0	0
East	Amador	Residential	15.87	13.00	2.87	150	7800	1722	9522	600		5713	-	0	0	0	0	0
East	Amador	Institutional	-	5.89	-	350	1767	-	1767	300		236	-	0	0	0	0	0
East	Amador	Commercial	-	15.20	20.00	125	3040	4000	7040	200		2519	-	0	0	0	0	0
East	Amador	Industrial	-	-	-	-	-	-	-	0		-	-	0	0	0	0	0
East	Amador	Tourist	-	-	38.00	-	-	9500	9500	250		7067	-	0	0	0	0	0
East	Amador	Total	164.43	34.09	60.87	625	12607	15222	27829	0		15535	15535	0	0	0	0	0
East	Balboa-Ancón	Residential	238.81	200.00	38.81	4500	16000	3105	19105	80		5731	-	0	0	0	0	0
East	Balboa-Ancón	Institutional	58.00	46.00	12.00	10062	13800	3600	17400	300		4649	-	0	0	0	0	0
East	Balboa-Ancón	Commercial	44.35	24.00	20.35	6000	6000	5088	11088	250		2975	-	0	0	0	0	0
East	Balboa-Ancón	Industrial	-	-	-	-	-	-	-	200		-	-	0	0	0	0	0
East	Balboa-Ancón	Total	341.16	270.00	71.16	20562	35800	11792	47592	0		13356	13356	0	0	0	0	0
East	Balboa Industrial	Residential	-	-	-	-	-	-	-	0		-	-	0	0	0	0	0

Sub-region	Community/ Zone	Use	Area (ha.)			Population Area B 2000	Saturation Population				Year of Saturation	Population, Area B+C 2006	Pop. Sum					
			A*	B	C		B	C	B+C	B+C (per hectare)			Total	Residential	Institutional	Commercial	Industrial	Tourist
East	Balboa Industrial	Institutional	94.70	90.00	4.70	2737	28125	1468	29593	312.49		5271	-	0	0	0	0	0
East	Balboa Industrial	Commercial	-	-	-	-	-	-	-	0		-	-	0	0	0	0	0
East	Balboa Industrial	Industrial	120.50	78.50	42.00	3485	3925	2100	6025	50		981	-	0	0	0	981	0
East	Balboa Industrial	Total	215.20	140.00	75.20	6222	45569	10801	56370	0		6252	6252	0	0	0	0	0
East	Cárdenas	Residential	-	22.98	51.30	735	3447	7694	11141	150		2205	-	0	0	0	0	0
East	Cárdenas	Institutional	-	10.04	10.04	-	3011	3011	6021	300		2681	-	0	0	0	0	0
East	Cárdenas	Commercial	-	-	-	-	-	-	-	250		-	-	0	0	0	0	0
East	Cárdenas	Industrial	-	3.23	3.23	-	484	484	969	150		394	-	0	0	0	394	0
East	Cárdenas	Total	197.00	36.24	64.56	735	6942	11189	18131	0		5281	5281	0	0	0	0	0
East	Clayton	Residential	100.26	42.70	57.56	5130	13664	24520	38184	250		5500	-	0	0	0	0	0
East	Clayton	Institutional	10.29	0.50	9.79	170	170	2937	3107	302		1038	-	0	0	0	0	0
East	Clayton	Commercial	186.72	130.80	55.92	58860	32700	13980	46680	250		4472	-	0	0	0	0	0
East	Clayton	Industrial	10.00	-	10.00	-	-	500	500	50		203	-	0	0	0	203	0
East	Clayton	Total	307.27	174.00	133.27	64160	46534	41937	88471	0		11213	11213	0	0	0	0	0
East	Corozal	Residential	-	14.10	-	415	2114	-	2114	150		1269	-	0	0	0	0	0
East	East/West Corozal	Institutional	-	31.73	-	504	6346	-	6346	200		1695	-	0	0	0	0	0
East	East/West Corozal	Commercial	-	3.90	0.60	297	975	149	1124	250		754	-	0	0	0	0	0
East	East/West Corozal	Industrial	-	17.70	53.80	2655	2655	8070	10725	150		1048	-	0	0	0	1048	0
East	East/West Corozal	Total	61.00	49.73	0.60	3871	12090	8219	20309	0		4766	4766	0	0	0	0	0

Sub-region	Community/ Zone	Use	Area (ha.)			Population Area B 2000	Saturation Population				Year of Saturation	Population, Area B+C 2006	Pop. Sum					
			A*	B	C		B	C	B+C	B+C (per hectare)			Total	Residential	Institutional	Commercial	Industrial	Tourist
East	Curundú Industrial	Residential	-	-	-	-	-	-	-	0		-	-	0	0	0	0	0
East	Curundú Industrial	Institutional	-	-	-	-	-	-	-	0		-	-	0	0	0	0	0
East	Curundú Industrial	Commercial	-	-	-	-	-	-	-	0		-	-	0	0	0	0	0
East	Curundú Industrial	Industrial	60.00	55.00	5.00	9750	10500	800	11300	188.33		1840	-	0	0	0	1840	0
East	Curundú Industrial	Total	60.00	55.00	5.00	9750	10500	800	11300	188.33		1840	1840	0	0	0	0	0
East	Altos de Curundú	Residential	11.00	6.40	4.60	594	960	690	1650	150		1980	-	0	0	0	0	0
East	Altos de Curundú	Institutional	2.05	2.05	-	260	615	-	615	300		116	-	0	0	0	0	0
East	Altos de Curundú	Commercial	1.03	-	1.03	-	-	258	258	250		331	-	0	0	0	0	0
East	Altos de Curundú	Industrial	1.07	1.07	-	88	-	-	-	150		36	-	0	0	0	36	0
East	Altos de Curundú	Total	15.15	9.52	5.63	942	1575	948	2523	0		2463	2463	0	0	0	0	0
East	Llanos de Curundú	Residential	40.00	25.00	15.00	1380	3750	2250	6000	150		2400	-	0	0	0	0	0
East	Llanos de Curundú	Institutional	10.00	10.00	-	1500	2500	-	2500	250		1336	-	0	0	0	0	0
East	Llanos de Curundú	Commercial	8.00	6.00	2.00	1800	1500	500	2000	250		537	-	0	0	0	0	0
East	Llanos de Curundú	Industrial	-	-	-	-	-	-	-	0		-	-	0	0	0	0	0

Sub-region	Community/ Zone	Use	Area (ha.)			Population Area B 2000	Saturation Population				Year of Saturation	Population, Area B+C 2006	Pop. Sum					
			A*	B	C		B	C	B+C	B+C (per hectare)			Total	Residential	Institutional	Commercial	Industrial	Tourist
East	Llanos de Curundú	Total	58.00	41.00	17.00	4680	7750	2750	10500	0		4273	4273	0	0	0	0	0
East	Quarry Heights	Residential	19.80	19.40	0.40	301	388	8	396	20		396	-	0	0	0	0	0
East	Quarry Heights	Institutional	-	0.60	-	331	150	-	150	250		67	-	0	0	0	0	0
East	Quarry Heights	Commercial	-	0.50	-	276	125	-	125	250		112	-	0	0	0	0	0
East	Quarry Heights	Industrial	-	-	-	-	-	-	-	0		-	-	0	0	0	0	0
East	Quarry Heights	Total	19.80	20.50	0.40	908	663	8	671	0		575	575	0	0	0	0	0
West	Diablo	Residential	-	29.99	-	1710	2999	-	2999	100		2999	-	0	0	0	0	0
West	Diablo	Institutional	-	4.00	-	280	1199	-	1199	300		534	-	0	0	0	0	0
West	Diablo	Commercial	-	1.99	-	227	498	-	498	250		446	-	0	0	0	0	0
West	Diablo	Industrial	-	-	-	-	-	-	-	20		-	-	0	0	0	0	0
West	Diablo	Total	41.00	35.98	-	2217	4697	-	4697	0		3979	3979	0	0	0	0	0
West	Howard Central	Residential	-	137.87	-	-	6894	-	6894	50		2500	-	0	0	0	0	0
West	Howard Central	Institutional	-	14.39	-	-	2878	-	2878	200		1282	-	0	0	0	0	0
West	Howard Central	Commercial	-	96.63	533.92	1296	7247	40044	47291	75		1500	-	0	0	0	0	0
West	Howard Central	Industrial	0	337.92	1047.98	3505	6758.4	20959.6	27718	20		2000	-	0	0	0	2000	0
West	Howard Central	Tourist	0	1.09	195.87	0	54.5	250	304.5	50		378		0	0	0	0	0

Sub-region	Community/ Zone	Use	Area (ha.)			Population Area B 2000	Saturation Population				Year of Saturation	Population, Area B+C 2006	Pop. Sum					
			A*	B	C		B	C	B+C	B+C (per hectare)			Total	Residential	Institutional	Commercial	Industrial	Tourist
West	Howard Central	Total	2382.17	587.9	1777.77	4801	23831.65	61253.6	85085.25	0		7659	7659	0	0	0	0	0
East	Los Ríos	Residential	0	18.6754	0	715	1867.54	0	1867.54	100		1868	-	0	0	0	0	0
East	Los Ríos	Institutional	0	1.3146	0	95	460.11	0	460.11	350		205	-	0	0	0	0	0
East	Los Ríos	Commercial	0	0	0	0	0	0	0	250		-	-	0	0	0	0	0
East	Los Ríos	Industrial	0	0	0	0	0	0	0	150		-	-	0	0	0	0	0
East	Los Ríos	Total	28	19.99	0	810	2327.65	0	2327.65	0		2072	2072	0	0	0	0	0
East	San Francisco Valley	Residential	0	43	480.25	3200	4300	48025	52325	100		8970	-	0	0	0	0	0
East	San Francisco Valley	Institutional	0	80.6	44.1	5398	12090	6615	18705	150		1666	-	0	0	0	0	0
East	San Francisco Valley	Commercial	0	5.1	339.3	350	1275	84825	86100	250		4000	-	0	0	0	0	0
East	San Francisco Valley	Industrial	0	44	100.65	300	6600	15097.5	21697.5	150		1766	-	0	0	0	1766	0
East	San Francisco Valley	Total	1137	172.7	964.3	9248	24265	154562.5	178827.5	0		16402	16402	0	0	0	0	0
West	Rodman	Residential	0	20.52	0	0	1026	0	1026	50		1026	-	0	0	0	0	0
West	Rodman	Institutional	0	40.72	0	0	8144	0	8144	200		3627	-	0	0	0	0	0
West	Rodman	Commercial	0	180	120.36	2152	13500	9026.75	22526.75	75		1000	-	0	0	0	0	0
West	Rodman	Industrial	0	86.47	320.09	2797.5	1729.4	6401.87	8131.27	20		2000	-	0	0	0	2000	0
West	Rodman	Total	950	405.9	440.45	4949.5	24399.4	15428.62	39828.02	0		7653	7653	0	0	0	0	0

Sub-region	Community/ Zone	Use	Area (ha.)			Population Area B 2000	Saturation Population				Year of Saturation	Population, Area B+C 2006	Pop. Sum					
			A*	B	C		B	C	B+C	B+C (per hectare)			Total	Residential	Institutional	Commercial	Industrial	Tourist
Atlantic																		
East	France Field	Residential	0	0	0	0	0	0	0	150		-	-	0	0	0	0	0
East	France Field	Institutional	0	0	0	0	0	0	0	0		-	-	0	0	0	0	0
East	France Field	Commercial	0	0	42.64	0	0	8528	8528	200		1000	-	0	0	0	0	0
East	France Field	Industrial	0	86.47	315	0	1729.4	6300	8029.4	20		1500	-	0	0	0	1500	0
East	France Field	Tourist	0	0	32	0	0	1600	1600	50		640	-	0	0	0	0	0
East	France Field	Total	1040.06	86.47	389.64	0	1729.4	16428	18157.4	0		3140	3140	0	0	0	0	0
East	North Coco Solo	Residential	0	0	0	0	0	0	0	0		-	-	0	0	0	0	0
East	North Coco Solo	Institutional	0	0	0	0	0	0	0	0		-	-	0	0	0	0	0
East	North Coco Solo	Commercial	0	0	0	0	0	0	0	0		-	-	0	0	0	0	0
East	North Coco Solo	Industrial	179.54	179.54	0	0	3590.8	0	3590.8	20		1500	-	0	0	0	1500	0
East	North Coco Solo	Total	179.54	179.54	0	0	3590.8	0	3590.8	0		1500	1500	0	0	0	0	0
East	Arco Iris	Residential	78.8	67.2	11.6	1455	13440	2320	15760	200		1800	-	0	0	0	0	0
East	Arco Iris	Institutional	0	19.6	0	4387.7	5488	0	5488	280		1500	-	0	0	0	0	0
East	Arco Iris	Commercial	0	5.2	0	2871.34	1560	0	1560	300		750	-	0	0	0	0	0
East	Arco Iris	Industrial	0	4.5	0	1013	450	0	450	100		183	-	0	0	0	183	0
East	Arco Iris	Total	103.6	96.5	11.6	9727.04	24528.8	2320	26848.8	0		4233	4233	0	0	0	0	0
East	Telfer	Residential	0	0	0	0	0	0	0	0		-	-	0	0	0	0	0
East	Telfer	Institutional	0	0	0	0	0	0	0	0		-	-	0	0	0	0	0
East	Telfer	Commercial	0	0	0	0	0	0	0	0		-	-	0	0	0	0	0
East	Telfer	Industrial	439.63	0	439.63	0	0	8792.6	8792.6	20		1431	-	0	0	0	1431	0

Sub-region	Community/ Zone	Use	Area (ha.)			Population Area B 2000	Saturation Population				Year of Saturation	Population, Area B+C 2006	Pop. Sum					
			A*	B	C		B	C	B+C	B+C (per hectare)			Total	Residential	Institutional	Commercial	Industrial	Tourist
East	Telfer	Total	439.63	0	439.63	0	0	8792.6	8792.6	0		1431	1431	0	0	0	0	0
East	Mindi	Residential	0	0	0	0	0	0	0	0		-	-	0	0	0	0	0
East	Mindi	Institutional	0	0	0	0	0	0	0	0		-	-	0	0	0	0	0
East	Mindi	Commercial	0	0	50	0	0	10000	10000	200		500	-	0	0	0	0	0
East	Mindi	Industrial	0	0	107	0	0	16050	16050	150		1000	-	0	0	0	1000	0
East	Mindi	Total	157	0	157	0	0	34842.6	34842.6	0		1500	1500	0	0	0	0	0
East	Margarita	Residential	41.85	39.75	2.1	1800	3378	178	3556	125		2500	-	0	0	0	0	0
East	Margarita	Institutional	19.8	16	3.8	650	5000	1187	6187	312.48		827	-	0	0	0	0	0
East	Margarita	Commercial	1.35	0.3	1.05	45	150	525	675	350		362	-	0	0	0	0	0
East	Margarita	Industrial	0	0	0	0	0	0	0	0		-	-	0	0	0	0	0
East	Margarita	Total	63	56.05	6.95	2495	8528	1890	10418	0		3689	3689	0	0	0	0	0
East	Espinar	Residential	419	113.4	305.5	1655	11340	30550	41890	100		4000	-	0	0	0	0	0
East	Espinar	Institutional	0	0	0	0	0	0	0	0		-	-	0	0	0	0	0
East	Espinar	Commercial	0	6	0	3313.1	1800	0	1800	300		966	-	0	0	0	0	0
East	Espinar	Industrial	0	0	0	0	0	0	0	0		-	-	0	0	0	0	0
East	Espinar	Tourist	0	51	39	28161.2	2550	1950	4500	50		1500	-	0	0	0	0	0
East	Espinar	Total	419	170.4	344.5	33129.3	15690	32500	48190	0		6466	6466	0	0	0	0	0
East	Davis	Residential	0	60.97	350.41	600	6097	35041	41138	100		3500	-	0	0	0	0	0
East	Davis	Institutional	0	14	19.04	725	4200	5712	9912	300		1059	-	0	0	0	0	0
East	Davis	Commercial	0	2.5	48.53	50	500	9706	10206	200		1000	-	0	0	0	0	0
East	Davis	Industrial	0	11.04	171.66	300	1656	25749	27405	150		2231	-	0	0	0	2231	0
East	Davis	Total	678.15	88.51	589.64	1675	12453	76208	88661	0		7790	7790	0	0	0	0	0
East	Other areas	Residential	0	0	0	0	0	0	0	0	0	15020	0	15020	0	0	0	0
East	Other areas	Institutional	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East	Other areas	Commercial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Sub-region	Community/ Zone	Use	Area (ha.)			Population Area B 2000	Saturation Population				Year of Saturation	Population, Area B+C 2006	Pop. Sum					
			A*	B	C		B	C	B+C	B+C (per hectare)			Total	Residential	Institutional	Commercial	Industrial	Tourist
East	Other areas	Industrial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East	Other areas	Tourist	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East	Other areas	Total	0	0	0	0	0	0	0	0	0	15020	15020	0	0	0	0	0
West	Sherman Urban	Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West	Sherman Urban	Residential	0	0	0	0	0	0	0	0		-	-	0	0	0	0	0
West	Sherman Urban	Institutional	0.7	0.7	0	10	30	0	30	42.86		13	-	0	0	0	0	0
West	Sherman Urban	Commercial	18.99	18.99	0	700	1400	0	1400	73.72		1252	-	0	0	0	0	0
West	Sherman Urban	Industrial	0	0	0	0	0	0	0	0		-	-	0	0	0	0	0
West	Sherman Urban	Tourist	134.01	35	99.01	2000	3000	14850	17850	133.20		3000	-	0	0	0	0	0
West	Sherman Urban	Total	153.7	54.69	99.01	2710	4430	14850	19280	0		4266	4266	0	0	0	0	0
East	Gamboa	Residential	56.4	145.8	70.7	900	10935	5302.5	16237.5	75		2000	-	0	0	0	0	0
East	Gamboa	Institutional	0	8.8	0	4859.2	2640	0	2640	300		705	-	0	0	0	0	0
East	Gamboa	Commercial	0	27.2	0	15019.3	6800	0	6800	250		1460	-	0	0	0	0	0
East	Gamboa	Industrial	0	0	0	0	0	0	0	0		-	-	0	0	0	0	0
East	Gamboa	Tourist	0	100	8	55218.1	10000	800	10800	100		5356	-	0	0	0	0	0
East	Gamboa	Total	56.4	281.8	78.7	75996.6	30375	6102.5	36477.5	0		9521	9521	0	0	0	0	0
Central																		
East	Paraiso	Residential	54.8	16.1	38.8	1415	2415	5820	8235	150		2000	-	0	0	0	0	0
East	Paraiso	Institutional	0	3	0	1656.5	900	0	900	300		401	-	0	0	0	0	0

Sub-region	Community/ Zone	Use	Area (ha.)			Population Area B 2000	Saturation Population				Year of Saturation	Population, Area B+C 2006	Pop. Sum					
			A*	B	C		B	C	B+C	B+C (per hectare)			Total	Residential	Institutional	Commercial	Industrial	Tourist
East	Paraiso	Commercial	0	1	0	552.2	250	0	250	250		224	-	0	0	0	0	0
East	Paraiso	Industrial	0	0	0	0	0	0	0	0		-	-	0	0	0	0	0
East	Paraiso	Total	54.8	20.1	38.8	3623.7	3565	5820	9385	0		2624	2624	0	0	0	0	0
East	Pedro Miguel	Residential	20.68	15.68	5	1006	940.8	300	1240.8	60		1241	-	0	0	0	0	0
East	Pedro Miguel	Institutional	1.91	1.41	0.5	327	352.5	125	477.5	250		128	-	0	0	0	0	0
East	Pedro Miguel	Commercial	0.33	0	0.33	0	0	82.5	82.5	250		83	-	0	0	0	0	0
East	Pedro Miguel	Industrial	1.5	0	1.5	0	0	300	300	200		49	-	0	0	0	49	0
East	Pedro Miguel	Total	24.47	17.09	7.33	1333	1293.3	807.5	2100.8	0		1500	1500	0	0	0	0	0

Pop. 2006	Pop. Sum					
Pacific	114,437	-	-	-	10,268	-
Atlantic	58,556	15,020	-	-	7,845	-
Central	4,124	-	-	-	49	-
Total B+C	177,117	15,020	-	-	18,162	-
Reduction Factor		1	0.4453109	0.8944359	0.4069958	1.2398026

Notes:

1. Howard includes Farfan, Kobbe and Arraijan Tanks
2. Rodman includes Cocolí.
3. North Coco Solo includes Margarita Island.
4. Telfer includes Brazo Brooks, Mount Hope and Cristóbal Port
5. France Field includes Gold Hill.
6. Area A = surface area of the community within the area of the Infrastructure Investment Plan.
7. Area B = developed surface area within Area A.
8. Area C = developable surface area within Area A, which has not yet been developed.

Scenario 3: Market + Governmental City

Sub-region	Community/ Zone	Use	Area (ha.)			Population Area B 2000	Saturation Population				Year of Saturation	Population Area B+C 2006	Pop. Sum					
			A*	B	C		Area B	Area C	Area B + C	Area B+C (per hectare)			Total	Residential	Institutional	Commercial	Industrial	Tourist
Pacific																		
East	Governmental City	Residential												-	-	-	-	-
East	Governmental City	Institutional								50000	2006	50000		-	50000	-	-	-
East	Governmental City	Commercial								10000	2006	10000		-	-	10000	-	-
East	Governmental City	Industrial												-	-	-	-	-
East	Governmental City	Tourist												-	-	-	-	-
East	Governmental City	Total								60000		60000	60000	-	-	-	-	-
East	Albrook	Residential	0	58.41	17.61	2340	7301	2201	9502	125		3801		-	-	-	-	-
East	Albrook	Institutional	0	4.29	0	107	1286	-	1286	300		573		-	-	-	-	-
East	Albrook	Commercial	0	46.31	29.12	1382	11578	7279	18857	250		6747		-	-	-	-	-
East	Albrook	Industrial	0	0	0	-	-	-	-	150		-		-	-	-	-	-
East	Albrook	Total	248	109.01	46.72	3829	20165	9480	29645	0		11120	11120	-	-	-	-	-
East	Amador	Residential	15.87	13	2.87	150	7800	1722	9522	600		5713		-	-	-	-	-
East	Amador	Institutional	0	5.89	0	350	1767	-	1767	300		236		-	-	-	-	-
East	Amador	Commercial	0	15.2	20	125	3040	4000	7040	200		2519		-	-	-	-	-
East	Amador	Industrial	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	Amador	Tourist	0	0	38	-	-	9500	9500	250		7067		-	-	-	-	-
East	Amador	Total	164.43	34.09	60.87	625	12607	15222	27829	0		15535	15535	-	-	-	-	-
East	Balboa-Ancón	Residential	238.81	200	38.81	4500	16000	3105	19105	80		5731		-	-	-	-	-

Sub-region	Community/ Zone	Use	Area (ha.)			Population Area B 2000	Saturation Population				Year of Saturation	Population Area B+C 2006	Pop. Sum					
			A*	B	C		Area B	Area C	Area B + C	Area B+C (per hectare)			Total	Residential	Institutional	Commercial	Industrial	Tourist
East	Balboa-Ancón	Institutional	58	46	12	10062	13800	3600	17400	300		4649		-	-	-	-	-
East	Balboa-Ancón	Commercial	44.35	24	20.35	6000	6000	5088	11088	250		2975		-	-	-	-	-
East	Balboa-Ancón	Industrial	0	0	0	-	-	-	-	200		-		-	-	-	-	-
East	Balboa-Ancón	Total	341.16	270	71.16	20562	35800	11792	47592	0		13356	13356	-	-	-	-	-
East	Balboa Industrial	Residential	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	Balboa Industrial	Institutional	94.7	90	4.7	2737	28125	1468	29593	312.49		5271		-	-	-	-	-
East	Balboa Industrial	Commercial	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	Balboa Industrial	Industrial	120.5	78.5	42	3485	3925	2100	6025	50		981		-	-	-	981	-
East	Balboa Industrial	Total	215.2	140	75.2	6222	45569	10801	56370	0		6252	6252	-	-	-	-	-
East	Cárdenas	Residential	0	22.977	51.295	735	3447	7694	11141	150		2205		-	-	-	-	-
East	Cárdenas	Institutional	0	10.036	10.036	-	3011	3011	6021	300		2681		-	-	-	-	-
East	Cárdenas	Commercial	0	0	0	-	-	-	-	250		-		-	-	-	-	-
East	Cárdenas	Industrial	0	3.2286	3.2286	-	484	484	969	150		394		-	-	-	394	-
East	Cárdenas	Total	197	36.241	64.560	735	6942	11189	18131	0		5281	5281	-	-	-	-	-
East	Clayton	Residential	100.26	42.7	57.56	5130	13664	24520	38184	250		5500		-	-	-	-	-
East	Clayton	Institutional	10.29	0.5	9.79	170	170	2937	3107	301.9436		1038		-	-	-	-	-
East	Clayton	Commercial	186.72	130.8	55.92	58860	32700	13980	46680	250		4472		-	-	-	-	-
East	Clayton	Industrial	10	0	10	-	-	500	500	50		203		-	-	-	203	-
East	Clayton	Total	307.27	174	133.27	64160	46534	41937	88471	0		11213	11213	-	-	-	-	-
East	Corozal	Residential	0	14.096	0	415	2114	-	2114	150		1269		-	-	-	-	-
East	East/West Corozal	Institutional	0	31.728	0	504	6346	-	6346	200		1695		-	-	-	-	-

Sub-region	Community/ Zone	Use	Area (ha.)			Population Area B 2000	Saturation Population				Year of Saturation	Population Area B+C 2006	Pop. Sum					
			A*	B	C		Area B	Area C	Area B + C	Area B+C (per hectare)			Total	Residential	Institutional	Commercial	Industrial	Tourist
East	East/West Corozal	Commercial	0	3.901	0.5966	297	975	149	1124	250		754		-	-	-	-	-
East	East/West Corozal	Industrial	0	17.7	53.8	2655	2655	8070	10725	150		1048		-	-	-	1048	-
East	East/West Corozal	Total	61	49.726	0.5966	3871	12090	8219	20309	0		4766	4766	-	-	-	-	-
East	Curundú Industrial	Residential	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	Curundú Industrial	Institutional	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	Curundú Industrial	Commercial	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	Curundú Industrial	Industrial	60	55	5	9750	10500	800	11300	188.33		1840		-	-	-	1840	-
East	Curundú Industrial	Total	60	55	5	9750	10500	800	11300	188.33		1840	1840	-	-	-	-	-
East	Altos de Curundú	Residential	11	6.4	4.6	594	960	690	1650	150		1980		-	-	-	-	-
East	Altos de Curundú	Institutional	2.05	2.05	0	260	615	-	615	300		116		-	-	-	-	-
East	Altos de Curundú	Commercial	1.03	0	1.03	-	-	258	258	250		331		-	-	-	-	-
East	Altos de Curundú	Industrial	1.07	1.07	0	88	-	-	-	150		36		-	-	-	36	-
East	Altos de Curundú	Total	15.15	9.52	5.63	942	1575	948	2523	0		2463	2463	-	-	-	-	-
East	Llanos de Curundú	Residential	40	25	15	1380	3750	2250	6000	150		2400		-	-	-	-	-

Sub-region	Community/ Zone	Use	Area (ha.)			Population Area B 2000	Saturation Population				Year of Saturation	Population Area B+C 2006	Pop. Sum					
			A*	B	C		Area B	Area C	Area B + C	Area B+C (per hectare)			Total	Residential	Institutional	Commercial	Industrial	Tourist
East	Llanos de Curundú	Institutional	10	10	0	1500	2500	-	2500	250		1336		-	-	-	-	-
East	Llanos de Curundú	Commercial	8	6	2	1800	1500	500	2000	250		537		-	-	-	-	-
East	Llanos de Curundú	Industrial	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	Llanos de Curundú	Total	58	41	17	4680	7750	2750	10500	0		4273	4273	-	-	-	-	-
East	Quarry Heights	Residential	19.8	19.4	0.4	301	388	8	396	20		396		-	-	-	-	-
East	Quarry Heights	Institutional	0	0.6	0	331	150	-	150	250		67		-	-	-	-	-
East	Quarry Heights	Commercial	0	0.5	0	276	125	-	125	250		112		-	-	-	-	-
East	Quarry Heights	Industrial	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	Quarry Heights	Total	19.8	20.5	0.4	908	663	8	671	0		575	575	-	-	-	-	-
West	Diablo	Residential	0	29.995	0	1710	2999	-	2999	100		2999		-	-	-	-	-
West	Diablo	Institutional	0	3.9966	0	280	1199	-	1199	300		534		-	-	-	-	-
West	Diablo	Commercial	0	1.9927	0	227	498	-	498	250		446		-	-	-	-	-
West	Diablo	Industrial	0	0	0	-	-	-	-	20		-		-	-	-	-	-
West	Diablo	Total	41	35.984	0	2217	4697	-	4697	0		3979	3979	-	-	-	-	-
West	Howard Central	Residential	0	137.87	0	-	6894	-	6894	50		2500		-	-	-	-	-
West	Howard Central	Institutional	0	14.39	0	-	2878	-	2878	200		1282		-	-	-	-	-
West	Howard Central	Commercial	0	96.63	533.92	1296	7247	40044	47291	75		1500		-	-	-	-	-

Sub-region	Community/ Zone	Use	Area (ha.)			Population Area B 2000	Saturation Population				Year of Saturation	Population Area B+C 2006	Pop. Sum					
			A*	B	C		Area B	Area C	Area B + C	Area B+C (per hectare)			Total	Residential	Institutional	Commercial	Industrial	Tourist
West	Howard Central	Industrial	0	337.92	1047.98	3505	6758	20960	27718	20		2000		-	-	-	2000	-
West	Howard Central	Tourist	0	1.09	195.87	-	55	250	305	50		378		-	-	-	-	-
West	Howard Central	Total	2382.2	587.9	1777.77	4801	23832	61254	85085	0		7659	7659	-	-	-	-	-
East	Los Ríos	Residential	0	18.675	0	715	1868	-	1868	100		1868		-	-	-	-	-
East	Los Ríos	Institutional	0	1.3146	0	95	460	-	460	350		205		-	-	-	-	-
East	Los Ríos	Commercial	0	0	0	-	-	-	-	250		-		-	-	-	-	-
East	Los Ríos	Industrial	0	0	0	-	-	-	-	150		-		-	-	-	-	-
East	Los Ríos	Total	28	19.99	0	810	2328	-	2328	0		2072	2072	-	-	-	-	-
East	San Francisco Valley	Residential	0	43	480.25	3200	4300	48025	52325	100		8970		-	-	-	-	-
East	San Francisco Valley	Institutional	0	80.6	44.1	5398	12090	6615	18705	150		1666		-	-	-	-	-
East	San Francisco Valley	Commercial	0	5.1	339.3	350	1275	84825	86100	250		4000		-	-	-	-	-
East	San Francisco Valley	Industrial	0	44	100.65	300	6600	15098	21698	150		1766		-	-	-	1766	-
East	San Francisco Valley	Total	1137	172.7	964.3	9248	24265	154563	178828	0		16402	16402	-	-	-	-	-
West	Rodman	Residential	0	20.52	0	-	1026	-	1026	50		1026		-	-	-	-	-
West	Rodman	Institutional	0	40.72	0	-	8144	-	8144	200		3627		-	-	-	-	-
West	Rodman	Commercial	0	180	120.357	2152	13500	9027	22527	75		1000		-	-	-	-	-
West	Rodman	Industrial	0	86.47	320.093	2798	1729	6402	8131	20		2000		-	-	-	2000	-
West	Rodman	Total	950	405.9	440.45	4950	24399	15429	39828	0		7653	7653	-	-	-	-	-
Atlantic																		
East	France Field	Residential	0	0	0	-	-	-	-	150		-		-	-	-	-	-

Sub-region	Community/ Zone	Use	Area (ha.)			Population Area B 2000	Saturation Population				Year of Saturation	Population Area B+C 2006	Pop. Sum					
			A*	B	C		Area B	Area C	Area B + C	Area B+C (per hectare)			Total	Residential	Institutional	Commercial	Industrial	Tourist
East	France Field	Institutional	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	France Field	Commercial	0	0	42.64	-	-	8528	8528	200		1000		-	-	-	-	-
East	France Field	Industrial	0	86.47	315	-	1729	6300	8029	20		1500		-	-	-	1500	-
East	France Field	Tourist	0	0	32	-	-	1600	1600	50		640		-	-	-	-	-
East	France Field	Total	1040.06	86.47	389.64	-	1729	16428	18157	0		3140	3140	-	-	-	-	-
East	North Coco Solo	Residential	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	North Coco Solo	Institutional	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	North Coco Solo	Commercial	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	North Coco Solo	Industrial	179.54	179.54	0	-	3591	-	3591	20		1500		-	-	-	1500	-
East	North Coco Solo	Total	179.54	179.54	0	-	3591	-	3591	0		1500	1500	-	-	-	-	-
East	Arco Iris	Residential	78.8	67.2	11.6	1455	13440	2320	15760	200		1800		-	-	-	-	-
East	Arco Iris	Institutional	0	19.6	0	4388	5488	-	5488	280		1500		-	-	-	-	-
East	Arco Iris	Commercial	0	5.2	0	2871	1560	-	1560	300		750		-	-	-	-	-
East	Arco Iris	Industrial	0	4.5	0	1013	450	-	450	100		183		-	-	-	183	-
East	Arco Iris	Total	103.6	96.5	11.6	9727	24529	2320	26849	0		4233	4233	-	-	-	-	-
East	Telfer	Residential	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	Telfer	Institutional	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	Telfer	Commercial	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	Telfer	Industrial	439.63	0	439.63	-	-	8793	8793	20		1431		-	-	-	1431	-
East	Telfer	Total	439.63	0	439.63	-	-	8793	8793	0		1431	1431	-	-	-	-	-
East	Mindi	Residential	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	Mindi	Institutional	0	0	0	-	-	-	-	0		-		-	-	-	-	-

Sub-region	Community/ Zone	Use	Area (ha.)			Population Area B 2000	Saturation Population				Year of Saturation	Population Area B+C 2006	Pop. Sum					
			A*	B	C		Area B	Area C	Area B + C	Area B+C (per hectare)			Total	Residential	Institutional	Commercial	Industrial	Tourist
East	Mindi	Commercial	0	0	50	-	-	10000	10000	200		500		-	-	-	-	-
East	Mindi	Industrial	0	0	107	-	-	16050	16050	150		1000		-	-	-	1000	-
East	Mindi	Total	157	0	157	-	-	34843	34843	0		1500	1500	-	-	-	-	-
East	Margarita	Residential	41.85	39.75	2.1	1800	3378	178	3556	125		2500		-	-	-	-	-
East	Margarita	Institutional	19.8	16	3.8	650	5000	1187	6187	312.475		827		-	-	-	-	-
East	Margarita	Commercial	1.35	0.3	1.05	45	150	525	675	350		362		-	-	-	-	-
East	Margarita	Industrial	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	Margarita	Total	63	56.05	6.95	2495	8528	1890	10418	0		3689	3689	-	-	-	-	-
East	Espinar	Residential	419	113.4	305.5	1655	11340	30550	41890	100		4000		-	-	-	-	-
East	Espinar	Institutional	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	Espinar	Commercial	0	6	0	3313	1800	-	1800	300		966		-	-	-	-	-
East	Espinar	Industrial	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	Espinar	Tourist	0	51	39	28161	2550	1950	4500	50		1500		-	-	-	-	-
East	Espinar	Total	419	170.4	344.5	33129	15690	32500	48190	0		6466	6466	-	-	-	-	-
East	Davis	Residential	0	60.97	350.41	600	6097	35041	41138	100		3500		-	-	-	-	-
East	Davis	Institutional	0	14	19.04	725	4200	5712	9912	300		1059		-	-	-	-	-
East	Davis	Commercial	0	2.5	48.53	50	500	9706	10206	200		1000		-	-	-	-	-
East	Davis	Industrial	0	11.04	171.66	300	1656	25749	27405	150		2231		-	-	-	2231	-
East	Davis	Total	678.15	88.51	589.64	1675	12453	76208	88661	0		7790	7790	-	-	-	-	-
East	Other areas	Residential	0	0	0	0	0	0	0	0	0	15020	0	15020	0	0	0	0
East	Other areas	Institutional	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East	Other areas	Commercial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East	Other areas	Industrial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East	Other areas	Tourist	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East	Other areas	Total	0	0	0	0	0	0	0	0	0	15020	15020	0	0	0	0	0

Sub-region	Community/ Zone	Use	Area (ha.)			Population Area B 2000	Saturation Population				Year of Saturation	Population Area B+C 2006	Pop. Sum					
			A*	B	C		Area B	Area C	Area B + C	Area B+C (per hectare)			Total	Residential	Institutional	Commercial	Industrial	Tourist
West	Sherman Urban	Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West	Sherman Urban	Residential	0	0	0	-	-	-	-	0		-		-	-	-	-	-
West	Sherman Urban	Institutional	0.7	0.7	0	10	30	-	30	42.85713		13		-	-	-	-	-
West	Sherman Urban	Commercial	18.99	18.99	0	700	1400	-	1400	73.72301		1252		-	-	-	-	-
West	Sherman Urban	Industrial	0	0	0	-	-	-	-	0		-		-	-	-	-	-
West	Sherman Urban	Tourist	134.01	35	99.01	2000	3000	14850	17850	133.1990		3000		-	-	-	-	-
West	Sherman Urban	Total	153.7	54.69	99.01	2710	4430	14850	19280	0		4266	4266	-	-	-	-	-
East	Gamboa	Residential	56.4	145.8	70.7	900	10935	5303	16238	75		2000		-	-	-	-	-
East	Gamboa	Institutional	0	8.8	0	4859	2640	-	2640	300		705		-	-	-	-	-
East	Gamboa	Commercial	0	27.2	0	15019	6800	-	6800	250		1460		-	-	-	-	-
East	Gamboa	Industrial	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	Gamboa	Tourist	0	100	8	55218	10000	800	10800	100		5356		-	-	-	-	-
East	Gamboa	Total	56.4	281.8	78.7	75997	30375	6103	36478	0		9521	9521	-	-	-	-	-
Central																		
East	Paraiso	Residential	54.8	16.1	38.8	1415	2415	5820	8235	150		2000		-	-	-	-	-
East	Paraiso	Institutional	0	3	0	1657	900	-	900	300		401		-	-	-	-	-
East	Paraiso	Commercial	0	1	0	552	250	-	250	250		224		-	-	-	-	-
East	Paraiso	Industrial	0	0	0	-	-	-	-	0		-		-	-	-	-	-
East	Paraiso	Total	54.8	20.1	38.8	3624	3565	5820	9385	0		2624	2624	-	-	-	-	-
East	Pedro Miguel	Residential	20.68	15.68	5	1006	941	300	1241	60		1241		-	-	-	-	-

Sub-region	Community/ Zone	Use	Area (ha.)			Population Area B 2000	Saturation Population				Year of Saturation	Population Area B+C 2006	Pop. Sum					
			A*	B	C		Area B	Area C	Area B + C	Area B+C (per hectare)			Total	Residential	Institutional	Commercial	Industrial	Tourist
East	Pedro Miguel	Institutional	1.91	1.41	0.5	327	353	125	478	250		128		-	-	-	-	-
East	Pedro Miguel	Commercial	0.33	0	0.33	-	-	83	83	250		83		-	-	-	-	-
East	Pedro Miguel	Industrial	1.5	0	1.5	-	-	300	300	200		49		-	-	-	49	-
East	Pedro Miguel	Total	24.47	17.09	7.33	1333	1293	808	2101	0		1500	1500	-	-	-	-	-
												Pop. 2006	Pop. Sum					
												Pacific	174,437	-	50,000	10,000	10,268	-
												Atlantic	58,556	15,020	-	-	7,845	-
												Central	4,124	-	-	-	49	-
												Total B+C	237,117	15,020	50,000	10,000	18,162	-
												Reduction factor		1	0.445310903	0.894435927	0.406995769	1.23980262

Notes:

1. Howard includes Farfan, Kobbe and Arraijan Tanks.
2. Rodman includes Cocolí.
3. North Coco Solo includes Margarita Island.
4. Telfer includes Brazo Brooks, Mount Hope and Cristóbal Port.
5. France Field includes Gold Hill.
6. Area A = surface area of the community within the area of the Infrastructure Investment Plan.
7. Area B = developed surface area within Area A.
8. Area C = developable surface area within Area A, which has not yet been developed.