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8.0 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

8.1 Introduction

This Environmental Management Plan (EMP) has been structured following the requirements defined in the current standard, Executive Decree Nº 209 of 2006, and incorporating additional elements required in mega projects mandated by the international borrowing institutions which constitute the International Finance Corporation (IFC).

8.1.1 Objectives and Organization

The objective of the Environmental Management Plan (EMP) is to make sure that the Panama Canal Expansion Project – Third Set of Locks, is carried out and operated with adequate prevention and mitigation of adverse social and environmental impacts. To achieve this purpose the EMP is organized in several components, according to the nature of the actions.

8.1.1.1 Objectives

The specific objectives of the EMP include the following:

1. To offer the Panama Canal Authority (the Promoter) a document which sets forth all the measures identified by the consultant to prevent, minimize, mitigate and compensate for the potential negative impacts derived from the Canal expansion, as well as to strengthen the

positive impacts;

2. To define the parameters and variables to be used to assess the environmental quality in the influence area of the Project;

3. To establish the mechanisms so that pertinent authorities can follow up on the Project environmental variables and implement the necessary controls;

4. To design the mechanisms for accident prevention and response, and for contingencies which may arise during the execution and operation of the Project; and

5. Assure compliance with the Project's social and environmental goals, including conformance with the Equator Principles and the Performance Standards on Social and Environmental Sustainability of the International Finance Corporation (IFC).

8.1.1.2 Organization

The Environmental Management Plan presented in this chapter, following the D.E. 209 stipulations, includes thirteen principal components, which are:

1. Presentation of the EMP, its objectives and organization, and aspects related to the socio-environmental policies, presentation of reports, and Plan reviews.
2. The definition of the **Entity Responsible for the Implementation of Measures** with the definition of the actors who take part in complying with the EMP;
3. **Description of Specific Mitigation Measures**, with the implementation mechanisms of actions tending to minimize the negative social and environmental impacts, and maximize the positive impacts;
4. A **Monitoring and Follow-up Plan** with the mechanisms, parameters and execution indicators for follow-up and social and environmental control, as well as the specific responsibilities to assure compliance with the acquired commitments through the EMP;
5. The EMP **Implementation Schedule**, adjusted to the implementation plans of the Project;
6. A **Citizen Participation Plan;**

7. A **Risk Prevention Plan**, in which possible accident risks are identified;
8. A **Wildlife Rescue and Resettlement Plan**;
9. An **Environmental Education Plan;**
10. A **Contingency Plan**, that includes accident risk prevention measures and responses, and control, in case they arise;
11. The **Post-Operations Environmental Recovery Plan**;
12. The **Abandonment Plan**; and
13. The **Environmental Management Costs,** in detail;

According to the Performance Standards on Social and Environmental Sustainability of the International Finance Corporation (IFC), a Management System shall include the following elements:

- Social and Environmental Assessment;
- Management Program;
- Organizational Capability;
- Training;
- Community Participation;
- Supervision; and
- Report Submittals.

These elements are included in the EMP components mentioned above.

8.1.2 Socioenvironmental Policies of the Project

In its vision and corporate mission, its strategic objectives, and, its guiding principles, the ACP is committed to protecting the environment and promoting a sustainable development, together with conserving the natural resources of the Canal Watershed. It is important to highlight that the ACP vision and mission reflect a significant change with relation to its predecessor agency, the former Panama Canal Commission, as it establishes the integration of the environment in which the Canal activity is developed and its inhabitants.

Conforming to this new vision, the ACP adhered to the United Nations Global Compact in December 2002 and, in August 2002, to the World Business Council for Sustainable Development (WBCSD) [3]. Moreover, the ACP utilizes international guides, such as the Equator Principles with respect to the standards on the subject of environmental impact assessment.

Consequently, the assessment of the components of the Panama Canal Expansion Project – Third Set of Locks, is a process that incorporates analysis, selection, consultation, and appropriate mitigation and follow-up actions. On subscribing those agreements, the ACP reiterates that in all its activities and Projects, the social and environmental aspects shall be considered to avoid or minimize possible negative impacts.

By way of the 2004 and 2006 publications of the Social and Environmental Report, ACP presented

the principal activities and achievements aimed at improving the condition of its collaborators, human rights, and the environment. The first report highlighted the activities that ACP has initiated to reach goals based on Social and Business Responsibilities indicators. These commitments are:

1 To guarantee the use of an organizational administrative system based on social and business responsibility.

2 To increase awareness of social and business responsibility among collaborators and develop a participation strategy.

3 To involve the interested parties by introducing a program aimed at their incorporation and participation in social and business responsibility.

4 To favor the production of social and environmental benefits with our services.

5 To improve the access to information as a transparency policy.

The Canal Expansion Project shall be developed within this social and environmental framework and shall also be guided, as previously indicated, by the Equator Principles and the Performance Standards on Social and Environmental Sustainability of the International Finance Corporation (IFC).

8.1.2.1 Equator Principles

The Equator Principles Financial Institutions (EPFIs) finance projects with capital costs greater than 10 million dollars only when the projects comply with the following requisites:

1. **Review and Categorization:** The EPFI shall review the Project for a category assignment according to its potential impacts. The criteria for the category definition of the Project are the following:

    a. "**Category A:** Projects with potential adverse social or environmental impacts which are diverse, irreversible or unprecedented."

    b. "**Category B**: Projects with limited potential adverse social or environmental impacts, which are few in number, generally specific to the site, mainly easily reversible through mitigation measures."

    c. "**Category C**: Projects without or with minimal social or environmental impacts."

2. **Social and Environmental Assessment:** Categories A and B projects require a Social and Environmental Assessment which complies with IFC Standard 1: Social and Environmental Assessment and Management System.

3. **Applicable Social and Environmental Standards:** The IFC Performance Standards and WB/IFC sectoral guidelines shall be adopted as the social and environmental standards for projects in countries that do not classify as OECD (Organization for Economic Cooperation and Development) high-income countries.

4. **Action Plan and Management System**: All Category A and B projects require an Action Plan and a Social and Environmental Management System. The Action Plan for a major project having significant impact potentials may be a group of specific plans, such as Resettlement Action Plan, Biodiversity Action Plan, Hazardous Materials Management Plan, Emergency Preparedness and Response Plan, and Community Health and Safety Plan.

5. **Consultation and Disclosure**: For projects with significant adverse impacts on affected communities, the financial institution shall determine if the Project has or has not adequately incorporated the concerns of the affected communities by way of a public consultation and information disclosure process that guarantees the free, prior and informed consultation that encourages an informed participation. This consultation shall be prior to any construction activity and shall be continuous.

6. **Grievance Mechanism:** All Category A projects and, if applicable, those in Category B, shall establish a Grievance Mechanism as part of the Management System to receive and facilitate the resolution of concerns and grievances of affected individuals or groups.

7. **Independent Review:** The EIA, the Action Plan and the documents on the Consultation Process of the entire Category A projects, and if applicable, those in Category B, shall be reviewed by an independent expert to contribute in the EPFI due diligence and assess compliance with the Equator Principles.

8. **Loan Covenant:** With regard to covenants incorporated into the loan documents, the covenant to comply with all laws, rules, and permits applicable to social and environmental

aspects is also included.

9. **Independent Monitoring and Reporting:** All Category A projects, and in an applicable case those in Category B, shall designate an independent expert to contribute in the monitoring and reporting processes throughout the life of the loan.

8.1.2.2 IFC Performance Standards on Social and Environmental Sustainability

On April 30, 2006, the International Finance Corporation (IFC) adapted eight performance standards on social and environmental sustainability to be implemented by all financed projects. The objectives of the eight Performance Standards (PS) follows:

PS 1. Social and Environmental Assessment and Management Systems

- To identify and assess the social and environmental impacts, both adverse and beneficial, in the Project's area of influence.

- To avoid, or where avoidance is not possible, minimize, mitigate or compensate for the adverse impacts on the workers, affected communities and the environment.

- To ensure that the affected communities are appropriately engaged on issues that could potentially affect them.

- To promote better social and environmental performance of companies through the effective use of management systems.

PS 2. Labor and Working Conditions

- To establish, maintain, and improve worker-management relationship.

- To promote the fair treatment, non-discrimination and equal opportunity of workers, and compliance with national labor and employment laws.

- To protect the workforce by addressing child labor and forced labor.

- To promote safe and healthy working conditions, and to protect and promote the health of workers.

PS 3. Pollution Prevention and Abatement

- To avoid or minimize the adverse impacts on human health and the environment, by avoiding or minimizing pollution from Project activities.

- To promote the reduction of emissions that contributes to climate change.

PS 4. Community Health, Safety and Security

- To avoid or minimize risks to and impacts on the health and safety of the local community the life cycle of the Project, from routine and non-routine circumstances.

- To ensure that the safeguarding of personnel and property is carried out in a legitimate manner that avoids or minimizes risks to the community's safety and security.

PS 5. Land Acquisition and Involuntary Resettlement

- To avoid or at least minimize involuntary resettlements whenever feasible by exploring alternative Project designs.

- To mitigate adverse social and economic impacts from land acquisition or restrictions on the affected persons' use of land by: (i) providing compensation for loss of assets at replacement cost, and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected.

- To improve or, at least, restore the livelihood and standards of living of displaced persons.

- To improve living conditions among the displaced persons through provision of adequate housing with security of tenure at resettlement sites.

PS 6. Biodiversity Conservation and Sustainable Natural Resource Management

- To protect and conserve biodiversity.

- To promote sustainable management and use of natural resources through the adoption of practices that integrates conservation needs and development priorities.

PS 7. Indigenous Peoples

- To ensure that the development process fosters full respect of the dignity, human rights, aspirations, cultures and natural resource-based livelihoods of Indigenous Peoples.

- To avoid adverse impacts of projects on the communities of Indigenous Peoples, or when avoidance is not feasible, to minimize, or mitigate or compensate for such impacts, and to provide opportunities for development benefits, in a culturally appropriate manner.

- To establish and maintain an ongoing relationship with the Indigenous Peoples affected by a project throughout the life of the Project.

- To foster good faith negotiations and informed participation of Indigenous Peoples when projects are to be located on traditional or customary lands under use by Indigenous Peoples.

- To respect and preserve the culture, knowledge and practices of Indigenous Peoples.

PS 8. Cultural Heritage

- To protect cultural heritage from the adverse impacts of Project activities and support its preservation.

- To promote the equitable sharing of benefits from the use of cultural heritage in business activities.

8.1.2.3 Environmental, Health and Safety Guidelines

The Equator Principles and IFC Performance Standards require compliance with the rules and standards of the general guidelines on the environment, health and safety (General EHS Guidelines) of April 30, 2007, and the applicable IFC specific sectoral guidelines.

Although IFC has not published specific guidelines for canal constructions or operations, it has published guidelines for ports and terminal ports (Environmental, Health and Safety Guidelines for Ports, Harbors, and Terminals), which include standards for dredged materials, air emissions, and other important aspects of the Project.

8.1.3 Reports

8.1.3.1 Promoter's Reports

ACP shall issue periodic reports on the Project's social and environmental performance and on each program and plan of this EMP for consultation by interested parties and communities. These reports shall be delivered to ANAM (Panama's National Environmental Authority), financial institutions, and disclosed to interested parties through the Project's Web page.

Those reports shall summarize the results obtained from the monthly reports prepared by the Environmental Specialist and Contractors.

As a signatory to the UN Global Compact, ACP shall issue its biannual Social and Environmental Report, which follows the Global Compact Guidelines for Communication on Progress and is distributed to local and international interested parties in printed format, and through the Internet.

8.1.3.2 Environmental Specialist's Reports

The Environmental Specialist shall prepare monthly reports, as well as special reports when unexpected events occur, or an established objective has been met within the work Program. The Environmental Specialist's monthly reports shall summarize and analyze the results and data submitted in each Contractor's reports, and shall present recommendations and general actions to improve the Project's Environmental Management System.

These results shall be sent to the Project Manager and the Contractor's Environmental Coordinator within five work days following the month in which the report is prepared. This report shall include all the information gathered from the different work fronts, emphasizing the environmental management measures implemented, achievements, and the difficulties encountered.

Unexpected events, such as accidents causing spills of toxic or hazardous products, or special and extraordinary programs for repairs and maintenance, and traffic and work-related accidents, shall always require special reports to document the magnitude of the impacts and effectiveness of the response.

8.1.3.3 Contractors' Reports

Each Contractor shall prepare a monthly report of the environmental and social management activities and results, including the data for each plan and program of this EMP that is within his/her competence and according to the Project Phase. The monthly reports shall at least contain the following elements:

- Introduction
    - Objectives
    - Methodology
    - Reporting Period
- Project Progress
    - Excavations

- Dredging
- Construction of Locks
- Others, according to Project Phase

- Environment
  - Water
  - Air
  - Noise and Vibrations
  - Soils
  - Flora and Fauna
  - Management of Wastes and Materials
  - Spoil Sites
  - Environmental Indicators
  - Environmental Training and Education Indicators
  - New Noncompliance
  - Noncompliance Resolution
  - Pending Noncompliance
  - Recommendations and Corrective Actions

- Health and Safety
  - Accidents
  - Incidents

    - Indicators
    - Training
    - Recommendations and Corrective Actions
- Social Aspects
    - Local Employment and Contracting Indicators
    - Cultural Resources and Paleontology
    - Communications and Consultations
    - Grievances and Concerns
    - Resolutions of Grievances Received
    - Pending Grievances
    - Violations to the Code of Conduct
    - Recommendations and Corrective Actions
- Summary

Within the two months that follow the conclusion of the construction of the Project, a draft version of the *Summary Report of Environmental Management during the Construction* that describes the work performed by the Contractor with respect to each environmental subject matter should be presented. This draft shall be reviewed and commented on by the Contractor's personnel and by the ACP. The final version of such report shall contain the comments made and shall be submitted one month after the comments have been received.

8.1.4 Review and Update of the Environmental Management Plan

As part of the permanent maintenance of its Management System, ACP shall duly review and update the EMP so that it can adequately address social and environmental matters resulting from any change in Project circumstances, and in accordance with feedback received from interested parties regarding the Plan.

ACP Top Management shall annually review the EMP, taking into account the various types of information regarding the social and environmental performance of the Project including, in an applicable case:

- Internal audit results
- Audit or compliance assessment results
- Feedback, questions and grievances by interested groups, including the communities and workers
- Environmental and social indicators
- Status of performance objectives and goals
- Status of corrective and preventive actions
- Pending actions of prior reviews
- Changes in the social and environmental situation:
    - Legal requirements and other covenants
    - Project Phase and activities

- Results of recent reviews of social and environmental aspects

- Applicable technological and scientific advances
- Accident and injury investigations, including emergency incidents and lessons learned
- Continual improvement process activities, including improvement recommendations and their status.

ACP shall inform the various interested groups, including ANAM (Panama's National Environmental Authority), financial institutions, and the communities of all EMP modifications and updates.

8.2 Entity Responsible for the Implementation of Measures

Described in this section are the organization and responsibilities required to guarantee the execution of the mitigation measures and environmental management set forth in the EMP.

8.2.1 Organization

The Panama Canal Authority (ACP) is the Promoter of the Project as well as the entity responsible for the execution of the measures undertaken by this Plan. However, the majority of the mitigation measures of the construction phase shall be executed by the construction Contractors, with the supervision and strict follow-up of the ACP.

8.2.1.1 Promoter

In view of the requirements for prevention, minimization, mitigation and compensation of the environmental impacts identified for this Project, the Promoter shall be responsible for ensuring EMP compliance. For this, the Promoter shall have within its personnel an Environmental Officer charged with the responsibility for achieving compliance completeness of the programs.

The ACP administrative organization responsible for the environmental management during the execution of the Canal Expansion Project is the Engineering and Programs Management Department (*Departamento de Ingeniería y Administración de Programas)*.

ACP has an Environmental Management System available which documents its procedures, establishes objectives and goals, and allows for the monitoring of significant environmental impacts of its operations and their periodic review, so that they can be considered in the planning process. The established system utilizes the ISO 14001 Standard as reference for the definition of an environmental management system in the Canal. In 2003, the Environmental Management Division received the certification for the Environmental Management System (EMS) under international standard ISO 14001-96 to strengthen the necessary programs and functions for compliance with the environmental responsibilities. The System received its Recertification in the year 2006 under the updated 2005 Standard.

8.2.1.2 Contractors

Each Contractor shall implement an environmental and social management system that shall include all the necessary resources and organization to assure compliance with the EMP.

Each Contractor shall have, as a minimum, the following key personnel:

- Project Socio-Environmental Manager
- Field Environmental Supervisor (Environmental Coordinator)
- Field Occupational Safety and Hygiene Supervisor

8.2.2 Responsibilities

8.2.2.1 Promoter

In accordance with Article 3 of Agreement No. 116, of July 27, 2006, "by which the Regulation on the Environment, Watershed, and Interagency Commission of the Panama Canal Watershed is approved", the ACP Administrator is responsible for applying the standards on the hydric resources and the environment established in the organic law and in the referenced Agreement, and for monitoring its compliance.

The specific responsibilities of the Project Environmental Officer delegated by the Promoter shall be:

1. Ensure compliance with the environmental requirements established in the EMP programs, and with the environmental conditions set for the execution of the Project. For that purpose, he/she shall have the necessary authority to stop all activities that do not comply with the established Standard.

- Guarantee that the EMP of the Project is appropriately implemented and monitored;
- Prepare quarterly, semi-annual, and annual reports during the construction, semiannually during the first year of operation, and annually beginning on the second year of operation, on the compliance and follow-up of the environmental dispositions, as the case may be;
- Provide information to the ANAM (Panama's National Environmental Authority) and other organizations of the Panamanian State whenever they request it; and
- Interact with local communities or third parties which consider themselves affected, whenever it is required, to keep them informed with respect to the Project.

8.2.2.2 Contractors

Each Contractor shall be obligated to comply with the socio-environmental policies of the Project and with all the requirements and specifications of this EMP and EIAs. Also, the Contractor is responsible for guaranteeing socio-environmental compliance by all its Subcontractors and suppliers.

The Socioenvironmental Manager of each Contractor shall:

- Ensure that all technical and human resources are available for compliance with the EMP and its comprised programs.
- Verify that the persons assigned to assist him/her adequately comply with their responsibilities and ensure that necessary training programs are strictly implemented.
- Review and approve weekly reports submitted by each work area assistant.

- Effect, in cases where an emergency occurs, the necessary coordination for implementation of contingency measures.

8.2.2.3 Subcontractors

Each Subcontractor shall be obligated to comply with the environmental policies of the Project and with all the requirements and specifications of this EMP and EIAs.

8.2.2.4 Supply Chain

The suppliers of materials, goods, and services for the Project shall comply with the IFC Social and Environmental Performance Standards, especially regarding work and working conditions, including nonuse neither of forced labor nor child labor.

8.3 Mitigation Plan

This section presents environmental programs that shall be implemented for the purpose of preventing mitigating and compensating the negative environmental impacts identified in Chapter 7, and strengthening the positive impacts.

8.3.1 Organization and Scope

The Mitigation Plan includes actions which have been grouped, by their nature and specific objectives they pursue, into a series of programs which are detailed below:

1. Air Quality, Noise and Vibrations Control Program;
2. Soils Protection Program;
3. Water Resources Protection Program;
4. Flora and Fauna Protection Program;
5. Waste Management Program;
6. Materials Management Program; and
7. Socioeconomic and Cultural Program

Further than minimizing adverse impacts, the Mitigation Plan also seeks to strengthen the positive impacts of the Project.

The Mitigation Plan also incorporates the necessary requirements for compliance with the IFC Social and Environmental Performance Standards.

8.3.2 Air Quality, Noise and Vibrations Control Program

The Air Quality, Noise and Vibrations Control Program was developed based on the valuation of environmental impacts on the air and on other receivers for which air is constituted as a means of transport/transference. The Air Quality, Noise and Vibrations Control Program is directed towards the opportune execution and implementation of the measures considered necessary to prevent and minimize significant negative impacts which the Project's construction and operation could cause on the air and, through it, to other sensitive receivers (persons, animals, infrastructures). This

program includes measures to mitigate possible impacts on air quality, generation of offensive odors, and on noise and vibrations.

As for microclimatic change and potential loss of carbon capture, because both are indirect impacts caused by soil use change and vegetation cover loss, the corresponding mitigation means are part of the Flora and Fauna Protection Program and the Soils Protection Program.

As established in the chapters on assessment of impacts, the Panama Canal Expansion Project – Third Set of Locks shall cause impacts on the air and on other receivers mainly due to the following Project construction activities:

- Establishment of work areas
- Construction of temporary and permanent access roads
- Excavation of access channels
- Cleaning and stripping of vegetation
- Construction of infrastructures
- Blasting
- Installation of facilities or temporary infrastructures
- Construction works
- Operation of vehicles, machinery and equipment
- Management of Material deposit

- Generation of wastes and effluents, solid and domestic, respectively
- Transportation of material and waste
- Removal and relocation of structures and infrastructures.

On a minor scale, the following principal activities shall generate air and other receiver impacts during the operation phase:

- Canal ship transits and operation
- Routine maintenance activities

As a consequence of the activities mentioned, the most significant impacts generated during the construction phase shall be the following:

- Air Quality Alteration
- Noise Level Increment
- Vibration Level Increment

8.3.2.1 Air Quality Control Measures

Construction Phase

During the construction phase of the Project, mitigation measures shall be principally directed towards minimizing particle and dust generation due to work performed on naked soils, either by material and waste transportation, or by contaminant gas generation caused by the use of internal combustion equipment. The measures to be implemented are the following:

1. All motors shall be adequately maintained to maximize combustion efficiency and minimize contaminant emissions, and in accordance with the manufacturers' specifications. The equipment suppliers and Contractors/Subcontractors of the Works shall present proof or equipment maintenance registration.

2. Combustion motors (of the heavy equipment to be used for dry excavations) shall be provided with exhaust systems, and filters (when applicable) that are in good operating condition. It is recommended that the age of the equipment usage not exceed 10 years.

3. During the dry season, wet working areas shall be maintained to minimize dust dispersion;

4. Establish adequate locations for storage, mixing and loading of construction materials, in a way that dust dispersion is prevented because of such operations;

5. Ensure that the loading and unloading of materials is done minimizing ambient dust dispersion;

6. Implement controls to prevent the dispersion of dust when handling materials by way of the use of lineal and simple transport systems that avoid multiple transferences, preferential belt and strap transportation of material in lieu of trucks, or installing dust suppressor or capture systems, among others. In cases that are contrary, another alternative shall be presented subject to the Contractor's approval.

7. Material mixing equipment shall be hermetically sealed;

8. Crushing of rocky and aggregate materials shall be wet-crushed, or performed with particle emission control systems;

9. The concrete batching and mixing plant shall be provided with filtering systems, dust collectors

or humidification or other technique (as applicable) that allow control of particle emissions in all its stages, including unloading, collection, aggregate handling, cement dumping, circulation of trucks and machinery inside the installations;

10. Trucks transporting excavated material in areas outside the Project that could emit dust shall be adequately covered with canvases;
11. Stored materials (gravel, sand) shall be covered and confined to avoid their being wind-drifted;
12. ACP shall regulate the speed limit within the area of the Project;
13. Temporary roads shall be adequately compacted and humidified, or superficially treated and maintained;
14. Combustible storage tanks shall be provided with control systems for volatile organic compound emissions;
15. Wastes shall not be incinerated on site;
16. Compliance with ACP standards and World Bank and IFC guidelines and principal aspects shall be required.
17. A system of oxidizing catalyzers to reduce CO, HC and particle emissions shall be adapted to the filters of diesel vehicles and equipment used for the construction.

Operations Phase

In view of the fact that during the Operation Phase the main sources of emissions into the air are constituted by the regular navigation of ships through the Canal which can only be regulated at international levels through the International Maritime Organization (IMO), mitigation measures are not proposed through these means; however, with respect to other activities related to Canal maintenance and routine tasks, controls similar to those indicated for the construction phase shall

be applied. Mitigation measures include:

1. All motors shall be adequately maintained according to the specifications defined by their manufacturers, to maximize combustion efficiency and minimize the contaminant emissions. Proof or maintenance register shall be required by the equipment suppliers and Contractors / Subcontractors;
2. Combustion motors shall be provided with exhaust systems and filters (when applicable) in good operating conditions;
3. A motor operating schedule shall be established in order to minimize, as much as possible, the operating time of emission sources.

8.3.2.2 Offensive Odors Control Measures

Construction Phase

The most important impacts regarding the perception of odors are associated with the Construction Phase and are principally related to gas emissions which could have some grade of toxicity or combustion, generated starting with the blasting activities, the operation of heavy equipment, as well as the generation of solid and liquid wastes.

To prevent or minimize impacts of odor perception increments during construction, the following measures shall be applied:

1. Establish a vehicle fleet preventive maintenance program, duly documented, and require the same from Subcontractors;

2. All motors shall be adequately maintained to maximize combustion efficiency, and minimize contaminant gas emissions that could generate offensive odors;

3. Apply measures contemplated in the Waste Management Program, specifically those measures directed towards ensuring compliance with regulations regarding waste management and its adequate disposal.

Operations Phase

Regarding the stage of the operation, the principal potential impact relative to the increment in odor perception would be related to the generation of odors produced by combustion gases during the operation of heavy equipment for dredging work, among others. During the operation stage, the following are proposed measures, the majority of which have been established as mitigation measures during the construction phase.

1. Establish a preventive maintenance program of the equipment utilized in maintenance work, duly documented, and require the same from the Contractors and Subcontractors;

2. All motors shall be adequately maintained to maximize combustion efficiency and minimize contaminant gas emissions;

3. Minimize, to the extent possible, the operating time of gas emission sources; and

4. Apply the measures contemplated in the Waste Management Program, specifically those measures directed towards ensuring compliance with regulations regarding waste management and its adequate disposal.

8.3.2.3 Noise Control Measures

Construction Phase

Construction activities on the Project construction site shall result in an increment, of a temporary nature, in the levels of environmental noise. This increment shall be principally experienced by the workers and personnel involved with Project activities in the proximity of the emitting sources. The magnitude of the noise shall depend on such factors as the specific construction being performed, the level of noise emitted by different construction equipment, the duration of the construction phase, and the distance between the noise source and the receivers.

Beginning with the analysis performed in the impact assessment chapter, as well as the receivers closest to the work sites (principally Project workers and personnel), the following areas have been identified as critical concerning noise matters[1]:

- Area 2 – Gatun Locks – Receivers in José Dominador Bazán.
- Area 3 – Gatun Lake – Receivers in Gamboa.
- Area 5 – Pacific Locks – Receivers in Paraíso and Pedro Miguel.
- Area 6 – Pacific Entrance – Diablo and La Boca.

1 It is considered necessary, as the different Contractors are selected for the Project and precise information is available about the equipment to be utilized, that simulations performed be checked to confirm or discard these or other noise sites which could be critical.

The following measures are considered necessary for reducing noise during Project construction, for the purpose of minimizing noise generation and, to the extent possible, prevent and avoid its potential impacts:

1. Assess, as the work fronts are located, the noise emission conditions, and critical sites, to define the need to establish additional control measures[2];
2. Maintain all rolling and construction equipment in good conditions and with adequate noise silencers; equipment suppliers and works Contractors shall present proof or maintenance register of their equipment;
3. Minimize, to the extent possible, the length of operation of noise emitting sources and avoid having idle equipment in operation;
4. Organize the loading and unloading of trucks, and handling operations for the purpose of minimizing construction noise on the work site;
5. Comply with the requirements and standards of the competent authorities with relation to the use of explosives;
6. Comply with the requirements, according the type of explosive utilized, concerning the distance of structures and populated centers, defined by their manufacturer and by the competent authorities;
7. Due to existing Canal operations, blasting operations shall be limited to a daily schedule between 0600 and 1800 hours;
8. The Contractor shall comply with all Government standards, regulations and ordinances related to noise level controls applicable to any contract-related work;

2 According to the results obtained from this task there could be required that an acoustic barriers be established in the noise critical sites.

9. On job sites that are near homes, work generating noise greater than 80 dB shall not be executed in the surroundings between eight o'clock at night (8:00 p.m.) and six o'clock in the morning (6:00 a.m.);

10. Communicate and coordinate opportunely with sensitive receivers of required construction work that will produce high noise levels and could affect them;

11. Maintain the communities that are near to the Project development sites informed about the programming of construction work and activities of major noise generation;

12. Avoid the unnecessary use of alarms, horns and sirens; and

13. Stationary equipment producing noise shall be located away from sensible receivers. In required cases where noises greater than 80 dB at more than 400 m are present, acoustic covers (fixed and/or mobile barriers) shall be utilized.

Operations Phase

In the case of the Operation Phase, noise sources shall be the routine Canal operation and maintenance activities. By the nature of these activities, and considering that they would be very similar to current baseline conditions, the mitigation measures to be applied would be limited to the following:

1. Maintain all equipment utilized for maintenance tasks in good condition and with adequate silencing systems. Maintenance registers shall be maintained, and the same shall be required by Subcontractors;

2. Minimize, as much as possible, the operating time length of the noise emitting sources, and avoid having idle equipment in operation;

3. Avoid the unnecessary use of alarms, horns and sirens.

8.3.2.4 Vibrations Control Measures

Construction Phase

The generation of vibrations during the construction stage could occur due to the explosives used for terrestrial and sub-aquatic blasting, as well as to heavy equipment or vehicle movement over or towards the construction areas and the operating properties of some equipment, principally that utilized for existing structures removal; such as docks, housing, meteorological stations, lighthouses, buildings, etc.

These vibrations could affect either the neighboring site structures or the personnel operating the vibration-producing equipment and/or machines. As relates to working machines and tools, these are designed to minimize vibrations transmitted to personnel utilizing them, and with specific indications as to required personal protective gear and/or the limitations regarding their use that must be followed.

The following measures shall be adopted and implemented during the construction and operation of the Project when performing blasts:

1. Limit the vibration velocity to that established in the contract documents (specification) for the purpose of protecting structures that could be potentially affected.
2. The Contractor shall provide within his/her task group with a qualified blasting consultant to

prepare and present for approval a blasting plan and to lead the blasting work, including initial blasting test supervision, with the objective of establishing baseline effects and conditions.

3. Restrict the blasting times (intervals), limit instant maximum loads, and provide adequate tamping material to guarantee exact drilling of blasting holes, plan delivery from and towards the site to minimize undesired and out-of-control effects.
4. Monitor vibrations in critical (sensitive) sites during the construction period.
5. Conduct structural integrity inspections prior to blasts on critical (sensitive) structures (for example: monitor the width and length of cracks and friezes).
6. Inform the public living and working in the vicinity about the possible effects, control and quality measures, precautions to be taken, and communication channels available to the general public.
7. Notify the affected public when blasting works are to be performed.
8. Observe limits in blasting schedules that exclude weekends, and are after 6:00 p.m. and before 6:00 a.m. during weekdays, unless a special permit is obtained.
9. Appropriate quality control measures of blasts in order to ensure an adequate control process.
10. Apply the Blasting Plan to be developed and implemented by the Contractor, and which shall be subject to ACP approval;
11. Comply with requirements and regulations of competent authorities regarding the use of explosives.
12. Comply with the requirements, according to the type of explosive utilized, as related to the distance of the structures and populated centers defined by their manufacturers and by competent authorities;
13. Comply with the requirements provided by the manufacturer for the handling of explosives and detonators.

The Blasting Plan which shall be developed and implemented by the Contractor, subject to ACP approval, shall include at least the following details and specifications:

- Description of all operations and blasts, including localization
- The qualifications of blast Contractors, size (weight), and limits of the blast loads
- Number of blasts
- Hours of operations of the blasts
- Estimated quantity of rock to be fragmented
- Alert measures
- Measures for ensuring mobilization and safe storage of explosives
- Use of blast covers
- A plan to videotape conditions prior to the blasts
- Inspection and improvement of neighboring buildings
- Coordination with local safety officials
- An assessment of the potential impacts of blasts on existing superficial and underground structure conditions as, for example, piping
- The identification and assessment of reasonable mitigation measures with respect to blasting impacts, including the use of alternative technologies, and
- A Plan to ensure compensation for damages that could occur as a consequence of the blasts.

As an example, in Appendix 6[3] there is a drilling and blasting plan.

3 EIS Category II – Pacific Entrance Widening and Deepening, PB Consult, March 2007

Operations Phase

For this phase there are no blasting activities programmed, consequently there is no requirement to present prevention and/or mitigation measures.

8.3.3 Soil Protection Program

The Soil Protection Program objective is directed towards timely execution and implementation of the measures considered necessary to prevent and minimize significant negative impacts which could be caused by the construction and operation of the Project to the soils and, indirectly, to the quality of the water through sediment generation, principally during the rainy season.

The Project activities during the Construction Phase which cause direct and indirect impacts to the soil include:

- Cleanup, stripping and leveling of construction areas;
- Construction of docks;
- Construction of Borinquen Dike;
- Excavation of locks trail and water reuse basins;
- Excavation of channel approaches to locks;
- Installation of crushing and concrete batching and mixing plants;
- Construction of permanent highways and roads for heavy equipment;

- Installation of sewage plants;
- Fill works;
- Construction of deposit areas and beaches for heavy equipment;
- Construction of offices and dressing rooms;
- Stabilization of adjacent land;
- Deepening of Gaillard Cut navigational channels; and
- Excavated and dredged material deposit in designated sites.

During the operation phase, impact-generating activities are related to the maintenance of the navigational channels and locks, management of dredged and excavated material deposit sites, and the Canal operation itself (transiting of ships). Being that a fraction of eroded soil ends up as sediment load in natural currents, the Soils Protection Program will indirectly mitigate sedimentation.

The impacts identified for which specific measures shall be developed in the sections that follow are:

- Undermining / Sinking
- Increase in Landslide Risks
- Increase in Soils Erosion
- Increase in Sedimentation
- Soil Compaction

- Soils Contamination
- Diminution of Soil Usage Aptitude

8.3.3.1 Undermining / Sinking Control Measures

Undermining / sinking phenomena incidents are associated with potential modifications to the local geological and/or hydrogeological characteristics of the area due to excavation and fill formation activities. In the first case, they may influence the hydrogeological conditions and relief the stress on soil and rocky massif; and, in the second, they entail the introduction of external stress (as a result of the fill).

Those changes to the local geology in certain sectors of the Project, principally those in which excavations and fills cross or are near a fault zone, may cause landslides and/or settlement, both in the construction phase, as well as in the operation stage. However, it has been noted in the impact assessment chapter that the importance of probable undermining and/or sinking impacts is very low.

In fact, during execution of excavation and fill works, an important additional activity consists precisely of controlling deformations and formations of bank sloping from excavations and fills through monitoring of deformations and slope movements (see Landslide Monitoring Program), and in such manner prevent the occurrence of the undermining and sinking, or settlement phenomena through application of appropriate excavation and fill formation techniques, as well as of geotechnical measures such as compaction, drainage control, cut and fill slope stabilizations, etc.

Based on the above, aside from the monitoring as a part of landslide monitoring, it is not considered necessary to establish additional specific environmental measures. Other applicable environmental measures are included in the following sections.

8.3.3.2 Landslide Control Measures

As mentioned in the chapter on the identification of impacts to the physical environment, the Panama Canal Authority established that a correlation exists between the construction and maintenance processes (channel widening and deepening), and the landslides activity. The potential increment in the occurrence and magnitude of landslides has been duly recognized and documented by ACP since widening works in Gaillard Cut were initiated in 1999.

Having documented the evident risk that landslides represent to Canal operations, the Panama Canal Expansion Project – Third Set of Locks, includes the execution of slope stabilization works as an important component in the construction management plan, and, subsequently, during its maintenance. For over twenty years, the ACP Geotechnical Section of the Engineering Division has had in operation a Landslide Control Program, and has realized studies and estimates of the civil works required to mitigate the potential impact of the Gaillard Cut channel deepening (ACP, 2002). The works required are duly incorporated into the project design of the Panama Canal Expansion Project – Third Set of Locks, as well as the corresponding costs.

Within this context, it is a top priority to establish a Mitigation and Monitoring Program for landslides that will allow for the execution of the Panama Canal Expansion Project – Third Set of Locks, without significant impacts during its construction and operation. The proposed Program utilizes, as one of its principal factors of production, the Landslides or Sinking Control Plan which the Geotechnical Section of the ACP has been applying. Such plan has been focused on the most

vulnerable landslide areas, the Gaillard Cut Section.

The objective of the Landslides or Sinking Control Plan is directed towards the opportune execution and implementation of measures considered to be necessary to prevent and minimize landslides.

The proposal contemplates a detailed and long-range plan which incorporates the ACP Landslides Control Plan into the permanent Panama Canal Operating System, and that, in addition to Gaillard Cut, it be applied to the new navigational channels of the Panama Canal Expansion Project – Third Set of Locks.

The proposed program contemplates the execution of actions tending to minimize the impacts and allows the provision of a quick response plan to risks and emergencies due to landslides. This protocol shall contemplate the definition of prevention and response mechanisms to accidents and contingencies that may arise during the execution and operation of the Panama Canal Expansion Project – Third Set of Locks. The risks contemplated are associated with the reoccurrence of landslides over all the Sector of Cucaracha. The Mitigation and Landslides Program contemplates two categories of actions, depending on the classification as to their vulnerability to landslides.

Construction Phase

In all the areas of excavation, widening and deepening of the navigational channels:

1. Controlled utilization of blasts so that the stability of slopes is not affected. (Approved by the Geotechnical Section of the ACP.)

2. Slope terraceous intercepting the superficial flow of currents to prevent water erosion and instability, mainly in areas where the geological material corresponds to the “La Boca” Formation.

3. Registers and incorporation into the spatial analysis of vulnerability to landslides, of rainfall amount and intensity, and its correlation with the landslide monitoring data.

4. Determination of antecedent precipitation accumulated in 7 days, 14 days or monthly, in relation to a severe climatic system forecast with the potential of triggering landslides.

5. Slope designs according to geological zoning and vulnerability to landslides, maintaining the established Safety Factor limit of 1.00 or its equivalent.

In sites prone to landslides during deepening of navigational channel, as the Gaillard Cut Section:

6. Establish slopes with historical landslide recurrences reducing the landslide-conductive forces by excavating the slope head, before dredging the slope toe under water.

7. Reduce loads without increasing slope infiltrations and, if necessary, waterproof the surface to reduce the infiltration of water in the slope after the excavation. According to the ACP Geotechnical Section (2002), it was estimated that "for each meter required to be excavated deeper than 34 feet PLD, the excavation of an additional 4 to 5 million cubic meters will be required in the existing slopes".

8. Diminution in the descending grade of design of the most unstable slopes, utilizing a slope ratio that guarantees its stability.

9. Systematic installation of horizontal or inclined drainage in unstable slopes at spacing located according to the hydrogeological conditions of each site, to the depths of the faults, once they have been identified.

Operations Phase

The mitigation measures during the operation phase are directed towards preventing landslide situations caused by works and projects realized during the construction, or by routine maintenance operations related to the use of blasts. These mitigation measures are complemented with a landslide monitoring program. The mitigation measures for the operation are as follows:

1. Give adequate maintenance to slopes and drains formed during the construction stage in sites prone to landslides.

8.3.3.3 Soil Erosion and Sedimentation Control Measures

Construction Phase

Project activity can negatively impact the soil producing losses caused by hydric erosion, principally during the rainy season. The increment in the levels of erosion shall be of greater magnitude in earthwork sites having greater slopes, mainly located in the areas of the Pacific Locks, Gaillard Cut and Gatun Locks. It is considered that after the first three years the hydric process shall have been controlled because the construction of installations and access roads by the Contractor have been concluded and all superficial soil removed from the areas of excavation.

However, to minimize the potential impacts and magnitude of loss caused by erosion in these sites during the construction phase, it is recommended that the following soil conservation and slope stabilization measures be implemented:

Soil Conservation

1. Perform the major earthworks operations to the extent possible during the dry season, prioritizing the initiation of these operations by sectors having major sloping, as are the Gaillard Cut Sector and the Pacific Locks.

2. During the rainy season, protect exposed soil surfaces with stabilizing material, such as screen, straw, and planting the areas subject to erosion as promptly as possible with fast-growing and high-density root grasses adapted to the soil and subsoil conditions that prevail in each site.

3. When required, utilize water flow retention structures, such as riprap and stone paving, at the drainage structure inlets and outlets;

4. Place sediment traps inside the excavation sites which allow the accumulation of the eroded soil.

Slope Stabilization

These measures shall be applied throughout the Panama Canal Expansion Project – Third Set of Locks, where major cuts of consolidated material and removal are performed, specifically in the new approach channels.

1. Slopes with cuts of up to 5 m in height shall be terraced maintaining slope inclination at 1:3 to 3:1.

2. Stabilize the exposed side of slopes utilizing stabilizing materials, such as biodegradable mats, or establish fast-growing and high-density root grasses adapted to the exposed soil

and subsoil edaphics.

3. Install underground drainage inside saturated slopes and reduce surface infiltration utilizing longitudinal sub-drainages at slope toes to avoid saturation of the soil profile.

4. Stabilization of sites prone to slope wash, sinking, landslides and other massive movements in cuts for access roads to new construction sites.

5. Stabilize cuts for new access roads in the construction areas of the Project with appropriate retention structures in critical points which require it, such as concrete walls, gabions, among others.

Operations Phase

The measures to be applied during the operation phase tending to prevent erosive processes correspond, in great part, to the maintenance of structures established during the construction phase. These measures include the following:

1. Provide maintenance to drainage, ditches and other infrastructures established during the construction stage.

2. Provide maintenance to areas where the vegetation cover has been restored so that it is conserved.

8.3.3.4 Soil Compaction Control Measures

Construction Phase

Several activities can directly or indirectly cause soil compaction during the construction. Soil compaction is produced in direct manner when utilizing earth moving equipment and each time equipment or machinery is moved along the equipment and machinery transit routes utilized during the construction of the Project. The soil is also compacted when excavated or dredged materials are deposited on the spoil sites.

To minimize impacts of the compaction of the soils during the construction stage of the Project, the following mitigation measures shall be applied:

1. Perform the major number of earth moving during the dry season, as once the rainy season starts, the compaction of the soil is greater;
2. Scarify topsoil in sites that lack vegetation to facilitate the natural vegetation growth and regeneration, and
3. Control the slope surface of the deposits to facilitate water drainage.

Operations Phase

For this stage mitigation measures are not recommended because the majority of the soil compaction effects shall occur during the construction phase.

8.3.3.5 Soil Contamination Control Measures

Construction Phase

According to the impacts assessment, the risk of soils contamination occurring in the direct impact area of the Project is mainly determined by the following factors:

- Increase in the probability of accidental oil spills, lubricants, greases and other chemicals associated to the operation and transport of machinery and equipment in the construction areas;
- Utilization of terrestrial blasting for construction in basaltic-type igneous rocks and quarrying, which may generate substances with some grade of toxicity.

In general, it is estimated that the potential impact shall be of very low significance. However, it is considered pertinent to establish the following measures to prevent and minimize any potential soils contamination:

1. Control and Maintenance of Project Construction Machinery and Equipment.

   All rolling equipment, including tractors, tanks, earth moving equipment and vehicles for the maintenance and transportation of fuel and personnel shall be controlled by way of a detailed register that guarantees compliance with the specifications established by the manufacturers regarding the type and frequency of maintenance for each equipment that guarantees the operating efficiency of the motors. Additionally, greasing, supplying, and transferring of fuels and lubricants in the field shall be performed by trained personnel and shall only be done over surfaces especially enabled and watertight that allow for containment and collection of accidental spills. Contractors shall enable these areas and their design shall be approved by ACP. Collect and recycle lubricants and greases during and after maintenance action on rolling equipment. When the works are concluded, these installations shall be remedied, in case they contain hydrocarbon residues or other contaminant elements.

2. Training of Specialized Personnel in Fuel Handling and Machinery and Equipment Maintenance.

   Mechanic and operator personnel involved in transporting materials and fuel shall have specific training and updated knowledge on matters related to the risks associated with spills and accidents in transporting and dispensing hydrocarbon and other contaminant substances. Training programs shall include modules on the adequate sensitization, utilization and maintenance of equipment, dispensers and containers for storage and transportation, as well as for handling and prevention of contingencies.

3. Control of Dumpsites and Temporary Installations

   The adequate collection and deposit of wastes from temporary installations, equipment yards, asphalt or concrete batching and mixing plants, in a manner that will not allow the burning or scattering of waste in these areas. In case an accidental spill occurs on the soil, depending on its magnitude, the affected soil shall immediately be removed and deposited in tanks for its subsequent processing as contaminant materials. If justified by the magnitude of the spill or dump, the Contingency Plan shall be activated.

4. Blasting Control

   If blasting utilization is necessary, they shall be executed with adequate control, place special canvases over the rocks before the blasts and dispose of the wastes generated in authorized dump sites.

Operations Phase

The risk of soil contamination for the operation phase can be minimized through correct management of materials and wastes to be utilized in routine maintenance operations. For this, the guidelines defined in the Materials and Waste Management Program of this EMP shall be followed.

8.3.3.6 Diminution of Soil Usage Capability Control Measures

Construction Phase

The diminution of the soil usage capability for the Panama Canal Expansion Project – Third Set of Locks, is associated to the interrelationship of the diverse construction activities that affect the properties of soil, such as erosion, compaction, contamination, and water storage ability.

Within this context, control measures for this impact are contemplated as part of the mitigation measures of the other soil impacts detailed above, and in the Flora and Fauna Protection Program.

Operations Phase

In the operation phase of the Project impacts to soil usage capability are not anticipated.

8.3.4 Water Resources Protection Program

Hydric resources refer to superficial and underground water which could be affected by the activities during the construction and operation phases of the third set of locks.

The Hydric Resources Protection Program was developed using as the base the assessment of environmental impacts to the waters. The objective of the Hydric Resources Protection Program is directed towards the opportune execution and implementation of measures considered necessary to prevent and minimize the significant negative impacts which the construction and operation of the Project could cause to the waters.

The activities to be carried out during the construction of the Project have been described in the Project Description chapter; however, the most important for its potentiality of affecting hydric resources shall be the following:

Dredging

- Deposit of dredged material in water (marina, estuarine y lacustrine)
- Disposal of dredged material on land

Excavation

- Deposit of excavated material in water (estuarine and lacustrine)
- Deposit of excavated material on land
- Diversions of the Grande (South branch) and Cocoli Rivers
- Hydraulic works construction, as well as field offices, workshops, exploitation of loan banks, and the operation of aggregate and concrete crushing plants.

The majority of these activities, except for the diversions of the Grande (South branch) and Cocoli Rivers and the construction of hydraulic works, shall also be carried out during the operation of the third set of locks, but on a minor scale. All of them are potentially impact-generating activities related to the maintenance of channels and locks, and to the management of dredged and excavated material deposit sites. The mitigation measures developed for such activities during the construction stage shall also apply during the operation stage. In the operation stage, the potential impacts derived from the Canal operation itself (lockage operations and ship transits) and the increment in the operating level of Gatun Lake shall be of greater concern.

The impacts identified for which specific measures are developed for the construction and operation stages in the following sections, are as follows:

- Water Quality Deterioration
- Alteration of the Water Flow Regime
- Alteration of the Drainage Pattern

8.3.4.1 Water Quality Deterioration Control Measures

Construction Phase

According to the considerations realized in the chapter on the assessment of impacts, the quality of superficial water shall be affected during the construction phase by the eight activities listed above. The impacts of the activities during the construction stage of the third set of locks shall be on the quality, characterized by suspended solids (turbidity).

The following describes the measures to prevent and control quality impairment caused by the increase in turbidity.

Measures to Reduce Turbidity during Water Dredging:

Turbidity feathers generated by dredging activity can have an important negative effect in the marine and lacustrine ecosystem. As indicated in the chapter on impacts, the magnitude of the dredging effect shall depend on the type of dredge to be utilized, which shall depend on the type of material to be removed. In general, in the process of dredging, rocks or hard or semi-hard materials generate fewer solids in suspension than in mud. However, rock extractions it is necessary to perforate and detonate in order to fragment it.

In Table 8-1 there is described the measures that shall be followed by the operators of hopper and suction, cutter and suction, and deep-suction dredges, for the purpose of reducing the concentration of suspension solids. One measure shall be the optimization of the velocity of suction

and cut of the dredges. The rest of the measures are described in Table 8-1. The implementation of these measures depends on a good water quality monitoring system that allows for the correction of unacceptable conditions *in situ*.

Another measure that shall be implemented in critical sites, as well as in areas near water intakes during deep dredge operation is the utilization of curtains or screens for the containment of suspended solids, which will allow water passage, but not of these. The curtain is suspended from the water surface to the sea bed.

TABLE 8-1

DREDGE MITIGATION MEASURES

Type of dredge	Mitigation Measure
Hopper-suction dredger	1. Optimize velocity, suction mouth, and deposit pumping. 2. Limit spillovers and/or chute load 3. Reduce water intake 4. Utilize a return flow 5. Reduce air content in spillover mix
Cutter-suction dredger	6. Optimize velocity of suction cut, balancing and discharge 7. Protect cutting or suction head 8. Optimize the cutting head design
Deep dredger	9. Utilize a visor over the bucket 10. Utilize a screen or curtain

Source: Table 10-1, EIS Category II – Pacific Entrance Widening and Deepening, PB Consult, March 2007

Measures for Reducing the Turbidity during Dredged Material Deposit in Water:

A way to minimize turbidity during the process of depositing the dredged material in water is to obtain a density flow (jet) so that the mix of sediments and very turbid water passes very quickly through the water pillar to the bottom (benthic bed). This type of flow is obtained because the water jet and sediments have a greater density than the water that surrounds it. The water jet can transport a large percentage of sediments to the bed without mixing with the body of water, and thus minimize the generation of turbidity. Figure 8-1 shows the difference in the turbidity generated by the dredged material deposit through the sedimentation of individual particles (A) and in the jet (B). The B discharge produces a feather is much smaller and of much shorter life than the A discharge, from a tube located above the water[4]. Figure 8-1 also shows the location and the effect of the curtain, which, as indicated before, prevents the suspended solids from being transferred beyond it.

The use of a chute with bottom doors assures the jet formation at the moment of deposition. With a cutter-suction dredger, elbowed piping may be used which places the submerged discharge opening in the water, and favors the jet persistence. The piping can also discharge within the chute to reconstruct the deposit and regularly open the chute doors to send the sediments to the bottom in a series of jets. Figure 8-2 shows the boom simulation when the dredged material is discharged.

PB Consult (2007) analyzed the effect of depositing dredged material in three Pacific Ocean sites (Palo Seco, Tortolita and Tortolita Sur). These sites have previously been utilized and it is planned

[4] A discharge from a tube above water generates much turbulence and traps a lot of air, which destroys the integrity of the jet and initiates a sedimentation process of individual particles. The sedimentation velocity of clay and loom is very slow (~0.1mm s^{-1}) which causes the feather to keep for a long time, and, finally it clears up by a combination of sedimentation and dilution processes.

to also use them for depositing part of the dredged materials of the Project. As indicated before, the turbidity effect depends on the type of dredge and the material deposited.

The Palo Seco deposit site is the one with the greatest potential of negatively affecting the aquatic environment (see the chapter on Impacts). If this site is used with a cutter-suction dredger, the technology illustrated in Figures 8-1 and 8-2 shall be required, in order to reduce the concentrations of suspended solids in the water column (PB Consult, 2007). It is also possible that the shallowness of the water of the site limits the efficiency of the recommended measures, for which the use of sediment control curtains would be an effective option (PB Consult, 2007). Another alternative for the disposal of dredged material would be to provide an anchorage dock in the coast, with piping over the Canal bed towards the land deposit site in Farfán (PB Consult, 2007).

The dredged material deposit in the Tortolita and Tortolita Sur sites shall probably be through hoppers. In these cases, the density of the deposited sediment shall create a column towards the bottom with comparatively little negative effect on the quality of the water surrounding it (PB Consult, 2007). If the discharge of dredged material through piping is considered, it will be necessary to include measures to reduce the turbidity effects on the water column. Also, the final covering with rocky material at the Tortolita and Tortolita Sur sites, shall have the advantage of restraining the erosion and displacement of deposited sediment by the action of waves. The rocky deposit mounds in Tortolita Sur could remain mud-free at the conclusion of the Project, due to the action of waves and the stable currents. If so, it could be colonized as an artificial rocky reef which could increase the productivity and biodiversity of the local fish epifauna (PB Consult, 2007).

The measures indicated by PB Consult (2007) to reduce the effect of dredging and dredged material spoils on the turbidity of water in the Pacific Ocean (Zone 6 of the Environmental Study), may be extrapolated to the site in the Atlantic Ocean (West Breakwater, Zone 1 of the Environmental Study). Likewise, for Zone 3 of the Environmental Study (Gatun Lake) the same measures would be

applied, and in the case of the Lake, because there is no influence of strong currents and there is a less intense wave action than in the sea, the dredging and its spoils effects shall be lesser. In the rest of the zones of the Environmental Studies (2, 4 and 5), material shall not be deposited in the water. The effectiveness of these measures shall be controlled through a good water quality monitoring system that allows for correction of unacceptable conditions *in situ*.

The measures previously indicated are summarized as follows:

- Discharge design which supports the density flow at piping exit;
- Employ sediment control curtains in sensitive areas; and
- Final covering on deposit sites with rocky material when sites reach their maximum capacity.

In addition to those mentioned above, the following general measures shall be applied:

1. To the extent possible, prioritize thick dredged material deposits (gravel and rock fragments) in aquatic deposits, and fine material deposits which can be transported and discharged through piping in land deposits.
2. Permanent coordination of dredging and deposit activities, to prevent the discharge of fine dredged materials during the occurrence of adverse meteorological conditions and water currents.

Measures to Reduce Turbidity During the Deposit of Dredged Materials on Land:

During the discharge operations of the cutter-suction dredger on land spoil sites, the runoff water will have high sediment content. Spoil sites consist of areas surrounded by dikes of certain

altitudes, formed with the dredged or excavated material itself. That is, so that the sediment discharge in bodies of superficial and groundwater or to the Canal can be reduced, sediment control weirs shall be constructed on each site. Such weirs shall be kept clean and free from obstructions, requiring periodic maintenance.

Monitoring of the concentration of suspended solids in water shall be performed, in order to verify that the containment of sediments used has the expected effectiveness.

In addition, spoil sites shall be filled to a level that is inferior to the dike top or perimetric retaining wall, so that the pressure will not affect the stability of such walls.

An effective manner of containing sediment transport outside the spoil site is to construct transverse intermediate walls that shall act as intermediate weirs and sediment barriers (PB Consult 2007). The construction of several walls in each spoil site shall reduce the discharge amount and velocity of sediments downstream. Figure 8-3 illustrates possible locations for such sediment control walls.

The measures to be implemented for sediment control in land spoil sites are summarized as follows.

- Use of sediment control weirs;
- Filling of spoil sites controlling the secure level corresponding to the perimetric containment;
- Use of sedimentation ditches; and
- Use of transverse intermediate walls.

Measures to Control the Effects of Excavations on the Quality of Water

It has been estimated that earth moving for the construction of new access channels to the locks shall be 83 million m^3. In the excavation process, principally during intense rainfall, if control measures (barriers, filter screens, slopes stabilization, among others) are not used, runoffs would transport solids towards the Canal deteriorating the quality of its waters, as well as contributing to its silting up. Furthermore, vehicles and machinery utilized could cause fuel and lubricant spills that would indirectly affect the quality of the water.

To minimize impacts of the deterioration of waters during excavation activities, the following mitigation measures shall be applied:

1. **Control and Maintenance of Project Machinery and Construction Equipment:** All equipment, including boats, dredges, tractors, tanks, earth-moving equipment, such as maintenance vehicles and vehicles for transporting fuel and personnel, shall be controlled through a detailed register that ensures compliance with specifications established by the manufacturers as to the type and frequency of maintenance of each equipment that will guarantee engine operation efficiency. This will allow minimization of ambient contaminant emissions; hence, the impact on the quality of the waters should be significantly reduced. In addition, greasing, supply, and transfer of fuels and lubricants in the field shall be performed by trained personnel, and shall only be executed over surfaces enabled for such purposes, with watertight surfaces and which allow retention and collection of any spilled substance. Collect and recycle lubricants and greases during and after equipment maintenance actions.
2. **Training of Specialized Personnel in the Handling of Fuels and Maintenance of**

Machinery and Equipment: Mechanic and operator personnel involved in the transportation of materials and fuels shall have received specific training and updated knowledge on issues related to risks associated with spills and accidents during the transportation and dispensing of hydrocarbons and other hazardous substances. Training programs shall include modules on awareness heightening, adequate equipment utilization and maintenance, dispensers and storage and transportation containers, as well as on the management and prevention of contingencies.

Measures to Prevent the Deterioration of the Water Quality During the Deposit of Excavated Material on Land:

Excavated material shall only be deposited in authorized dumping sites. Consequently, the material excavated for the Canal and construction of water reuse basins in both the Pacific and the Atlantic, as well as surplus roads to be constructed, or existing ones to be improved, shall be adequately formed in the dumping sites described in the Project Description.

Surplus material formation from excavation and general earth moving in dumping sites, are common works performed in the Canal, which consist of the spreading out of the material dropped off by trucks in the dumping sites previously identified, and compacting it in such manner that solids are not dragged during intense precipitation events. The material compacted shall form platforms at previously established elevations. Additionally, temporary and permanent drainages shall be constructed to adequately carry rainwater to previously established sites containing sedimentation traps. The purpose of these temporary works is to minimize the transportation of solids in runoffs to receiver bodies of water, including the Canal.

Mitigation measures are summarized as follows:

1. Compaction of the material;

2. Installation of temporary and permanent drainage; and

3. Use of sedimentation traps.

Measures to Prevent the Deterioration of the Water Quality caused by the Diversions of the Grande (South branch) and Cocoli Rivers:

The majority of the measures indicated below are of a preventive nature to be implemented during the design stage of the diversion channels. As the length of the new channel increases, the sloping decreases, and the possibility of sedimentation of solid particles shall increase. In that sense, the channel sloping shall be sufficient to minimize the silting of solids, as, on the one hand, the extension of the flood plain would increase, and, on the other, faced with extreme hydrological events, the force of the water would drag those solids, deteriorating the quality of the receiver body of water, which would be Gaillard Cut for the Grande River (South branch), and the Pacific Entrance to the Canal, in the case of Cocoli River, and, eventually these would contribute to its silt-up.

The new channels shall be able to resist maximum water velocities so that they won't collapse, as their sinking would occur, and drag of solids towards the Canal, which would contribute to its silting, as well as to the deterioration of its waters.

Measures to Prevent the Deterioration of the Water Quality caused by the Construction, Operation and Closing of Field Installations:

In the chapter on impacts it was indicated that, included among the activities on Contractor sites, were activities such as the operation of crushing and concrete batching and mixing plants. These activities are similar to those performed in the rehabilitation and improvement of roads, although

in the Panama Canal Expansion Project – Third Set of Locks, the magnitude and duration of the works shall be greater.

The measures to prevent, control and mitigate the deterioration of the water quality caused by the operation of these installations shall include:

1. The adequate management of waste water, including sewage and grey water generated in the field installations and work fronts;
2. The prevention of hydrocarbon spills and their treatment (oil/water separator if applicable) in workshops, and in any other area where equipment maintenance and machine construction works are performed;
3. Construction of sedimentation traps on aggregate exploitation sites and rehabilitation of those sites;
4. Retention of fine sediments generated during crushing through sedimentation and wash water clarification basins, if applicable;
5. Retention and sedimentation of effluents generated when cleaning the concrete plants.

Before initiating the construction works, the Contractor shall submit for ACP consideration the specific design of the indicated treatments to minimize the deterioration of the quality of water.

Operations Phase

The Project activities generators of impacts on the quality of water during the operation stage shall be almost the same as during the construction stage, but of a lesser magnitude, because they are maintenance activities, and the volumes to be dredged or excavated will be much smaller. Also, they shall be activities that have been carried out since the Canal has been in operation. Additionally, when the third set of locks initiates operation, the fluctuation range level of Gatun Lake shall increase. Among the principal activities potentially generators of impacts during the operation are:

- maintenance dredging;
- excavation (landslide prevention and slope maintenance);
- dredged spoil deposit in water (marina and lacustrine);
- dredged spoil deposit on land;
- excavated spoil deposit in water (marina y lacustrine);
- excavated spoil deposit on land;
- fluctuation in the level of Gatun Lake; and
- Canal Operation – that will involve lockage, ship transit, and dock activities.

Of the above-listed activities, the first six are similar, but of lesser magnitude than those to be performed during the construction phase for which the corresponding mitigation measures were already discussed. That is why the following describes only the measures to minimize and control potential impacts on the quality of water due to the change of the fluctuation range in the Gatun Lake water level, and to the operation of the third set of locks.

Measures to Reduce the Deterioration of the Water Quality caused by the Fluctuation in the

Level of Gatun Lake

The land strip surrounding the Gatun Lake perimeter that will be affected by the new water level fluctuation range can contribute to the provision of solids resulting from small soil slips caused by their saturation while sloping is stabilized. Although the Lake's water level changes will not be abrupt, that the bank sloping is minimal, and that, to date, extreme water abundance and shortage events have occurred (0.2 m over the maximum level of 26.67 m, and 0.25 m below the minimum level of 85), these could contribute with solids in the water. In this sense, the measures proposed shall be of a preventive and corrective nature.

The preventive measure proposed is to realize Lake Shoreline monitoring, for the purpose of identifying critical sites of possible solid contributions, and, according to the soil and subsoil characteristics, propose corrective measures for its stabilization.

Measures to Reduce the Deterioration of the Water Quality caused by the Operation of the Third Set of Locks

The quality of the water could be affected by the typical activities occurring in ports and navigational channels. Canal ship transiting and related activities have been carried out for a long time. Moreover, with the new set of locks, the number of ships will not increase significantly, as what will happen is that the new (Post Panamax) vessels shall have the capacity to transport more than twice the cargo transported by current vessels (Panamax).

The transit of ships involves the risk of possible hydrocarbon waste spills which could be dragged to the Canal by the processes of precipitation and runoff, as well as bottom sediment resuspension

in the navigational channel. Also, if waste waters are not adequately treated, they would affect the quality of the receiver body of water, in this case, the Canal. The risks described above are potential as, to date, rain and waste waters have been adequately managed by the ACP, as well as oil spills controlled and prevented during Canal transits, and will continue to be done in the future. Consequently, a specific mitigation measure is not proposed for it, and the recommendation in this regard is to continue with the current plan of spills, waste and rain water treatments, and adapting such plan taking into consideration the new types of vessels and locks.

Other relative aspects of the Gatun Lake water quality during the operation phase are related with the possible intromission of chloride ions in the water.

The various studies realized by ACP on the potential increment in the content of chlorides in Gatun Lake as a consequence of the third set of locks operation show that it will not increase significantly (URS, 2005).

Consequently, as a result of the recommendations included in the studies mentioned, and the optimization of the designs it is concluded that the Canal Expansion Project – Third Set of Locks, shall not require the application of specific mitigation measures. It is recommended that the water quality monitoring measure be implemented through continued probing assessments of those parameters that will allow for detecting any changes in the concentrations of chloride ions, according to the details included in the Monitoring Plan which are part of this EMP.

8.3.4.2 Water Flow Regime Control Measures

Construction Phase

The new deposit sites shall vary the drainage pattern. In this respect, the mitigation measures shall be to control the new drainage patterns from runoffs, in order to avoid the increase of solids transport to the Canal.

Measures of a preventive nature shall be to channel runoffs through the new drains, constructing bulwarks of the same material, in order to reduce solids transport, minimizing the deterioration of the water quality of the receiver body of water (Canal). Among constructive measures that could be used are retention dikes, infiltration ditches, cross walls, among others. These works shall require adequate and opportune maintenance (desilting), so they may comply with their function of solid retention. The solids retained shall be adequately deposited.

Mitigation measures are summarized as follows:

1. Control the new drainage patterns;
2. Channel runoffs through new drains;
3. Utilize retention dikes, infiltration ditches, cross walls, among others; and
4. Provide adequate and opportune maintenance to the works.

Operations Phase

The same dredged or excavated spoil dumping sites used during the construction stage shall probably be used for the operation stage. Consequently, the previously indicated measures indicated for the construction stage, shall continue to be applied: Channel runoffs, utilize retention dikes, infiltration ditches, among other, to retain solids and avoid that they deteriorate the water quality and Canal silting.

8.3.4.3 Ground-Water Level Variation Control Measures

Construction Phase

In the ground spoil sites for dredged and excavated material, which location and characteristics were described in the Project Description chapter, the rates of water infiltration will decrease, and runoffs will increase. Upon the reduction of the infiltration rate due to the material deposited over them, water runoffs will increase during precipitation events. However, both the reduction in infiltration rate and the increase in runoffs due to the size of the affected areas, compared to the total Watershed, will not affect the regional hydric recharge and discharge. Moreover, there are no water underground uses (mechanical wells) in the area of influence of the spoil deposit sites, and the reduction in the contribution of underground water, compared to the rest of the Canal watershed shall be minimal.

To prevent the erosive processes and drag of material and sediments towards bodies of water, the measures included in the Soils Protection Program shall be applied.

Operations Phase

The dump sites to be used for the dredged or excavated spoils disposal produced by maintenance works, shall probably be the same used during the construction stage, but its effect in the rate of infiltration and runoff shall be less, due to their magnitude and duration. Specific measures of mitigation have not been considered.

8.3.5 Flora and Fauna Protection Program

Flora and fauna impacts can be divided into two groups: terrestrial impacts and aquatic impacts. The impacts are summarized in the following manner:

Impacts on the Terrestrial Biological Communities

- Habitat loss
- Flora loss
    - Vegetation cover loss
    - Forestry potential of woodlands loss
- Effect on fauna
    - Disturbance to Fauna

- Direct elimination of wildlife
- Risk increase of collision with wildlife
- Poaching

Impacts to Aquatic Means

- Marine aquatic resources alteration
- Freshwater resources alteration

This program has as its objective to prevent, reduce or compensate, as appropriate, impairments that could be generated by the Project on terrestrial and aquatic (flora, fauna) present in the *AID*.

8.3.5.1 Vegetation Cover Loss Control Measures

Construction Phase

1. Vegetation Biomass Clearing and Disposal Actions

The principal objective is to set forth procedures directing the measures to be applied during the clearing and disposal of biomass that results from the cutting down of existing vegetation in the Project trail. These measures shall contribute to mitigate the impact produced by the disposal of vegetation wastes principally generated by woody debris from the felling of arboreal species.

During the execution of the clearing and cleanup of the Project area designed to be impacted, the following measures shall be taken into account:

- The working area limits shall be clearly marked with stakes or flagpoles.
- Ecological indemnity in accordance with Resolution AG-0235-2003/ANAM
- During the construction, moving equipment shall be operated in such manner that minimum deterioration is caused to the vegetation and surrounding soils.
- Train operators on the procedures of clearing the vegetation cover.
- Under no circumstance shall vegetation be dumped in areas where drainage channels would be obstructed. However, in some cases vegetation could be utilized as a barrier to control erosion.
- Wherever required, tree pruning shall be performed by trained personnel.
- Utilize part of the biomass (trunks and stakes) as energy dispersers to reduce the effects of hydric erosion, stakes and rods.

2. Reforestation Plan

Among the principal objectives of these measures are to mitigate negative impacts produced by the loss of vegetation cover, recover part of the habitat loss, improve the aesthetic-landscaping aspect of the area, compensate the loss of forestry species, provide vegetation cover to nude soil, and reduce water erosion.

To compensate for the loss of vegetation cover, a Reforestation Plan will be developed and executed by which native species shall be planted at a density of 1,110 saplings per hectare, with a mix no

smaller than 50 species.

During the development of the Project construction works, a loss of approximately 1866.21[5] hectares of vegetation is anticipated, and it will be necessary to compensate and mitigate the loss of this vegetation with an equal surface. Of these, 55.71 hectares of intermediate secondary forests, 9.85 hectares of brushes and stubbles, and 59.82 hectares of grasses and pastures shall be compensated as indicated in the EIA for the Earthworks and Leveling of Cerro Cartagena project, approved through ANAM Resolution No. 219-2007. In addition, 197.91 hectares of brushes and stubbles, and 11.83 hectares of grasses and pastures shall also be compensated as indicated in the EIA for the T6 Site Preparation project (URS Holdings, Inc., 2007). Felling of the remaining 434.85 hectares of arboreal vegetation (mature secondary forest, intermediate secondary forest, and mangrove forest) require to be compensated through the planting of an equivalent to twice its surface, which represents 869.7 hectares. See Table 7-21, of the Impacts chapter.

For the reforestation program, fast-growing native species shall be used, selected from the list of identified species for the current forests in each area, and appropriate for the recovery of degraded areas. Also, species of interest and of forest value shall be merged in lesser proportion, although their growth is not as fast (of 5-10%).

Legal Situation

All sites proposed for reforestation are government property.

5 Includes Mature Secondary Forests, Intermediate Secondary Forests, Mangrove Forests, Grasses and Pastures, and Brushes and Stubbles.

Selection of species

The selected species shall comply with the following conditions:

- Reforestation
    - That they be native trees
    - That they be of deep radicular growth
    - That they be the heliophyte species (tolerant to direct sunlight)
    - That they their growth in height be medium to low
    - That they be tolerant to edaphics and specific climatic site conditions
    - Include species of forest value and species that will serve as wildlife feed

Of the forest species selected, the following, among others, are proposed:

- Espave
- Hog plum
- Laurel
- Annon scrub
- Amaryllis
- Malaguetos
- Sigua
- Carob
- Mahogany

To guarantee that the reforestation is successful, it is necessary that planted saplings have an adequate annual maintenance and are provided with forest fire protection for a minimum period of five years given the aggressive growth of a white grass known as *paja blanca* (also, *paja canalera*).

First Year

- During the first year, sowing is performed and a maintenance plan designed that shall, at least, include four clean-ups after the sow, and establishment of firebreak beltways.

Second year

- Reforestation lots maintenance during the second year consist of five manual clean-ups, construction and maintenance of fireguards, and one fertilizing.

Third year

- During the third year of maintenance, weed growth has been weakened, and the planted saplings have a fully developed radicular system, consequently, they have increased their crown diameter, and reached sufficient height to partially control the weeds, especially the *paja blanca* (white weed). At least three clean-ups shall be performed, no fertilizers applied, and fireguard construction and maintenance continued.

Fourth, fifth, and sixth years

- During these final three years, maintenance is reduced to manual clean-ups and fire protection, as the trees shall have already controlled the weeds.

The Contractors, through the ACP, shall develop and submit to the Autoridad Nacional del Ambiente (Panama's National Environmental Authority), for the pertinent approvals, a Reforestation Plan, Tree-Planting and Sodding detail, including real costs. This plan shall be prepared by competent personnel, taking into account the special handling, as it is proposed to execute part of these reforestations within the Protected Areas with some restrictions relative to uses.

Operations Phase

The impact during the operation stage is related to possible felling due to maintenance activities, such as the potential effect or loss of vegetation resulting from the increase in the operating level of Gatun Lake.

The increase in the operating level of Gatun Lake could mean an impairment of approximately 4.4 hectares of intermediate secondary forest and of bushes and stubbles (See Table 7-19 of the Impacts chapter). However, given the present conditions of the Lake level, some of these species could be tolerant of such fluctuation. Based on the above, the recommended mitigation measures are as follows:

1. Realize a study regarding existing species in the banks of Gatun Lake and the islands to evaluate their resistance to the level fluctuations of the Lake.

2. Define, according to the results of the preceding study, the impairment or loss of expected vegetation.

8.3.5.2 Potential Forest Loss Control Measures

The objective of the measures hereby proposed is to minimize the impact on the potential forest that could occur in the Direct Impact Area.

Construction Phase

To execute the required activities for the construction of the Project, it is necessary to eliminate the general vegetation cover and, consequently, trees of commercial value are included within the Project trail area, such as they were inventoried and presented in the base line of this EIS.

This impact shall occur during the construction stage; consequently, the execution of the following measures is proposed:

1. Mark the trail area before performing the fell, thus guaranteeing that the area to be felled is exactly the one necessary to realize the proposed works.

2. Include planting of forest native species in the Reforestation Plan.

3. Explore the alternative use of felled forest resource, or donate it to a social welfare institution.

4. Direct tree falls towards the direct impact area to avoid damage to trees in the adjacent areas which should not be impaired.

Operation Phase

Although forest plantation impairment caused by the increase in the level of Gatun Lake is not anticipated, the development of a more in-depth study is recommended to assess the impacts which the maximum operating level (MOL) of the Lake would have on the vegetation elevation, principally, based on the duration of the elevation level, seasonal fluctuations of the water level and type of existing vegetation, and the contingent mitigation measures that could be required.

8.3.5.3 Habitat Loss Control Measures

Construction Phase

The vegetation cover of the Project trail area, including grasses, stubbles and forests shall be lost due to the construction works to be executed. Reforestation, as a means of compensation heeds both the vegetation cover loss and the habitat impairment, and offers an alternative in the areas where reforestation is to be carried out.

This program has as its objective to partially compensate part of the habitat lost during the construction stage of the Project.

Operations Phase

Although it is not anticipated that habitat will be lost during the operation state due to the increase in the operating level of Gatun lake, it is recommended that a more in-depth study be developed to assess the impacts that the maximum operating level (MOL) could have on the vegetation, principally based on the duration of the elevation level, seasonal fluctuations of the water level and type of existing vegetation, and the contingent mitigation measures that could be required.

8.3.5.4 Disturbance to Wildlife Control Measures

This program has as its principal objective to prevent or minimize probable disturbance which the activities developed during the construction and operation phases could cause on wild fauna.

Construction Phase

To minimize or compensate for disturbances caused to fauna during the construction, it is recommended that the following measures be applied:

1. Avoid unnecessary noise generated by whistles, horns, sirens, pipes, and running engines, among other
2. Install and maintain noise mufflers of motorized equipment (vehicles, equipment and machinery) in good condition.
3. Coordinate the rescue of animals that enter the working areas.
4. Train construction works personnel on wildlife protection and poaching prevention procedures.
5. Direct lighting towards specific worksites, avoiding lights on fauna habitat.

Operations Phase

In connection with the operations phase, the principal disturbance identified is the artificial lighting that will be maintained during night hours in locks installations and the navigation system. To minimize this impact, the following mitigation measures are recommended:

1. Keep the inclination angle of lighthouses specifically directed towards the installations, in such manner that the radius of illumination is localized; and

2. A dim intensity of lighting shall be employed, providing that the navigational operations allow it so that the impact[6] is not magnified.

8.3.5.5 Measures to Control Risk of Collision with Wild Animals

During the construction phase, vehicles transporting Project material and personnel utilize temporary and permanent roads that go through sites occasionally inhabited by wildlife. Because of this, there exists the possibility of collisions with the animals, as well as of vehicular accidents. In the operation phase the utilization of permanent roads near wildlife habitats, although at lesser scale than during the construction phase, also constitutes a risk of collision with wild animals. Consequently, it becomes necessary to take measures to reduce the possibility of such events.

Construction and Operations Phase

To minimize or reduce the risk of collisions with animals during the construction and operation phases, application of the following measures is recommended:

1. Strict velocity control shall be generally implemented for all Project vehicles.

6 Subject to lighting brightness conditions required for safety maintenance.

2. For the purpose of preventing the growth of vegetation that obstructs visibility, maintenance shall be provided to access road shoulders.

3. Informative signs shall be produced regarding the crossing of fauna in pertinent stretches.

8.3.5.6 Poaching Control Measures

Construction Phase

The possibility exists that construction workers attempt to hunt the wild fauna found within, or near, the areas of work and/or circulation. Consequently, preventing the decrease or disappearance of the local wild fauna through direct extraction/elimination by man during the construction stage is the principal objective of this component.

For the purpose of preventing or minimizing the impact produced by illegal hunting, application of the following measures is recommended during the construction stage:

1. Prohibit workers to practice any type of hunting or fishing within the Project Area;

2. Prohibit or regulate the use of firearms within the Project premises;

3. Comply with the laws and standards established by the Autoridad Nacional del Ambiente (Panama's National Environmental Authority) on wildlife protection;

4. Place warning signs indicating hunting prohibition;

5. Implement an Environmental Training Program for the workers.

Operations Phase

Because of this impact's low level of significance and the ACP restrictions for public access to the new Project sites, it is not considered necessary to establish mitigation measures for this impact during the operation phase.

8.3.5.7 Direct Impact on Fauna Control Measures

It is probable that during the construction stage, principally during cleanup and uprooting of vegetation, and earthworks, the life of some animals could become threatened. To prevent and reduce the sacrifice of animals, especially those of the arboreal and nocturnal species, the measure recommended is the execution of a rescue and relocation operation of the terrestrial vertebrate fauna present in the trail area. Among the objectives contained in this measure is the capture of the majority of the animals that could be eliminated, disturbed, or lose their habitat during the construction and transfer of the individuals captured to adequate sites that assure their survival. More details regarding this measure are found in the Wildlife Rescue and Relocation Plan, Section 8.8 of this EIS.

8.3.5.8 Aquatic Ecosystems Variation Control Measures

Construction and Operations Phase

The principal objective of these measures is to try to minimize the impacts that arise during the construction and operation of the Project on existing aquatic ecosystems in the direct impact area

of the Project.

The work areas of improvement to navigational channels are: Atlantic Entrance, Gatun Lake, Gaillard Cut, Pacific Entrance, and the approach channels to the new locks. Whereby, with this section's contents it is expected to prevent or reduce probable impairments that could be generated by the impacts; alteration to Miraflores Lake resources; alteration to coastal marine resources, alteration to Lake Gatun resources, and alteration to aquatic resources in rivers and creeks.

During the construction stage, dredging and spoil and excavated material deposits shall be the most important direct activities that will affect the aquatic environment and its resources. This effect shall be observed throughout the deposit areas.

The construction of this Project modifies the environment and, consequently, the ecological conditions of the area, increasing the suspended solids and sediments through the dredging activities performed during the widening of the navigational channels. The excessive presence of suspended solids in water changes the environment and could affect the aquatic organisms.

Spoil deposited on ground has the potential of increasing the turbidity in the areas where runoffs flow towards the bodies of water.

In marine deposit beds, there exists the potential of affecting the coral reefs in Zone 1 (Atlantic Coast) and the mangroves in Zone 6 (Pacific Coast).

When the expansion Project construction is concluded, the works that follow shall be the principal

induced activities which could generate impacts on the aquatic resources during the operation stage.

Two maintenance dredging operations shall be identified:

- Cleanup of sediments brought by the sea and by the rivers.
- Reestablishment or preventive maintenance of Canal navigation in cases of slides in Gaillard Cut.

The measures destined to control the impact on the aquatic ecosystem are focused on controlling the problem in the source. In this context, no particular measures are contemplated for this impact, but that compliance with the air quality, noise and vibration programs; soils protection program; hydric resources protection program; management of materials program; and the waste management program shall be the base for preventing the impairment of the aquatic ecosystems.

8.3.5.9 Impact on Protected Areas Control Measures

Because during the Project activities to be executed there will be no direct impacts generated on any of the Protected Areas, and that such impact has been qualified as low, application of mitigation measures is not considered necessary.

8.3.6 Waste Management Program

Construction work of the magnitude of the Panama Canal Expansion Project – Third Set of Locks, which employs a great number of people and requires significant amounts of consumable goods and services for its construction, shall inevitably generate a stream of wastes of varied composition. This program establishes guidelines for the safe management of the principal wastes expected to be generated as a consequence of the Project execution. This program does not include excavation and dredging wastes which have specific management measures as part of the construction process. Neither does it include management and control of gaseous emissions and/or particulate material into the atmosphere. Pertinent measures are included in other sections of this EMP.

The objective of this waste management program is to minimize any adverse impact on the workers' health and on the environment, as well as to limit risk exposures, by offering guidance on the management of solid, liquid, and hazardous wastes. Furthermore, throughout this section mention is made of the key technical requirements aimed at ensuring compliance with the environmental laws of the country, and the environmental standards of ACP, which are binding. In this context, the ACP material and waste management manual *[Manual para Manejo de Materiales y Desechos de la ACP]* (ESM-107) results in special application.

Considering the above, the Waste Management Program has been designed to assist Contractors in achieving the following goals:

1. Reduce health risks resulting from deficient storage and mishandling of wastes.
2. Identify and classify wastes;

3. Minimize waste production;

4. Select appropriate alternatives for waste disposal;

5. Document all aspects of the waste management process;

6. Ensure compliance with the regulations on waste management practices.

8.3.6.1 Responsibilities

Each Contractor shall delegate the responsibility for the management of its waste to its Socioenvironmental Protection Manager, and through him, to its Field Environmental Supervisor and eventually to his assistants, who must all be appropriately trained to inspect, supervise, and keep a record of waste management practices.

8.3.6.2 Organization

The Waste Management Program has been divided in three different components, as follows:

1. Solid Waste Management;

2. Liquid Effluent Management (that is, sewage water); and

3. Hazardous Waste Management.

8.3.6.3 Waste Management

By virtue of the activities to be performed during the Project construction and operations stages, various different types of waste will be generated. These must be managed in such a manner that may prevent the accumulation of garbage that can cause the proliferation of diseases that may affect worker health. To a certain extent, the aim is to prevent situations detrimental to the health of workers and the population with an adequate processing of waste that does not, in turn, cause environmental contamination.

The new requirements for the management of waste involve the taking of actions during the construction and operation of the Project to:

1. Prevent the generation of waste (waste prevention at the source),
2. Find other uses for waste (that is, its reuse),
3. Recover materials (recycling), and
4. Recover energy (valuation).

In waste management, reduction at the source and reuse are considered the best options instead of having to implement recycling, treatment, and disposal.

8.3.6.4 Solid Waste Management

Waste materials generated during the construction stage, such as wood, pieces of rods, boxes, paper, cans, plastic items, etc., and domestic trash generated by employees shall be disposed of in closed containers located in an especially designated and adequately protected area within the site. The Contractor shall be responsible for the final disposal of this waste, and shall abide by the country's current laws on this matter.

In order to ensure the proper management of solid waste, the following principles shall be established:

1. Train workers with regard to solid waste management regulations;
2. Prohibit the burning of solid waste;
3. Establish a proper location for and labeling of solid waste containers;
4. Minimize the production of waste;
5. Maximize recycling and reuse;
6. Provide safe transportation, and the
7. Proper disposal of waste.

Solid Waste Management Training

A key element in achieving an adequate solid waste management is the training of all workers who

will participate in the construction work. For it to provide good results for the program and savings to the Contractor and the Panama Canal Authority, this training must be provided prior to the start of the work. It shall include aspects such as safe practices for the management, storage, transportation, treatment and disposal of waste, according to its type.

It is also important to provide yearly refresher training and keep a record of the training provided, along with documentation on such training.

Containers for the Collection of Solid Waste

Non biodegradable solid waste containers or bins must be located at the work sites and at operations centers to encourage their use for proper garbage disposal and discourage littering. Bins shall be marked appropriately so that employees may dispose separately of any plastic, metal or any other category of non biodegradable waste material.

Solid waste containers shall be lined with plastic bags and placed at any worker service areas (kitchens and lunch areas), as well as work sites. These containers must be labeled to show that they are intended for disposing of non biodegradable materials. Plastic bags shall be available at all work sites.

Indoor and outdoor organic (biodegradable) waste containers with covers shall be provided. In the case of containers for inert waste (non biodegradable), and depending on their size, proper action shall be taken to prevent them from flooding during the rainy season.

Biodegradable and non biodegradable waste containers shall be moved along with project equipment or machinery, that is, as work advances, and must not be left behind in the areas where work has been completed.

Procedures to Minimize the Generation of Solid Waste

The procedures to minimize solid waste shall include both its reduction at the source as well as its reuse. Reduction of waste at its source shall include a reduction in the amount of materials carried into work sites and to Project rights-of-way. In order to make such reduction at the source, the Contractor shall take into account the following elements:

1. Purchase products with a minimum quantity of wrapping (such as food and paper);
2. Use longer life products that can be repaired (such as durable work tools and appliances) ;
3. Substitute single use disposable items with reusable ones (such as bottles instead of cans);
4. Use fewer resources (such as photocopying on both sides of the paper, etc.)
5. Increase the recycling of products and materials (i.e., find items that are easily accepted by the local recycling centers). Waste materials that can be recycled include used asphalt, used concrete, leftover paint, construction lumber, brush clearing debris such as stumps and branches, used pallets, waste metals, and other materials.

The purpose of reducing waste sources is to avoid having to manage solid waste, by simply not generating waste. The Contractor shall investigate opportunities for local reuse of products (such as appliances, furniture, used oil), instead of having to dispose of them.

Procedures for the Recycling of Solid Waste

Materials shall be recycled whenever possible. The Contractor shall check the availability of local recycling centers. If such centers are located, all paper, wood, plastic items, and other dry waste that cannot be reused shall be collected in clearly marked containers and stored for transportation to such centers. Used tires shall be delivered or sold to local recycling companies for recycling. Under no circumstance shall the burning of tires be allowed.

Guidelines for the Safe Transportation of Solid Waste

During the construction phase, it will be necessary to move solid waste from Project sites where it is generated to its final disposal site. The Contractor shall ensure that the personnel responsible for this task follow proper waste transportation procedures. These guidelines shall include, as a minimum, the following:

1. Drivers of vehicles carrying solid waste shall avoid making unauthorized and unwarranted stops along the transportation route.
2. Vehicles transporting solid waste shall be equipped with the following features:

- A cover (such as a tarps or nets) to prevent spilling solid waste along the route;

- Vehicles shall be capable of operating without breaking down in severe weather conditions;
- Vehicle design capacity shall be observed without overloading, and the vehicles shall be cleaned up frequently to prevent unpleasant emissions.

The Contractor shall be responsible to the Panama Canal Authority for the proper compliance with all aspects of the required solid waste management transportation procedures during Project construction. It is imperative that the Contractor instruct all haulers of solid waste on the proper and environmentally safe transportation procedures from the collection point of its final destination.

Final Disposal of Solid Waste

The Contractor shall follow all the required procedures for final disposal of the waste generated during Project construction. It shall also certify, in writing, that all waste management activities have been performed in an acceptable technical, legal, sanitary, and environmentally safe manner. The Contractor shall be responsible for any claim resulting from an inadequate management of solid waste. Whenever it becomes necessary to establish a temporary disposal site due to the logistical requirements of the operations, the Contractor shall submit a request to the Panama Canal Authority for approval. Pacific Area waste shall be disposed of at the Patacon Sanitary Landfill, and Atlantic Area waste shall be disposed of at the Mount Hope Sanitary Landfill.

8.3.6.5 Liquid Effluents

Liquid sanitary waste or sewage water will be generated as a result of human activity throughout the entire Project. The volume generated will depend on the number of workers and the availability of sanitary facilities at the various work sites.

At short-term work sites, portable field toilets shall be provided on contract by a specialized firm that shall also perform the cleanup of their content as frequently as required, in order to keep them in an acceptable sanitary condition. These facilities shall be installed at a rate of one per each 20 workers. The firm selected for this work shall comply with the regulations established by the Panama Canal Authority for the treatment and final disposal of the effluents and sludge they accumulate.

In prolonged work areas, sewage water treatment plants shall be built and operated. The quality of the sewage waters for disposal after treatment shall comply with the requirements of Technical Regulation DGNTI-COPANIT 35-2000, if the effluent must be discharged into surface ponds. If sanitary sewers are available, the water quality shall comply with the requirements of Technical Regulation DGNTI-COPANIT 35-20.

Moreover, it is important to keep in mind that the Panama Canal Authority has a program in operation to manage waste water, which includes the improvement of sanitary sewers, the construction of pump stations, and waste water treatment, which can assist in complying with environmental protection regulations during the Project operations stage.

8.3.6.6 Hazardous Waste

Hazardous waste will be generated during the construction of the Panama Canal Expansion. Some of the equipment required for use during the construction and operations phases of the Project will generate hazardous waste that may include used oil, compressed gas cylinders, refrigeration equipment, batteries, oil solvent filters, paint, and absorbent materials.

All hazardous waste management must be performed in an environmentally safe manner. All hazardous waste shall be collected, recorded, and guarded properly at temporary storage areas within work installations, specifically at locations previously designated for such purpose. Final disposal shall be authorized and done at facilities designed for hazardous waste, or at recycling centers. Prior to transporting hazardous waste for its final disposal or recycling, the Contractor or Subcontractor shall pack and mark all hazardous waste safely.

Procedures to Minimize Hazardous Waste

Minimizing is considered as the first alternative to the generation of hazardous waste. It not only reduces the volume generated, but also allows economizing on resources. There are two ways to achieve the minimizing of waste:

1. *Substitution of Materials:* This applies whenever it is possible to substitute hazardous materials with biodegradable or environmentally harmless materials.

2. *Stockpiling or Inventory Control*: This involves keeping only the required quantity of materials in stock, and facilitates the efficient use of materials stocked.

Hazardous Waste Reuse Procedures

The following are some of the actions that can be taken for the reuse of waste that is considered hazardous:

1. Verify whether it is possible to return any excess materials to the supplier.
2. In the event it is not possible to return materials to the supplier, examine the possibility of extending the life of the materials for use at a future date.

3. If it is not possible to keep them, consider the possibility of arranging the exchange of materials with other sections.

4. When an exchange is not feasible, the existence of facilities for the recycling such waste shall be investigated.

5. If recycling is not feasible, its sale must be considered. Once the above measures have been exhausted, disposal shall be made as appropriate.

Hazardous Waste Management Procedures

Hazardous waste shall be separated (solvents, acids, and caustic materials) to prevent reactions due to incompatibility. The management of each type of waste shall be done as follows:

Used Oil

Used oil shall be considered hazardous waste and collected in oil collection drums or tanks, duly marked with safety labels. These drums or tanks shall be placed in guarded zones within the hazardous waste storage area at the work camp with the proper warning signs, until its final disposal or delivery to an authorized agent for incineration or recycling. The mixing of used oil with antifreeze, paint waste, degreasing solvents, synthetic lubricant oil or any other liquid, with the exception of water, is prohibited.

Gas Cylinders

Gas cylinders shall be returned to the Contractor or supplier. However, if they are not empty prior to their return, they must be labeled with the name of the material they contained or contain, information on the supplier, cylinder serial number, pressure, their last hydrostatic test date, and any additional identification marking that may be considered necessary.

Refrigeration Equipment

Prior to their disposal, all refrigeration equipment, including refrigerators, freezers, and air conditioners shall be emptied of any Freon they may contain. Freon extraction shall be performed in an enclosed environment, in order to prevent its release into the atmosphere. Refrigeration equipment shall use refrigerants not prohibited by the Montreal Protocol.

Used Batteries

Alkaline or zinc-carbon batteries are not considered hazardous waste, and shall be disposed of as common waste. However, acid lead (vehicle), nickel cadmium (radios and cell phones), and mercury and lithium batteries require a special treatment because their toxic elements can adversely affect the environment. Therefore, they shall not be disposed of or placed in inadequate containers without first neutralizing their acid content. During Project operations, they shall be sent to the Quality Control and Property Disposal Section.

Oil Filters

When replacing filters, they shall not be disposed of at the storage area without ensuring that they are not contaminated with hydrocarbons or other substances considered as hazardous. Filters that can be completely drained and crushed may be disposed of at the authorized sanitary landfills.

Used oil must be properly drained from filters prior to their disposal. The filter draining process shall be done at a temperature equal or similar to the original equipment operating temperature (hot). There are several acceptable ways to perform this operation. For example, the filter can be perforated or crushed, and the used oil drained into an appropriate collection container. Contaminated filters that cannot be drained shall be transported to an authorized hazardous waste storage facility.

Solvents

Used solvents shall not be disposed of but recycled by distillation in solvent recovery areas. During this process all contaminants are removed and restored to their original purity. Prior to recycling, Contractors shall comply with the following:

1. Label tanks properly, indicating their source and content.
2. Separate solvents by type: xylene, dilution or epoxy thinner, etc.
3. Prior to sending them to the Mount Hope solvent recovery area, place drums inside protective containers.
4. Coordinate any hauls with the solvent recovery area by calling 443-7603, Monday through Friday, from 7:30 a.m. to 3:30 p.m.
5. Keep a record of all used solvents sent to the recovery area.
6. Use recycled solvents for cleanup and degreasing operations.

Drums or tanks containing used solvents require careful handling and thorough management, as well as a strict control of their content. Therefore, the following requirements shall be met: the drums or tanks must be kept in good condition, hermetically sealed, and have visible updated labels with information about their owner.

Paint

Paint is a significant source of hazardous waste. For this reason, partially used cans must be grouped for disposal by paint type. The mixing of solvents or paints of different types shall be avoided at all times. Utensils such as paint brushes, paddles, or stirrers may be disposed of provided they are dry.

Contaminated Rags

Contaminated rags and materials shall be handled by applying the same criteria and methodology as the product they absorbed, according to the Panama Canal Authority 2005 Materials and Waste Management Manual.

Hazardous Waste Storage and Packing

A Contractor that handles this type of materials or substances shall build a hazardous waste storage area according to the 2005 Manual on Materials and Waste Management of the Panama Canal Authority. Also, it shall have hazardous waste storage procedures for its workers to follow, covering, at least, the following aspects:

1. ***Location of Hazardous Waste***: Hazardous waste shall be stored in adequately prepared areas protected from the rain, with a containment guard, and under lock and key. Storage of hazardous at less than 250 meters from body of water shall be prohibited.

2. ***Temporary Storage Areas***: Temporary storage areas shall be located within maintenance shop areas, far from surface ponds or water (at least 250 meters). Hazardous waste on temporary storage may not be kept there more than 60 days prior to its transfer to the hazardous waste storage. A person shall be responsible for collecting, inventorying, recording the movement, and the final disposal of, hazardous waste.

3. ***Hazardous Waste Storage Containers***: Waste shall be stored in proper containers along with compatible items. Container covers shall be closed with the proper tools to prevent them from opening accidentally by hand. Threaded drum covers shall be firmly locked to prevent them from uncovering accidentally. Waste shall be placed in containers, as appropriate (meaning that if there is any doubt about the waste, it should not be placed in containers). The Contractor shall comply at all times with the 2005 Manual on Materials and Waste Management of the Panama Canal Authority. Any other proposed or selected method must be authorized by the Panama Canal Authority.

Hazardous Waste Storage Area Inspection

Drums and containers used to store hazardous waste shall be inspected to detect any leaks, deterioration, or human error that may cause drips or leaks. These inspections must be conducted frequently, and any deficiency corrected immediately. The person in charge of Environmental Protection shall conduct regular inspections of the drums and containers used for waste, in addition to the area where they have been stored. During his inspections, he shall verify compliance with at least the following:

1. All drums and containers in the hazardous waste storage area shall be inventoried and listed in a permanent record;

2. The information in the recordkeeping form shall be checked during the daily inspection;

3. No drum or container in the storage area, that is marked "Hazardous Waste" may remain more than two months in that location;

4. A report on the actions taken to correct the deficiencies found in the storage area shall be attached to the inspection report;

5. The drum and container storage area shall be inspected daily to:

    a) Detect any spills or deterioration of the spill containment system;

    b) Ensure that drums and containers are stored on shelves or pallets;

    c) Ensure that there is enough aisle space to reach all drums and containers;

    d) Ensure that drums and/or containers are not piled up;

    e) Ensure that all openings, as well as the spill containment system blocking valves, if any, are closed.

    f) Record the date and time of inspection, the inspector's name, his comments on the inspection, and the action to be taken in the inspection log; and

    g) Record any drips or spills detected in drums or containers, as well as the cleanup performed in accordance with the established procedures.

Transportation of Hazardous Waste

The Contractor shall use drums and/or containers in good condition, from which all prior markings have been removed prior to their transportation. All waste liquids shall be stored in closed containers or drums. They may not be filled to the brim, and a margin of 10 centimeters shall be left unfilled to provide for the expansion of the contents.

All containers shall be marked as hazardous by means of labels or decals. A record shall be kept of all containers transported to their final disposal site. These records shall include, at least, the following information:

1. The information on record about the hauler (for example, the truck license number, driver's name, date, time, and contents);
2. Disposal date;
3. Number of containers and volume of waste;
4. Type of waste;
5. Final disposal site; and
6. A description of the final disposal operation.

All hazardous waste shall be transported beyond the boundaries of the Project facilities for its subsequent treatment or storage. A record shall be kept of this action.

Hazardous Waste Training

The Contractor shall establish a training and information program for workers that may become exposed to operations with hazardous waste, to advise them about the level and degree of exposure they could face. Their training program shall include all the proper elements for each assigned position. No unsupervised work may be performed by workers prior to completing their training on the management of hazardous waste. Such training shall be provided prior to starting the work, with refresher courses every year thereafter. A record shall be kept of the training, as well as of the training materials used. As a minimum, the training shall include the following elements:

1. Inspection, repair, and replacement of containers with hazardous waste;
2. Communication and alarm systems;
3. Fire and explosion response;
4. Response to soil and/or surface water contamination incidents; and
5. Turning the equipment off.

Workers who receive this training shall be issued the proper certificate, and a record shall be kept of same.

Workers shall be provided with Material Safety Data Sheets (MSDS) in Spanish, and a copy kept in the record of all chemicals. The MSDS shall contain the information established in the Panama Canal Authority standard on Hazardous Materials 2600 ESS-201.

In addition to the MSDS information, the Contractor shall explain to workers how to identify and interpret the labels on containers with chemicals. For example, labels may contain the following information:

1. Identification: the code number, code name, or actual name of the chemical;
2. The code signal indicating the degree of hazard associated with the product;
3. A Hazard Statement, indicating, for example, whether the product is "extremely flammable," or "noxious if inhaled."
4. Precautions to prevent injury or illness, for example: "Do not inhale," or "Rinse well after handling;"
5. First aid instructions with information in case of exposure;
6. Antidote: The action to be taken to counteract the effects of chemical exposure;
7. Instructions in case of fire, leaks or spills: information on how to control a fire and clean up spills and leaks;
8. Notes to physicians: Information for physicians in case a worker is exposed to a chemical; and
9. Handling and storage instructions: Special procedures for the handling and storage of chemicals.

A good training program on hazardous waste must include information on how to handle chemicals safely and use personal protection equipment. It must also explain basic emergency procedures for each one of the chemicals found in hazardous waste. Workers must know the location of first aid stations and communications procedures (for example, to contact emergency services, hospitals, specific personnel and their telephone numbers).

8.3.7 Materials Management Program

A project of the magnitude of the Panama Canal Expansion – Third Set of Locks Project, that employs large numbers of persons and requires a significant amount of supplies and services for its construction, will inevitably require the handling of a large volume of materials of various types. This program shall establish the general guidelines for a safe handling of different types of materials that are expected to be required during the performance of the Project.

The objective of this Materials Management Program is to minimize any adverse impact on worker health and the environment, as well as to limit exposure to hazards by providing instruction on the management of hazardous and non hazardous materials, as well as of worker personal use items. Moreover, this section includes the key technical requirements to ensure compliance with Panama's environmental protection laws, as well as the mandatory Panama Canal Authority environmental protection standards.

Responsibilities

Each Contractor shall delegate the responsibility for the management of materials to its Socioenvironmental Manager and, through him, to his Environmental Protection Supervisor in the field and eventually to his assistants, who must be adequately trained to inspect, supervise, and keep a record of materials management practices.

Organization

The Materials Management Program has been divided into the following components:

1. Load Management Procedures;
2. Management of Hazardous and Non Hazardous Materials, including worker personal items; and
3. Inspection of Materials Storage Zones.

8.3.7.1 Load Management Procedures

It is important to follow the established load management procedures. The following are some recommendations for the loading of materials:

1. The movement of materials more than four meters long shall be made by groups of workers, posting one employee at every four meters.
2. 55 gallon drums may only be loaded manually, and drums with a larger storage capacity shall be moved with wheelbarrows of other machinery.
3. The maximum load a worker may move manually may not exceed 50 pounds. Mechanical handling equipment shall be used for loads exceeding the allowed weight limit.
4. Employees shall use the necessary protection equipment for the work they perform, especially when such work involves the movement of objects with sharp edges, slivers, nails, or other hazardous objects.
5. When using wheelbarrows, employees shall observe the following:
    a. Ensure that the area over which the load will be moved is flat.
    b. When unloading onto containment areas, chocks must be placed in the unloading area.

c. Never turn your back on a load.

8.3.7.2 Materials Management

During the construction process, Contractors shall be responsible to the Panama Canal Authority for preparing a materials management program based on the information in this Environmental Management Plan and the standards on the matter. The program must contain sufficient elements to describe the activities to be performed, as well as the specific facilities to be adapted or built for these purposes.

Various types of materials will be used during the construction of the Project, some of which are considered hazardous due to their physical features and chemical components. For this reason, the Materials Management Program has been organized in two sections: one for the management of hazardous materials, and the other for the handling of non hazardous materials, that includes worker support items.

Management of Hazardous Materials

This refers to all activities involving the storage, management, and transportation of materials capable of posing some type of hazard to human health, the environment, and property. Substances considered as hazardous include: explosives, fuel, oils, toxic and flammable gases, and any other material involving some type of hazard. The use of hazardous materials during the construction and operation of the Project will be governed by Hazardous Materials Standard 2600ESS-201, as well as by other specific standards for the work to be performed.

Transportation, Storage, and Use of Explosives

Explosives are considered a special group of hazardous materials. The following proposed measures for their storage and handling are based on Decree 104 of October 1930, and the Panama Canal Authority safety standards for the management, transportation, storage, and use of explosives and munitions (2600ESS-108); also, the vibration control measures in section 8.4.2 of this Environmental Management Plan shall apply, as well as those on the Drilling and Blasting Plan included in Annex 6. These measures require that:

1. The Contractor submit all the necessary information confirming that the personnel performing activities requiring the use of explosives are qualified for such work, and are also familiar with the safety regulations on explosives.
2. Those in charge of the blasting have a device to detect electrical storms in a radius of 10 miles during the transportation, storage, and handling of explosives.
3. The quality and manufacturing standards shall comply with Panama and international standards.
4. There shall be a shipping manifest for the explosives to be used, stating their date of shipment, their date of arrival, the name of the Contractor, the type and name of the hauler, and its classification according to United Nations standards.
5. All shipping manifests for explosives shall clearly state the contents of the shipment, and their Material Safety Data Sheets shall be on the outside of each box.

6. The delivery of the explosives shall be planned in advance to avoid surpluses. This planning must be made with the assistance of a blasting plan stating the quantity of explosives, and starters, and the location at the plant.

7. Any vehicle to be used by the Contractor to carry explosives shall be approved by the Panama Canal Authority.

8. Storage facilities containing explosives shall display proper signage according to the type of facility and to the provisions of Publication #1 of the Institute of Makers of Explosives (IME).

9. Explosives shall be used according to their storage date, giving priority to the oldest, provided they have not deteriorated.

10. All electrical equipment, connections, and lamps used inside storage facilities shall be explosion proof. Fixed equipment shall be properly grounded.

11. The location of the explosives storage within the work site shall be accessible to local and/or national emergency crews, and shall have the approval of the Panama Canal Authority Safety Division.

12. At the time of the blasting, the perimeter shall have proper safety warning signage, barricades, and cones. In addition, the area shall have berms of a similar or larger diameter than that of the tires of the largest vehicle transiting the area.

13. Blasting design and optimization rules established by the manufacturers for conditions such as the verticality of the holes, time fuses, and the properties of the explosives shall be followed. Likewise, each blast hole shall be inspected for obstructions.

14. Explosives shall be kept separate from detonators.

15. In the event of loss or theft, the Panama Canal Authority Safety Division shall be notified immediately.

Training shall be provided prior to the start of the work, followed by yearly refresher courses. Training records shall be kept for the duration of the work plus an additional five (5) years, along with a copy of the instruction materials used for training.

Flammable Liquids, Solvents, and Fuels

The handling and storage of these substances shall be conducted in such a manner so as to minimize the possibility of spills that may affect persons and the environment. The proposed measures are based on the following standards: Resolution No. CDZ-003/99 of February 11, 1999, and the Panama Canal Authority standards for the handling and storage of flammable liquids, solvents, and fuels (2600ESS-128). The recommended measures include:

1. Eliminate all ignition sources that may generate hazards, such as, lamps, cigarettes, welding, friction, sparks, chemical reactions, etc.
2. Flammable liquid and solvent storage areas shall maintain adequate ventilation in order to prevent the accumulation of vapors.
3. Storage areas shall have the necessary fire extinguishing equipment, appropriate for the type of material stored. In addition, all personnel must be knowledgeable about the use and location of this equipment.
4. Storage areas with oil, hydraulic fluids, solvents, paints, and other liquid items used on construction machinery shall be located in a specific area protected from the rain. If these products are considered flammable, they must be stored in properly grounded cabinets.
5. Whenever the work requires the use of flammable liquids, solvents, and fuel in confined spaces, Panama Canal Authority regulations that apply to this type of space shall be followed.

Likewise, it is necessary to have the site inspected by an Industrial Hygienist prior to starting work.

6. Bronze alloy tools shall be used to remove covers when installing air vents. Omission of this recommendation can cause a fire.

7. Dispensers shall be equipped with the appropriate grounded safety vent and valves with an automatic lock. Most importantly, the containers used for dispensing and receiving flammable liquids must be checked to ensure that they are electrically interconnected.

8. Fuel or any other hazardous liquid storage drums shall be kept inside a secondary container with a minimum capacity of 110% of its volume.

9. The fuel unloading area for supplying storage tanks shall be waterproof and have a containment to control spills. Also, these areas shall have ground connections for trucks and firefighting equipment.

10. During the transfer of fuel from the trucks into a storage tank, the following steps must be taken:

    a. Check that the sumps in the unloading area are working properly.

    b. Make sure that there is emergency equipment (to control spills and fires) in good working condition.

    c. Check the stability of the fuel truck at the unloading platform – for example, apply the hand brake and install wheel chocks.

    d. Check that the fuel truck has been grounded.

    e. Check the fuel truck connections to the storage tank intake.

    f. Have a representative present during the entire fuel unloading operation.

    g. After transfer operations have been completed, and prior to disconnecting the connecting hoses, make sure that the valves have been turned off.

11. Daily inspections shall be conducted at containment areas for the following purposes:

    a. If rainwater is found within the containment, it shall be examined to determine whether it has hydrocarbons. If such is the case, the water shall be extracted and sent for adequate treatment. If the water does not contain hydrocarbons, it can be drained.

    b. Keep a daily log of these inspections and of rainwater discharges, and record the extraction, transportation, treatment, and storage of the water that contains hydrocarbons.

12. Have a layout on hand showing the drainage pattern at the work sites.

Compressed Gas Cylinders

Much of the work performed during the construction and operation of the Project often requires the use of compressed gas cylinders to store industrial chemicals. However, if not handled properly, these cylinders may pose gas exposure hazards for workers, and cause suffocation, explosion, or fire. The measures established for their handling are based on the safety standards for the handling and storage of compressed cylinder gas (2600ESS-116), and the management of hazardous materials (2600ESS-201), both established by the Panama Canal Authority. In order to minimize the hazards during their use:

1. All employees using compressed gas cylinders shall be knowledgeable about the hazards of their handling, and the actions they must take in the case of an emergency. Additionally, employees must know the protection equipment required for their handling, as well as their proper cleaning procedures.

2. Periodic inspections shall be conducted on the alarm systems and sites where the equipment is located, to detect any gas leaks. These inspections shall be done according to the manufacturer's recommendations.

3. All cylinders shall bear markings identifying their contents. When empty, the valve must be closed, the cover on, and the cylinder marked with the word "Empty." It is important to keep in mind that the color of the cylinder is no indication of the substance it contains.

4. The following precautions must be taken during transportation of compressed gas cylinders:

    a. Do not drag, roll, or slide the cylinders on the ground, as any blows or falls can cause leaks.

    b. Cylinders must always be transported in a vertical position, taking care that they do not hit each other.

    c. Whenever they are moved manually, a cart especially designed for such purpose shall be used, and each cylinder shall be moved separately, keeping its protective cover in place.

5. Cylinder storage sites shall be well vented, dry, not hot, and away from incompatible materials, heat sources, and areas that could be affected during an emergency.

6. Empty cylinders shall be stored away from full cylinders. However, the same safety standards must be applied to both.

7. Access to cylinder storage sites shall be limited exclusively to authorized personnel. Also, the necessary safety measures shall be taken at such sites to prevent the cylinders from falling, being hit, or handled by unauthorized persons.

Management of Non Hazardous Materials

Non hazardous materials include construction materials and worker support materials. It is important that during the management of these materials certain safety measures be taken, because, although they may not be hazardous, the safety of persons using them must be protected.

During the handling of these materials, safe loading procedures such as those established in the program shall be followed, both for hazardous as well as for non hazardous materials.

Construction Materials

In handling these materials, the purpose is to avoid any actions that can adversely affect health, on the basis of the Contractor's Safety and Health Plan, as established in the Panama Canal Authority materials management standard (2600ESS-110).

Certain general regulations must be kept in mind to ensure work safety when handling materials, such as the following:

1. Keep storage sites dry and free from obstructions. Also, a peripheral barrier is recommended to keep materials from coming in contact with any runoff.
2. When storing materials on shelves, their size shall be taken into account to prevent materials from protruding and causing accidents and/or obstructions in aisles. Likewise, it is of vital importance to ensure that the shelving is stable and has the necessary capacity for the use it is being given.
3. Light sources, vents, electrical installations, fire extinguishers, water or air intakes shall be kept free from obstructions during the distribution and storage of materials.
4. When stacking or piling up pallets, bags and/or containers, their shape and height must be taken into account in order to prevent them from collapsing or sliding.
5. Whenever the use of pallets is required, they must be inspected to ensure that they are in good condition and free from exposed nails.

6. Storage personnel shall be trained in methods for lifting, carrying, placing, unloading, and storing different types of materials.

Worker Support Materials

Worker support materials include food and personal use items. See the applicable regulations, such as the Labor Code of the Republic of Panama and the Panama Canal Authority Work Site Housekeeping Standard (2600 ESS-285).

Food Handling

Due to the features of the area in which the work will be performed, not all workers may have access to food refrigeration at work. The Panama Canal Authority Work Site Housekeeping Standard (2600 ESS-285) establishes the standard industrial health and housekeeping practices that are of mandatory compliance by Contractors. For more clarification, the following measures shall be taken at sites with food refrigeration, as well as those without it:

1. Refrigerators for food storage at work sites may not be used to store any item other than food.
2. Periodic maintenance shall be provided to refrigeration equipment to ensure its proper operation.
3. Foods that do not require refrigeration shall be stored in areas designated exclusively for such purpose.

4. All food containers shall have proper covers to prevent contamination by insects, rodents, or other disease vectors.

5. Appliances for food storage shall be kept at an acceptable temperature and humidity to preserve their contents.

6. Storage areas shall be inspected periodically to ensure that they are kept clean and in a condition that is appropriate for storage.

Storage of Materials for the Personal Use of Workers

The Labor Code of the Republic of Panama requires the employer to provide a safe place to store worker belongings that must be kept at the workplace by reason of the work.

Personal use items include, but are not limited to, kitchen utensils, tableware, flatware, paper items, detergent, soap, and other personal use items provided by Contractors at work sites. As mentioned above, Panama Canal Authority Work Site Housekeeping Standard 2600 ESS-285 establishes the standard industrial health and housekeeping practices and requirements that must be implemented at work sites and are of mandatory compliance by Contractors. The areas to store these items shall be designed to keep them at the temperature and humidity necessary to adequately preserve their contents. Storage of hazardous or non hazardous construction materials at these facilities shall not be permitted.

8.3.7.3 Inspection of Materials Storage Areas

Materials storage areas shall be inspected monthly to ensure the proper storage of all materials, their inventory, and that the aisles between the stored materials are kept free from obstructions to allow access to them. These inspections shall be recorded and included in quarterly operation reports.

Likewise, inspections shall be conducted at fuel storage areas at least weekly by recording the condition of tanks, containment dikes, sumps, and all related equipment. These documents, along with the daily inspection documents and fuel transfer logs, shall be attached to the quarterly operation reports.

Inspections of the personal use storage areas shall be conducted weekly for the purpose of ensuring their cleanliness, and their inspection documents shall be attached to the quarterly operation reports.

8.3.8 Socioeconomic and Cultural Program

For the purpose of integrating the Project's social aspects, this section has the objective of proposing measures to expand the positive impact, developing the prevention, and mitigation of, and/or providing compensation to the inhabitants in the Socioeconomic Study Area for, the impacts identified as negative. It also includes measures to protect the sites of historical, archaeological, paleontological, and cultural value previously identified in Project construction areas.

8.3.8.1 Measures to Promote the Greatest Stimulus to the National Economy

Construction Phase

Due to the magnitude of the Panama Canal Expansion Program – Third Set of Locks, the Panama Canal Authority recognizes a clear opportunity during the construction phase to continue maximizing benefits to the local economy and encourage the participation of businesses in the country in the contracts, subcontracts, and support services required for this phase.

The proposed measures to promote this positive impact are as follows:

1. Continue with the process of informing local enterprises about the characteristics and requirements established for each phase of the construction, in order to increase their awareness about them and allow them to prepare themselves in advance, as required.

2. Contractors shall relay such information to medium-sized and small businesses about the business opportunities that will be generated with the development of the contracts relative to the Panama Canal Expansion Program – Third Set of Locks.

Operations Phase

In the operations stage, it is not considered necessary to apply measures to promote this positive impact.

8.3.8.2 Measures to Promote an Increase in National Treasury Revenues

Construction Phase

During the construction phase, the measures to promote this positive impact will be similar to the measures established in the above item in order to enhance the stimulus to the national economy, as well as those mentioned in the following item with regard to providing support to job generation. Nonetheless, it must be added that during the construction of the third set of locks, the Panama Canal Authority will transfer operating surpluses to the National Treasury in an amount that will never be less than that of the surplus of 2005 or 2006[7].

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Operations Phase

In the Operations phase, the application of measures to enhance this positive impact is not considered necessary.

8.3.8.3 Measures to Promote Employment

It is recommended that this positive impact benefit the population of Panama to the extent possible.

Construction Phase

The measures proposed to achieve the above are as follows:

1. Promote the hiring of local manual labor according to recruitment requirements and general policies regarding the work and employment conditions, on the basis of the Equator Principles and the IFC Social and Environmental Sustainability Performance Standards.
2. Include in the bid specifications the dissemination of employment opportunities to the country's population through the mass media, as appropriate.

Operations Phase

Once the new facilities begin operations and there is a reduction in staffing requirements, the current support to the training programs through educational organizations will continue, in order to maintain the job offer to meet the new needs of the Canal.

8.3.8.4 Measures to Mitigate a Possible Increase in Population and Migration Flows Construction Phase

According to a study conducted by INTRACORP (2007), it is relevant to point out that the effects of internal population movements cause significant urban changes due to a constant displacement of people from rural to urban areas, mainly in search for a new and better quality of life, hoping to find a job, proper housing, access to health services, and higher education levels for their children. Some of these expectations may never be met and can become only a change of address, often into the so-called "spontaneous or informal settlements" in the periphery of the provinces of Panama and Colon.

In the event part of the people who migrate as a consequence of the Project tend to settle in locations adjacent or outside the perimeter of the areas controlled by the Panama Canal Authority, it will be necessary that both the Contractor and the Panama Canal Authority differentiate between the areas of their direct responsibility and those where they cannot intervene directly because they are outside the areas designated for their exclusive use.

Consequently, after determining their scope of direct influence, it is proposed that measures be agreed upon with the National Police, the Municipalities of Arraijan, Colon, and Panama, the

communities, and the Panama Canal Authority, in order to prevent squatters from settling in the Environmental Study Area.

Operations Phase

Measures established to prevent squatters from settling in the Environmental Study Area shall be kept up during the construction phase by coordinating and enforcing the actions agreed upon with the National Police, the Municipalities of Arraijan, Colon, and Panama, the communities, and the Panama Canal Authority.

8.3.8.5 Measures to Minimize Changes in Soil Usage

Construction Phase

In its Master Plan, the Panama Canal Authority has established its Cadastre and Titling policy through the Land Cadastre and Titling Program conducted by the National Agrarian Reform Directorate of the Ministry of Agricultural Development and the National Directorate of Patrimonial Property of the Ministry of Economy and Finance of the Republic of Panama.

Therefore, for the construction of the Project, the preparation of an integrated management plan for the Watershed and the updating of the region soils use plan are being proposed.

Operations Phase

During the operations phase, application and improvement of the Canal Watershed integrated management plan shall be continued, which should enhance the benefits from the increase in the level of Gatun Lake (facilities for transportation and fishing), as well as their effect on economic activities (agriculture and farming), that may result from changes in their current levels.

8.3.8.6 Measures to Mitigate the Impact on Vehicular Traffic Due to an Increase in Transportation Demand

Construction Phase

The following measures are being considered to meet the possible effects on transportation in the Environmental Study Areas:

1. Transportation of materials and machinery shall be done preferably by water or railroad.
2. Once in the Project area, heavy equipment and transportation vehicles shall keep to the Panama Canal Authority's internal road infrastructure.
3. In specific situations, when the use of the public road infrastructure is required, the pertinent actions shall be coordinated with the Panama Traffic and Land Transportation Authority

(*Autoridad del Tránsito y Transporte Terrestre – ATT)*, in compliance with the traffic regulations in force.

4. Any plan for the transportation of employees and materials to and from the work areas must be approved by the Panama Canal Authority.

5. Alternative measures shall be established for the communities of Costa Abajo de Colon in those cases when it becomes necessary to limit the use of the land access over Gatun Locks.

Operations Phase

Vehicle traffic in the Environmental Study Areas shall not be affected during the operations phase because of the Project, which means that it is not considered necessary to establish measures for this phase. Nevertheless, as soon as the construction of the new locks is completed, a new access shall be built in Colon.

8.3.8.7 Measures to Compensate for Impact on Public Infrastructure

Construction Phase

As mentioned in the chapter on impacts, the area where the construction work will take place is inside the areas under the exclusive administration of the Panama Canal Authority, and therefore, the public infrastructure to be relocated or altered shall be mainly its own, with only specific effects on certain public utilities.

Consequently, the measures proposed to mitigate this impact are as follows:

1. Build new transmission towers prior to the start of the construction phase to replace those that will be affected.
2. Take the necessary precautions to ensure that public infrastructures are modified without affecting their service.

Operations Phase

No mitigation measures are considered necessary for the Project operations phase.

8.3.8.8 Measures to Compensate for Impact on Private Structures

The elevation of the level of Gatun Lake to 27.1 meters PLD will affect approximately 66 private and community structures, 9 of them houses, 34 piers or docks, and some bohios, as well as water intakes, ponds, etc. In this regard, the information obtained by Moffat & Nichol / Golder in 2005 was subsequently updated by the Panama Canal Authority in 2006 and is an approximation to determine this effect.

Additionally, the construction of the water savings basins will affect the former town of Gatun (on the Atlantic side), four row houses located on Panama Canal Authority administered land, and a spiritual retreat center on the Pacific side.

On the basis of the above, the measures considered to compensate for this impact are as follows:

Construction Phase

1. Appraise the infrastructures that will be affected by the elevation of the maximum operating level of Gatun Lake.
2. Relocate (Resettlement Plan – Section 8.4.8.20) the users of the affected structures in coordination with the corresponding organizations or agencies, according to the legal situation of each case.
3. Prepare and implement a long-term Socioenvironmental Management Plan for the banks of Gatun Lake (Section 8.4.8.19). This Plan shall be for the purpose of determining, in detail, the structures (89 PLD) that will require compensation to their occupants or owners; conduct surveys and appraise the structures located on land managed exclusively by the Panama Canal Authority, as the starting point for any pertinent actions and to assist in meeting the objective of the Expansion Project of preventing any socioenvironmental impact and achieving a sustainable management of resources.

Operations Phase

No effect on infrastructures is expected during the operations phase. However, it is recommended that the Socioenvironmental Management Plan for the banks of Gatun Lake be maintained and improved.

8.3.8.9 Measures to Prevent the Risk of an Increase in Work-Related Illnesses

Construction Phase

The prevention measures considered for this impact, in addition to those in the Waste Management and Hazard Prevention plans are directed mainly to workers. These measures are as follows:

1. Implement the Solid Waste Management Program of the Panama Canal Authority for the identification of problems relative to the improper handing of solid waste and the design of alternatives using the proper technology according to the features of the region and the waste produced.

2. Strengthen the disease vector control Program of the Panama Canal Authority and the Panama Ministry of Health *(MINSA).* The aim of this program is to reduce the morbidity associated with vectors, such as those of leishmaniasis, malaria, Chagas, and dengue fever disease.

3. Keep health centers in the surrounding areas informed about the progress of the Project and the number of active personnel involved, so they may be prepared to provide emergency treatment, if necessary.

Operations Phase

No mitigation measures are considered necessary for the Project operations phase.

8.3.8.10 Measures to Prevent an Increase in Work-Related Accidents

Preventive measures considered for this impact will complement those covered by the Panama Canal Authority Occupational Health and Safety Plan, as follows:

1. Apply a strict policy of work safety education and information for Contractor and Subcontractor personnel.
2. Provide all workers with personal protection equipment according to Panama Canal Authority standards, and enforce their use at work sites;
3. Install the appropriate signage at work sites.
4. Implement preventive maintenance programs for machinery and equipment.

Also, compliance with the following general policies on working conditions shall be required according to the Equator Principles and IFC Social and Environmental Sustainability Performance Standards.

1. The Project shall provide workers with a safe and healthy work environment, considering the hazards inherent to their particular area and the specific hazards at their workplace, including physical, chemical, biological, and radiological hazards.

2. The Project will take measures to prevent accidents, injuries, and illnesses that may arise, are associated with, or occur during the course of the work, to minimize the causes of hazards to the extent practicable.

3. Consistent with good international industrial practices, the Project shall survey the various areas to identify possible hazards to workers, especially those that may pose a threat to their life, and establish prevention and protection measures including the modification, substitution, or elimination of hazardous conditions or substances; worker training; recording and submission of accident, illness, and occupational incident reports; and arrangements for emergency prevention, preparation, and response actions.

Operations Phase

No mitigation measures are considered necessary for the Project operations phase.

8.3.8.11 Measures to Prevent an Increase in Crime Levels

Construction Phase

Crime levels are not expected to increase significantly during the construction and operations phases of the Project; however, the following basic prevention measures or lines of action are proposed.

1. Disseminate and enforce the Project Code of Conduct;

2. Promote initiatives by organizations that could very well and effectively conduct mainly preventive programs and projects for unsafe civilian scenarios in the periphery of urban or semiurban focal points where the largest concentrations of migrants at an extreme poverty level may be located, even when they come from other areas of the metropolitan region;

3. Obtain co-sponsorship by several sectors (the Offices of Population Education and Integral Prevention of the Ministry of Education, the Ministry of Health Promotion Directorate, the National Police of the Ministry of Government and Justice, and the Youth Section of the Office of Social Development) and local governments of selected districts, for an integrated project to prevent violence and crime, and supervise the preparation and implementation of such project.

Operations Phase

Mitigation measures other than those provided for the construction stage are not considered necessary.

8.3.8.12 Measures to Mitigate Public Utility Overload

Construction Phase

In this case, and since this is an unavoidable impact, the necessary preventive actions must be taken to provide an adequate basic utility infrastructure to absorb such effects. The measures that must be taken to minimize this impact consist of the following:

1. Provide advance information to businesses and organizations regarding the features of the Project and their duration, so they may include an expansion of their operations in their planning, according to the needs generated by the construction stage.
2. When possible, use private services that complement services rendered by Government agencies, as in the case of solid waste management, as well as security and surveillance services.

Operations Phase

The direct demand for public utilities will decrease considerably during the operations stage of the expanded Canal. Nonetheless, indirect pressure on them will increase steadily from the beginning of the works because of the expected boom in the economic activities of the metropolitan zones of the Environmental Study Area. This permanent demand must be met by:

1. Promoting resource (energy and water) savings campaigns internally among Panama Canal Authority workers.

8.3.8.13 Measures to Mitigate an Increase in Waste Generation

Construction Phase

Increased waste will be generated during the construction phase by a greater number of workers and visitors to the area. In addition to mandatory Contractor compliance with the Waste Management Program actions in this Environmental Management Plan, the following measures are proposed to complement Panama Canal Authority Work Site Housekeeping Standard 2600 ESS-287, in order to mitigate the impact on the surrounding natural and socioeconomic environment:

1. Require that Contractors disseminate and enforce compliance by their employees of the requirements established by the Panama Canal Authority in its Materials and Waste Management Manual.
2. Establish well defined areas to supply foods and beverages, in order to prevent littering in other Project areas.
3. Install trash cans and signs in areas with greater worker and visitor density.

Operations Phase

Mitigation measures other than compliance with the Waste Management Plan included in this Environmental Management Plan and the Panama Canal Authority Materials and Waste Management Manual are not considered necessary during this phase.

8.3.8.14 Measures to Increase Tourism Flows

Construction Phase

The Project construction phase will create a positive effect on tourism as the magnitude of the works will undoubtedly attract visitors of all kinds, such as technicians and engineers, the international media, representatives of the shipping industry, insurance companies, financial organizations, interest groups from other countries, and the public in general from around the world who may be interested in the various aspects of the Project.

The following are among the measures being considered:

1. Include, as Contractor policy, the facilitation of such activities to the extent they do not interfere with the progress of the work, by means of guided tour programs, observation posts, tour schedules, and other measures to obtain the best advantage possible from this item and derive additional benefits even prior to the implementation of the Project operations, thereby maximizing the benefits to the local economy from the construction process.
2. Establish programs to exploit this source of income to expand the benefits from the Panama Canal System. This would require an increase the capacity for taking in visitors, not only at the current locks but at the new ones on both entrances, and also at intermediate points along the route from one ocean to the other.

3. Provide information and access to organize, both locally and internationally, tour packages for visitors from home and abroad.

Operations Phase

No mitigation measures are considered necessary for the operations phase of the Project.

8.3.8.15 Measures to Mitigate the Impact on Landscape

Construction Phase

The effects of the construction phase will be noticeable mainly in the industrial landscape throughout the Environmental Study Areas. The changes in the natural landscape, mainly due to the shape of the terrain and the construction of the Borinquen dikes, may be seen mainly from certain points located in the East Urban Zone and the West Urban Zone. These changes will occur with the excavations required on the Pacific Side, including the leveling of Cartagena Hill. Naturally, there will be other less obvious visual impacts.

Notwithstanding the fact that construction activities will increase public interest in general and will constitute an additional attraction for tourists, from the landscape point of view the impact will be negative and direct, as it will alter the harmony of the landscape in Project areas. In this context, it is important to mitigate the negative visual effect during this phase with the following actions:

1. Implement an effective control of dust and gas emissions to prevent the rising of gas clouds and/or particulate materials from chimney exhaust, as generated by activities such as excavation and blasting;

2. Disseminate literature about the ongoing work at lookouts set up by the Panama Canal Authority;

3. Minimize the time of visitor exposure to the excavation, reshaping and alignment of slopes and fills as soon as possible; and

4. Improve the visual aspect of excavation slopes and fills with replanted vegetation.

Operations Phase

As part of the studies, four very important locations were identified for lookouts on the Project area, i.e., the Bridge of the Americas, the Jose Dominador Bazan town site (the former Fort Davis), the Miraflores Visitors Center, and the Centennial Bridge, due to their nearness to major elements of the works and the number of persons who at any time may wish to see the changes in the landscape from these sites. At these lookouts, the natural background landscape would be disturbed by an industrial landscape, the Borinquen dikes, Post-Panamax ship traffic, and the new navigation channel which they will transit. These features can become attractions for onlookers.

For the purpose of maximizing the benefits of the Project from the visual impact of the works, the implementation of the following measures is considered pertinent:

1. Facilitate the access of the public to strategic lookouts on the Canal and its structures;

2. Disseminate literature on the works and the operation of the Canal, as well as its importance for international trade;

3. Keep up an adequate maintenance and permanent replanting of vegetation on excavation slopes and fills whenever possible.

4. Provide lookouts with the proper equipment, such as telescopes and other items.

8.3.8.16 Measures to Control the Impact on Known Archaeological Sites

It is considered that any type of effect on Pre-Columbian sites will be irreversible, as archaeological property is a non renewable resource.

The main impact is associated with the loss of the archaeological context. The activity that will generate the greatest impact on archaeological resources is that of earth movement during the initial phases of the construction stage.

Such earth movement can partially or totally raze Pre-Columbian sites. Therefore, it is important that the Panama Canal Authority consider the imperative need of implementing an archaeological program well enough in advance to prevent interruptions in its work schedule, as research work in archaeological sites is usually slow, and it is extremely difficult, if not impossible, to perform such work at a fast pace. It must also be considered that any sites reported (and their immediate surroundings) cannot be (and should not be) altered until archaeologists have completed their work, and the competent authority, which in this case is the National Directorate of Historic Patrimony, or *Dirección Nacional de Patrimonio Histórico* - DNPH-INAC, gives its approval.

The proposed mitigation measures are as follows:

Construction Phase

1. The hiring of a professional archaeologist for the implementation of an Archaeological Rescue and Salvage Plan;
2. Archaeological rescue and salvage, if applicable, under a plan that includes various office and field activities; and
3. A constant monitoring of earth movement for the purpose of detecting other unreported archaeological sites.

Operations Phase

Mitigation measures for the operations phase of the Project are not considered necessary.

8.3.8.17 Measures to Control the Impact on Unknown Archaeological and Paleontological Sites

Environmental inspectors shall supervise earth movement operations to check for the presence or archaeological and paleontological vestiges. If new and theretofore unknown archaeological sites are found, the following procedures shall be followed:

Construction Phase

1. Stop the activity that generated the discovery, in a radius of at least 50 meters.
2. Contact a professional archaeologist or paleontologist, as appropriate, and notify the competent authority (National Historic Patrimony Directorate - DNPH-INAC).
3. The professional archaeologist or paleontologist shall take the pertinent actions to record the removed substrata and assess the undisturbed context over a prudential period that may not affect Project work, but also may not detract from the quality of a detailed professional recording of information about the discovered site or sites;
4. The Panama Canal Authority shall take action to preserve these resources in the manner they were at the initial moment they were found. The Panama Canal Authority shall protect these resources and be responsible for their preservation until the competent authority informs it about the procedure to be followed.

Operations Phase

Mitigation measures are not necessary against effects on archaeological sites.

8.3.8.18 Measures to Mitigate the Impact on Indigenous Population

The indigenous population in the Project Environmental Study Area has already integrated itself into the urban culture and economy of the cities in the area. There is no documented traditional indigenous settlement within the Project Socioeconomic Study Area that could be affected by the Panama Expansion Program – Third Set of Locks. For this reason, there are no specific mitigation measures to be submitted for an indigenous population. Having already integrated into the general society and economy, indigenous people will benefit from this Plan's general socioeconomic measures.

8.3.8.19 Gatun Lake Socioenvironmental Plan

Environmental conditions in the Gatun Lake area of vital importance for the water supply of a significant part of the population of the Panama Metropolitan Region, as well as for the sustainable operation of the Canal. As part of the mitigation measures, the Panama Canal Authority will develop a management plan for Gatun Lake for the purpose of determining the structures that require a settlement or compensation to their occupants or owners, and conduct surveys and appraisals of the structures located in the strip under the exclusive administration of the Panama Canal Authority, for the purpose of using them as a starting point for any pertinent actions in achieving the objectives of the Panama Canal Expansion Project – Third Set of Locks by preventing any possible Socioenvironmental impacts and sustainable management of resources. For the purpose of complying with the provisions of the Plan, it is proposed that activities be conducted to include gathering basic information, conducting a detailed topographic survey of the area as well as a detailed inventory of its structures and infrastructures, and a socioeconomic characterization of the area. The details of this Plan are submitted in Annex 6.

8.3.8.20 Resettlement (Relocation) Plan

With adequate community participation, the Resettlement (Relocation) Plan seeks to provide adequate compensation for Project impact by proposing benefits, indemnity, and resettlement schemes, as well as ensure transparency and the effective participation of the families involved in the discussion of any alternatives and their control upon implementation. To such end, there must be advance planning starting with an inspection of the area where the work will take place, to establish an initial contact with reality and define the means of collecting the adequate data about the local context. Once such means is defined, the families and the features of their property will require a thorough socioeconomic and physical characterization in order to propose adequate compensation measures. The details of this Plan are submitted in Annex 6.

8.4 Monitoring and Follow-up Plan

8.4.1 Objective

The objective of the Monitoring and Follow-up Plan is to record the degree to which the prevention, mitigation, and compensation actions described in the Environmental Management Plan achieve their objective of minimizing the negative impact associated with the construction and operation of the Project. In order to show and document the achievement of the goals, it is necessary to collect and report key information that shows how the environmental variables have behaved and when the actions considered have been carried out, as well as their degree of effectiveness in preventing, mitigating, and compensating the environmental impact.

8.4.2 Functions

Environmental management will be performed by the Contractor with the assistance of an Environmental Specialist hired to provide this service. The Environmental Specialist, as mentioned in other sections of the Environmental Management Plan, will work directly with the Contractor's Environmental Coordinator in issuing directions and conducting specific activities.

The specific functions of the Environmental Specialist in charge of the monitoring shall include:

1. A Work Plan developed to implement the Environmental Management Plan. This Work Plan must provide for the identification of personnel, their responsibilities, field logistics, work schedules, their training, monitoring requirements, monitoring report forms, and communication and exchange of information with Contractors, Subcontractors, and the country's regulating agencies.

2. Follow-up of the technical environmental specifications established in the Environmental Management Plan for excavation, dredging, construction, and operation procedures, construction worker behavior patterns with regard to the environment, the environmental quality of Subcontractor work, compensation measures, and other elements the Environmental Mitigation Plan considers as necessary. Environmental monitoring personnel must observe all Project activities with regard to the proposed mitigation measures, and shall prepare the appropriate reports for each one of the following program and plans:

    a. Quality Control of Air, Noise, and Vibrations;

    b. Protection of Soils;

    c. Protection of Water Resources;

    d. Protection of Flora and Fauna;

    e. Waste Management;

    f. Materials Management;

g. Socioeconomic and Cultural factors;

h. Participation by the Citizenry;

i. Hazard Prevention;

j. Wildlife Rescue and Relocation;

k. Contractor Contingency;

l. Environmental Education;

m. Post-Operations Environmental Recovery;

n. Project Work Site Closure.

The Environmental Specialist shall have access to all information on the work of Contractors and Subcontractors, and shall also facilitate contact with their respective engineering and inspection teams to ensure that their work complies with the Environmental Management Plan. In the performance of his duties, the Environmental Specialist shall meet with the Contractor's Environmental Coordinator, who shall provide him with the required information. The Environmental Specialist in charge of the monitoring shall have the following responsibilities:

1. Conduct periodic monitoring activities to supplement the information collected daily and weekly by the Environmental Coordinator of the work;
2. Establish the overall priorities of the Follow-up and Monitoring Plan.
3. Maintain a Project data base on licenses and compliance;
4. Prepare all monitoring reports;
5. Enforce compliance;

6. Gather field data in conjunction with the Environmental Coordinator;

7. Prepare monthly reports on environmental conditions in the area affected by the Project, and on the implementation of the Environmental Management Plan; and

8. Report to the Contractor any noncompliance within 24 hours of same.

The joint responsibilities of the Environmental Specialist and the Environmental Coordinator shall include, without being limited to, the follow-up of actions to prevent erosion control and protect water resources, wildlife, and vegetation. Also, due to the nature of the area affected by the Project, the Environmental Specialist and the Environmental Coordinator shall follow up on environmental noise levels and the actions taken to keep them within a range tolerable to humans, the actions to protect air quality, the effects on infrastructures and utilities, and the promptness with which they are restored when interrupted. Also, they must follow up on Contractor relations with community members in order to minimize complaints due to the effects of construction activities.

8.4.3 Special Monitoring Aspects

In the field, the Environmental Specialist in charge of monitoring shall apply his best criteria at all times to ensure that the documentation on violations, auditing, and environment related events is forwarded to the pertinent Project staff. In turn, he shall inform the Contractor's Environmental Coordinator and the Panama Canal Authority about all such events.

8.4.3.1 Air Quality

The Air Quality Monitoring Program shall include the activities required to monitor the ambient air, the air quality of the working environment, and unpleasant odors.

Ambient Air Monitoring

Air quality monitoring shall focus on real time detecting contaminant concentrations with passive techniques in areas that are sensitive to this environmental aspect where there are sensitive receptors, or because the nature of the work performed.

Due to the current limited data on air quality to diagnose the base line conditions for this program, it is recommended that it be launched when construction work begins. Monitoring shall continue for the duration of construction activities, and subsequently on a yearly basis during Project operations, until the Canal is operating at full capacity.[8] The air quality monitoring program shall be updated yearly according to the results of the previous monitoring, in order to adjust the work schedule as required. Tables 8-2 and 8-3 show the details of the sites to be monitored, the techniques to be used, and their frequency and parameters.

8 Monitoring frequency may vary as results on the compliance of requirements are obtained, and will depend on any critical conditions arising during the construction stage, as well as the reduction in the intensity of activities affecting air quality.

Table 8-2

Ambient Air Quality Monitoring During Construction

Location	Monitoring Stage9	Parameters	Type of Monitoring
Clayton	Construction	PM10 and NOx	Passive
Pedro Miguel	Construction	CO, SO2, NOx, and PM10	Real Time (continuous)
Paraiso	Construction	CO, SO2, NOx, and PM10	Real Time (continuous)
Cocoli – Future location and water savings basins	Construction	NOx	Passive
South of Disposal Site T6	Construction	PM10	Passive
Jose Dominador Bazan Residential Development	Construction	PM10	Passive
Gatun – Future Location of Water Savings Basins	Construction	NOx	Passive
South of Monte Lirio Disposal Site	Construction	PM10	Passive

Source: URS Holdings, Inc.

Table 8-3

9 In all cases, monitoring shall be conducted over the duration of the work in the areas next to these sites.

Ambient Air Quality Monitoring During Operations

Location	Monitoring Stage	Parameters	Type of Monitoring
South of Disposal Site T6	Operations	PM10	Passive
Paraiso	Operations	CO, SO2, NOx, and PM10	Real Time (continuous)
Pedro Miguel	Operations	CO, SO2, NOx, and PM10	Real Time (continuous)
Clayton	Operations	PM10	Passive
Ancon	Operations	PM10 and NOx	Passive
Gatun – Future location of water savings basins	Operations	NOx	Passive

Source: URS Holdings, Inc.

The probable locations of air quality monitoring sites are shown in Tables 8-2 and 8-3.

On the basis of the duration of the construction stage and the sites to be monitored, it is estimated that air quality monitoring during this stage will cost approximately US$190,000.00. In the case of passive monitoring, it has been assumed that four of such monitoring events will be conducted per year throughout the duration of the work in areas adjacent to work sites (assuming a maximum of 4 years), and each monitoring event shall last one month. In the case of continuous monitoring, it has

been assumed that it will be done while work is performed at the sites next to the monitored locations.

In turn, the cost of monitoring during the operations stage is estimated at US$30,500.00. Assuming that 4 passive monitoring events are conducted per year depending on the results, after the first year they could be reduced to 2 monitoring events per year. Continuous monitoring can be conducted with equipment used during Project construction.

Working Environment Air Quality Monitoring

For the purpose of evaluating the exposure of personnel to chemical substances at workplaces during the construction stage, air quality must be monitored in such areas.

In view of the variability of this aspect, because of the features of the substances handled and the sources of emissions in the vicinity of each work site, this program must be defined in detail when selecting Contractors for the various types of work to be performed. For this purpose, at the time Project contracts are awarded, the selected Contractor shall comply with the following:

- Submit to the Panama Canal Authority for its consideration a preliminary identification of possible critical air quality sites.
- Once the field work starts, reconnoiter, assess, and control possible sites that may be vulnerable to contaminants, following the requirements of Technical Regulation DGNTI 43-2001.

- Implement a specific monitoring program at each work site (if applicable), depending on the results obtained with the above mentioned tasks.

With regard to the air quality monitoring of work sites during the construction stage, the distribution and number of work sites to be located on the Atlantic and Pacific sides is still unknown; therefore, an assumption has been made that there will be a total of 25 sites. Considering the above, it is estimated that the cost of such monitoring will be US$280,000.00 (4 monitoring events / 7 years[10] / 25 sites / US$400.00). It will be necessary to adjust the monitoring frequency according to the results obtained from the initial monitoring, as well as the provisions of Technical Regulation DGNTI/COPANIT 43-2001.

Odor Monitoring

Odor monitoring shall include the collection of information regarding odors found in the Project area, specifically in areas where work is performed constantly with heavy equipment, the blasting areas, and the solid and liquid waste disposal sites. To this end, a sample group of workers involved in such activities shall be consulted and an inspection conducted once a month during the construction phase. A positive detection of the members of this group must be followed with monitoring of the intensity of the odor by means of the olfactometer method, in order to determine its level.

Odor monitoring shall include at least the following:

- A determination of a source of emissions representative of the odor generating activity,

10 This number is a conservative assumption; nonetheless, it must be taken into account that the work will be performed in sequential phases at different work fronts, and that for the purposes of monitoring, real time may be reduced due to the duration of the work in each zone.

- A reading taken in the field at the identified receptors (work sites or posts) nearest to the source of emissions;
- Four readings taken with the field odor meter, three downwind and one upwind; as odor is dispersed by the wind, monitoring must be done in several directions. As mentioned previously, these readings will only be done if according to the opinions taken, the workers positively detect the odors.
- Record the data on ambient temperature, humidity, opacity, and wind direction.

The cost assigned to odor monitoring at work sites during the construction phase is of approximately US$52,500.00 (7 years / 25 sites – assuming this is the number of complaints per year / US$300.000). Odor monitoring during the operations stage is not expected.

8.4.3.2 Noise

From the analyses conducted as proposed in the impact assessment chapter, in addition to the receptors (mainly workers and Project personnel) nearest to the work sites, it is considered that the following sites will generate critical noise levels:

- Zone 2 – Gatun Locks – Receptors at Jose Dominador Bazan
- Zone 3 – Gatun Lake – Receptors at Gamboa
- Zone 5 – Pacific Locks – Receptors at Paraiso

Other sites also considered of interest, although they may not reach critical noise levels, are Pedro Miguel, Diablo, and La Boca.

For the purpose of monitoring noise generation and its potential effect on identified sensitive receptors, the following noise monitoring program must be implemented during the construction, due to the importance of the Expansion Project and the fact that, in general, noise generation at the various zones will continue for several years (see summary on Table 8-3):

Noise monitoring at field facilities and work areas: In these areas, noise dosimetry is proposed because the effect will be more of a work type. Initial monitoring for exposure of workers to noise must be conducted to determine the degree of mitigation required for the assignment of personal protection equipment. In addition to the above, monitoring of the exposure of workers and work sites to higher noise levels (over 85dBA) shall be conducted on a yearly basis and over the duration of the Project implementation.

In the case of workplace noise, the standard guideline is Resolution No. 506 of October 1996, whereby Technical Industrial Health and Safety Regulation DGNI-COPANIT 44-2000, Health and Safety Conditions in Working Environments where Noise is Generated (G.O. 24, 163).

Noise monitoring permanent stations shall be installed at Jose Dominador Bazan, Gamboa, and Paraiso (Zones 2, 3, and 5), which have been identified as critical sensitive noise receptors. It is proposed that monthly readings be taken with sound level meters during periods of at least 24 continuous hours, for the duration of the construction work at work sites near these zones. For Pedro Miguel, Diablo, and La Boca, the program will be a similar one; however, the reading periods shall be of 1 hour (both during the day shift as well as during the night shift), on a quarterly basis.

In any case, if detected noise levels exceed those established in the standards in force or the criteria defined in this Environmental Impact Study, the appropriate corrective or mitigation actions shall be taken.

For the purpose of determining the costs of noise monitoring at field facilities and work areas (noise dosimetry), the need to assess some 25 work posts was assumed, and therefore, the cost of the above monitoring is estimated at approximately US$87,500.00 (1 monitoring event / 7 years / 25 sites / US$500.00). Therefore, it has determined that the ambient noise monitoring cost will be approximately US$162,000.000 (12 monitoring events @ 24 hours / 5 years / 3 sites / US$600.00, and 12 monitoring events @ h / 5 years / 3 sites / US$300.00).

During the operations stage, the sources of noise would be ship traffic, which would increase by approximately 25% over current levels, and the routine maintenance and dredging of the waterway. No noise monitoring will be necessary during the operations stage, but only as required with regard to occupational health, for which the Panama Canal Authority standards and internal programs shall apply.

8.4.3.3 Vibrations

Blasting (noise) overpressure outside work areas and vibrations are controlled by the amount of explosives used, and the time fuses assigned to each blast. To confirm compliance with blasting limits, the contractor shall monitor the vibrations that result from blasting, on nearest residence and submit a report with the data.

Table 8-3a contains a summary of the vibration monitoring program proposed.

From the beginning of blasting activities, seismographs shall be installed at the following locations:

- Zone 2 – Gatun Locks – Receptors at Jose Dominador Bazan
- Zone 3 – Gatun Lake -- Receptors at Gamboa
- Zone 5 – Pacific Locks – Receptors at Paraiso

Also, the Contractor shall submit a list of other locations for the installation of seismographs, among them Diablo and La Boca, to measure the vibration produced by each blasting at sites designated by Panama Canal Authority Project supervisors. The blasting vibration records shall be provided to the Panama Canal Authority Project representative.

The Contractor shall videotape each blasting starting one minute prior to the blasting and ending one minute after it has been completed. The tapes or tape sections shall be identified properly and clearly for each blasting.

As part of the routine monitoring procedure, prior to and after blastings, the Contractor, in conjunction with the supervisor designated by the Panama Canal Authority, shall conduct structural integrity inspections on critical (sensitive) structures (for example, monitoring the width and length of cracks in the concrete and friezes). For this purpose, and as part of the Blasting Plan, the Contractor shall submit a detailed description of the structures to be monitored, showing their precise location.

The Contractor shall provide a weekly report to the Supervisor on the inspection results, attaching copies of the blasting tapes, the vibration blasting records, photographs, tables with details of the readings, a report of any eventual complaints, etc., with the recommended corrective and mitigation actions, and compensation.

Table 8-3a

Noise and Vibrations Monitoring Plan

Component	Location	Techniques	Frequency
NOISE			
Monitoring of work and ambient noise intensity	Work camps and areas	Noise dosimetry	Yearly during construction
	Jose Dominador Bazan, Gamboa, Paraiso, Pedro Miguel, Diablo, and La Boca	Sound level meters	Monthly during construction
VIBRATIONS			
Readings of vibrations transmitted through the soil to sensitive receptors, due to the impact of blasting (explosions)	Jose Dominador Bazan, Gamboa, Paraiso, and other sites proposed by the Contractor	Seismographs	For the duration of blasting
	Structures and/or major construction near blasting sites	Structural integrity inspections	Prior to and after each blasting
	Site of each blasting	Video tapes	Starting 1 minute prior to and up to 1 minute after each blasting

Source: URS Holdings, Inc.

The number of blastings that will be required during Project construction is still unknown. Therefore, the exact number of vibration monitoring events that will be needed cannot be

determined. However, considering the number of locations to be monitored, the techniques to be employed, and the magnitude of the Project, the cost has been estimated at approximately US$400,000.00. No blastings will be performed during the operations phase.

8.4.3.4 Soil

Soils monitoring shall focus on the assessment of conditions that can cause landslides. The contents of this section pertain to directives previously issued by the Panama Canal Authority to handle this problem.

Landslide Monitoring

The Program proposed for monitoring landslides shall consist of a permanent program, starting with the construction stage of access channels and the deepening of the existing navigation channels, particularly at the more landslide prone sites located in the Pacific Side, specifically, at Gaillard Cut. The proposed program shall be maintained throughout the operations stage of the Panama Canal Expansion. A summary of the proposed Plan is submitted on Table 8-4.

The Panama Canal Authority must officially adopt a Landslide Monitoring Plan with mechanisms, parameters, and performance indicators for environmental follow-up and control under the direction and supervision of the Geotechnical Section of the Panama Canal Authority Engineering Division. The Panama Canal Authority Geotechnical Section is already implementing this Monitoring Plan, and therefore, it is not believed that its official adoption will involve much additional cost. The essential elements of the proposed Monitoring Plan are as follows:

1. The establishment of a continuous Monitoring System in the Gaillard Cut section of horizontal slope displacements with the utilization of Electric Distance Measurement systems (EDM), and inclusion of the data in the Geographic Information System (GIS). The monitoring system must be established as soon as the dry excavation is completed, with monitoring every two weeks.

2. Continuous monitoring at landslide prone sites by skilled inspectors to establish evidence *in situ* of the existence of early landslide surface activity such as cracks, erosion furrows, percolation or formation of ponds at the head of the slope, all of them signs of instability that predispose terrain to considerable landsliding.

3. Monitoring and inclusion in a spatial analysis of the susceptibility to landslides, the quantity and intensity of rainfall, and their correlation with landslide monitoring data. A determination of the total previous cumulative rainfall over 7 days, 14 days, or monthly, in connection with a severe weather system forecast capable of causing landslides.

Detailed information on the Monitoring Plan can provide an efficient mechanism for landslide management and control in the areas already identified as most susceptible to landsliding. A Control Plan for imminent landslides detected by the monitoring program must be implemented to proceed according to the findings of the Monitoring Plan.

Landslide Control Plan

On the basis of the results of the Monitoring Plan, instability conditions must be identified to warrant an "Emergency Situation" statement that will activate a series of landslide control actions. Differentiation between a "Probable Slide" and an "Imminent Slide" will depend on significant evidence collected during monitoring.

According to the Panama Canal Authority Geotechnical Section, there are circumstances that justify a Probable Landslide code statement associated with processes considered as early signs of landslides, including:

1. Whenever an Electronic Distance Measurement (EDM) records a consistent orientation or the horizontal displacement is more than 30 millimeters, or the total cumulative value is more than 100 millimeters over the length of the actual resulting vector.
2. A severe weather system forecast with the probability of generating rainfall that may trigger significant landslides.
3. Total cumulative rainfall over 7 days, 14 days, or monthly prior to a severe weather system.
4. Small fissures or cracks observed in the field, indicative of slope displacement.
5. Observation of percolation or formation of ponds at the head of the slope.
6. Instrument reading in the field showing subsurface movement of the ground prism.

Landslide Response Protocol

1. **EDM**: Lateral displacement increments of 30 millimeters in one month, or yearly increments of more than 100 millimeters,
2. Three successive increments in displacement acceleration.
3. Total daily rainfall of more than the established "threshold value" limit, as a landslide trigger,
4. Significant cumulative rainfall representing extreme values that can potentially trigger landslides, and

5. Evidence in the field of early signs of landslide movements.

Table 8-4

Landslide Monitoring Plan

Component	Site	Techniques	Frequency
Measurement of horizontal displacements on slopes	Slopes in the Gaillard Cut area	Electronic Distance Measurement Systems	Every two weeks / permanently (Construction and Operations periods)
Visual inspection and record of evidence of early signs of landslide surface activity		Especially trained personnel (qualified inspectors)	Continuous / Permanent
Record of the quantity and intensity of rainfall		Rain gages already installed and operated by the Panama Canal Authority	Continuous / Permanent

Source: Prepared by URS Holdings, Inc.

It has been estimated that to monitor the soils conservation situation during the Project construction stage, an investment of approximately US$910,000.00 is required. The estimated annual cost of monitoring during the operations stage is of US$180,000.00.

8.4.3.5 Water Quality and Sediments

The objective of this Plan is to verify the efficiency and efficacy of the implementation of preventive and corrective actions under the Water Resource Control Program during the Project construction and operations stages that seek to minimize the impact on water resources. As stated above, it does not involve compliance with prevention and mitigation actions, but the results of its implementation.

Monitoring is the only way to verify that the actions implemented by the Contractor achieve the expected environmental protection and mitigation objectives. Monitoring is conducted by means of laboratory analyses of samples, and direct readings in the field. From the viewpoint of environmental variables, the efficacy of mitigation actions is determined by continuous or periodic monitoring to prevent the generation of unnecessary impacts.

The Contractor shall submit to the Panama Canal Authority a detailed work plan that includes the various monitoring activities to be conducted over given periods. The work plan shall be evaluated and approved by Panama Canal Authority representatives, who may suggest additional actions as they may deem appropriate. During the Project stages, the Contractor shall submit periodic reports on its various activities.

For an efficient attention to specific problems that may arise during Project activities, specialists on each of the work areas covered by this section shall be appointed. A sedimentology specialist will be required for the dredging and disposal areas.

The following monitoring plans are described below:

- Water and Sediment Monitoring Plan
- Disposal Site Drainage and Runoff Monitoring Plan
- Gatun Lake Chloride and Related Parameter Monitoring Plan

The following is a brief description of the scope of each plan to be developed by the Contractor. More details are available on Tables 8-5 and 8-6.

Water and Sediment Monitoring Plan

The implementation of impact prevention and mitigation actions can reduce the effects on water quality in coastal (1 and 6), lake (3), and land (5, 2,) areas. To a great extent, the frequency and number of sampling sites in the monitoring program depends on the intensity, duration, and extent of the dredging, excavation, and disposal of excess material. The monitoring plan shall include the measurement of parameters in the water column (ocean and lake), and surface (land), in order to identify the physiochemical conditions at each site being dredged or excavated, and at each disposal site.

Table 8-5 summarizes the water quality and sediment monitoring plan that can provide an effective method to identify effects at the time they occur, to be used to correct dredging activities, excavation, and disposal activities, especially during adverse weather conditions (intense rain, swells, etc.). This will allow the improvement of such activities to minimize any possible effects on marine, lake, and land environments. This type of monitoring plan has effectively been used in

dredging operations in several countries; it is a recognized method due to its effectiveness in operations of this magnitude (Marine Environment Monitoring Group, 2003). The plan shall include field data analyses to make adjustments in the manner in which the work is performed.

Disposal Site Drainage and Runoff Monitoring Plan

The purpose of monitoring the runoff in dredging and excavated material disposal site drainages is to determine whether the transportation of solids may deteriorate water quality and contribute to blockages in the Canal. Table 8.5 shows that water samples will be taken from the new drainages and the morphometry of the drainage patterns within the disposal sites.

Gatun Lake Chloride and Related Parameter Monitoring Plan

This Plan is based on the monitoring proposal included in the tropical lake ecology study conducted by URS Holdings, Inc. (2005). A series of sampling sites and permanent water quality parameter gage stations have been selected for the purpose of monitoring chloride and some complementary parameters.

Table 8-6 includes a summary of the parameters to be monitored, as well as sampling sites, techniques, and frequency.

The approximate cost of monitoring the water quality and sediments during the construction stage has been estimated at US$3,217,000.00, while its annual estimated cost during the operations stage is US$225,000.00.

Table 8-5 -- Water Quality and Sediment Monitoring Plan

Component	Features	Techniques	Fre
1 Water column (surface., middle, and bottom) in marine (1 and 6) and lake zones (3), at dredging sites; at the disposal sites of dredged and excavated material; and surface areas at the exit of dredged material disposal sites (2, 4, and 5)	1.1 Sediment Plume	Aerial photography and flyovers, covering all areas with dredging and disposal of dredged and water excavated material	2-3
	1.2 Light penetration	Secchi disc (m) measurement at several points to determine the transparency of water	Mo and firs twi sea rai nav dis are
	1..3 Turbidity / suspended solids	(i) use of water samplers at several depths, to determine concentrations at different depths (profile); (ii) use of turbidity meters calibrated against natural sediments (NTU)	
	1.4 Chemical compounds in the water	Analyses for trace metals, petroleum hydrocarbons, or halogenated hydrocarbons, suspended and in dissolved phase. Use AQC/QA techniques	
	1.5 Organic carbon particulate	Analyses for organic carbon particulates using the *Loss-on-Ignition* percentage, the CHN analyzer (for example, Carlo-Erba, Perkin-Elmer), or wet oxidation technique, followed by spectrophotometry.	
2 Hydrography of marine, lake, and land zones	2.1 Bed currents	Current meters	
	2.2 Short term flow	Direct reader current meter (DRCM), create depth profiles during tidal cycles in coastal zones (1 and 6), with buoys installed at the sites shown on Figure 8-6.	Mo dur onc mai adj
	2.3 Long term circulation	In coastal zones (1 and 6), use a current meter installed on the buoys shown on Figure 8-6, to record the depth profile continuously, and at least over one lunar cycle.	

Table 8-5 -- Water Quality and Sediment Monitoring Plan

Component	Features	Techniques	Fre
	2.4 Sediment movement	Place suspended sediment traps at key sites and various depths, in coastal (1 and 6) and lake zones (3). 3 traps must be installed in coastal zone (1), 8 in coastal zone (6), and 12 in Gatun Lake (zone 3), at the sites shown on Figure 8-7.	
	2.5 Morphometry and drainage pattern at the disposal sites of dredged and land excavated material	Use the elevation model to show changes in morphometry and site drainage patterns.	Yea upo con
3. Marine and lake bed (physical and chemical characteristics)	3.1 Depth	Sonar - transducer on a ship, corrected for tidal depth; if possible, the use of an Ecosonde tidal indicator. Side-scan sonar for area sweep, and dimensional interpretation.	Use Pan insp
	3.2 Bathymetry	Record marine and lake bed profiles; use sonar	
	3.3 Type of soft sediment	Subjective evaluation of sludge; color and texture (silty, sandy silt). Take sediment samples, perform granulometric tests using sieves for the coarser grains, and laser granulometry such as Malvern or Frisch, Coulter counter, or pipette analysis for finer grain, if it is <5% by weight. Use similar techniques with tipping material particles); use AQC/QA techniques.	Per at s rep adja nav disp adja
	3.4 Chemical compounds in sediment	Sediment sampling to perform digestion and atomic absorption or emission-plasma spectroscopy for metals, GCMS or HPLC for organic petroleum hydrocarbons by extraction and gravimetry, or GCMS. Use AQC/QA techniques.	
	3.5 Organic content of the sediment	Sediment sampling. Take carbon and nitrogen readings with a CHN analyzer or the wet oxidation technique for carbon, followed by the micro-Kjeldahl for nitrogen.	
	3.6 Redox balance of sediment	Depth measurements of the sediment with a platinum electrode, to obtain Eh and redox profiles at a discontinuous level.	

Source: Table 10-2 of the Environmental Impact Study, Category II – Widening and Deepening of the Pacific Entrance, PB Consult, March 2007.

Table 8-6

Gatun Lake Chlorides and Related Parameter Monitoring Plan

Component	Characteristics	Techniques	Frequency
Sampling for laboratory analysis (to be collected from the water column) in Gatun Lake (see Tables8-8, 8-9, and 8-10).	Total Dissolved Solids (TDS), Sulfates, Chlorides	Van Doorn or Diskin type bottles, with a capacity of 2.5 1.	During and until completion of construction and during operations, at the beginning and end of the dry and rainy seasons
Field measurements at 2 depths (bottom and surface).	Depth, temperature, electric conductivity, salinity, TDS.	With type SBE 19 Plus or similar manual instruments at all sampling sites (8-8, 8-9, and 8-10).	
	Temperature, TDS, conductivity, chlorides, and salinity.	Permanent water quality gage stations installed on buoys, capable of analyzing and transmitting information by telemetry.	1. Continuous recording.

Source: Prepared in-house based on URS Holdings, Inc., January 2005 Technical Memorandum No. 5. Tropical Lake Ecology Assessment with Emphasis on Changes in the Salinity of Lakes.

8.4.4 Inspections and Audits

8.4.4.1 Inspections

The matter of inspections is covered by Article 42 of Agreement 116 of July 27, 2006, which provides that the Administrator of the Panama Canal Authority shall conduct periodic inspections and monitoring to evaluate compliance with the actions and measures shown on the Environmental Impact Studies performed for the entire new project in areas under Panama Canal Authority administration. Likewise, and as part of the Agreement of October 2, 2006 between ANAM and the Panama Canal Authority, it has been established that inspections must be conducted during the implementation and evaluation phases of the Panama Canal Expansion Project – Third Set of Locks.

In addition to the above, regular inspections must be conducted by government agencies to provide follow-up of the actions established in the Environmental Management Plan and verify that their implementation is progressing properly. Likewise, special inspections must be conducted as the case warrants; for example, after reported accidental spills, or whenever any of the Panama Government agencies may consider it necessary, to ensure that the regulations under their jurisdiction and competence are being implemented adequately with the expected results.

The Environmental Management Plan monitoring and implementation reports shall be used as the starting point for regular inspections, and these reports shall be submitted by the Contractor to the Panama Canal Authority not later than the five days after the end of the reported month. During these inspections, the responsible Monitoring Specialist and the Contractor's Environmental Coordinator shall be available to provide any additional information as may be required for such inspections.

The staff in charge of the inspection shall have the authority to investigate matters at all levels of the operational organization at any time or place, and may point out to the Environmental Coordinator and/or the Contractor itself any non compliance with environmental standards.

The specific objectives of the inspections shall include:

1. A determination of whether the specific Project Environmental Management Plan actions are being adequately implemented by the Contractor or Contractors.
2. A review and an evaluation of the reports prepared by the Environmental Specialist responsible for the monitoring and by the Contractor's Environmental Coordinator;
3. A verification of the degree of compliance with environmental provisions;
4. Recommendations on actions to prevent, minimize, control, or mitigate Project construction impacts on the physical, biological, and socioeconomic environment.

8.4.4.2 Audits

The Panama Canal Authority shall conduct periodic audits to ensure Contractor compliance with its environmental obligations. Additionally, outside auditing shall be provided, in order to have a neutral party to examine and certify the Project's environmental performance.

8.4.5 Follow-Up, Surveillance, and Control of Specific Programs

8.4.5.1 Scope and Objective

The Panama Canal Authority shall implement follow-up, surveillance, and environmental control for the purpose of conducting a periodic, integrated, and permanent evaluation of the dynamics of the effects of environmental variables on the socioeconomic component, and recording the degree to which the prevention, mitigation, and compensation actions described in the Environmental Management Plan achieve its objective of minimizing the negative impact associated with the construction and operation of the Project.

This program shall establish the follow-up, surveillance and control actions to:

- Minimize the negative impact on the environment from the construction, operation, and closure of the work and facilities;
- Prevent accidents involving infrastructure or materials as well as construction work sites, the operation, and the closure of the work, and
- Minimize the adverse effects of environmental hazards.

In order to show and document the fact that the goals are achieved, it is necessary to compile and report key information showing how environmental variables behaved, when were the

recommended actions implemented, and their degree of effectiveness, in order to prevent, mitigate, and compensate for the environmental impact.

8.4.5.2 Responsibilities

The implementation of this Program must be organized with the participation of Contractors and Subcontractors, the personnel assigned to the environmental aspects of the Panama Canal Authority's Expansion Project, and the participation of other Government agencies.

According to Article 56 of Executive Decree 209 of September 5, 2006, the Regional Administration and the Environmental Quality Protection Directorate of ANAM, in conjunction with Sector Environmental Units shall supervise, control, and examine the compliance with the Environmental Management Plan on the basis of the follow-up, surveillance, and control program established in this Plan.

According to Article 57 of Executive Decree 209 of September 5, 2006, the Panama Canal Authority shall prepare and submit to the Regional Administration of ANAM periodic detailed reports and results regarding compliance with the Environmental Management Plan established in the Environmental Impact Study Resolution.

The Contractor shall submit to the Panama Canal Authority a detailed work plan that shall include the various activities to be performed over given periods. The work plan shall be evaluated and approved by Panama Canal Authority representatives, who may suggest additional actions as they may deem appropriate.

8.4.5.3 Follow-Up Measures

According to Executive Decree 209 of September 5, 2006, environmental follow-up is the group of decisions and activities planned for the purpose of ensuring compliance with the environmental agreements established during an environmental assessment process.

The Panama Canal Authority shall conduct a strict follow-up of all the activities prescribed in this Environmental Management Plan, by establishing a system for the documentation of all activities. An internal and outside auditing program will be a key element to monitor the Project's social and environmental performance.

The activities required by this Plan shall be verified by the Panama Canal Authority, and it shall enforce the compliance with environmental protection legislation and contract terms. The Panama Canal Authority may require that corrective action be taken on any measures that do not provide the expected results, in order to reduce significant environmental alterations. The personnel assigned to the environmental performance of the Panama Canal Expansion Program of the Panama Canal Authority shall monitor implementation of the actions proposed regarding the identified adverse impacts that may affect the environment and the communities. The implementation of this program during Project stages shall be done by means of a series of tasks that will include the inspection of activities, sampling, analysis of results, and preparation of reports.

8.4.5.4 General Control and Surveillance Measures

According to Executive Decree 209 of September 5, 2006, environmental control includes the inspection, surveillance, and application of the actions necessary to reduce or prevent the emission into the environment of contaminants from processes created by humans, be it into the water, air, or soils, and to abate any hazards to human health.

The application of the mitigation actions described in the Mitigation Plan (Section 8.4 of this Environmental Management Plan) shall control any potential adverse effects generated by Project activities. Inspection and general surveillance actions are described in sections 8.4.3, *Special Monitoring Aspects,* and in 8.4.4, *Inspections and Audits,* of this Plan.

The Panama Canal Authority shall keep the documentation of the control and surveillance activities, including a record of non conformance, the required corrective actions, assignment of responsibilities, performance deadlines, and verification of the required actions.

8.4.5.5 Specific Control and Follow-Up Measures

Control and follow-up actions, along with the frequency of verification, are summarized on Table 8-7.

8.5 Implementation Schedule

In general the EMP will be implemented throughout the life of the Project, including the design and planning, construction and operations phases. Many of the activities necessarily start during the Project design and planning phase, incorporating controls and protection measures as critical elements of the works design and continue with consultation and disclosure activities among stakeholders and communities. Table 8-8 presents a general schedule of EMP activities.

Table 8-8

General Schedule of EMP Activities

Activity	Beginning	Ending	Duration
Air Quality and Noise Control Program	Construction	Operation	Not determined
Soil Protection Program	Construction	Operation	Not determined
Water Quality Control Program	Construction	Operation	Not determined
Flora and Fauna Protection Program	Construction	Operation	Not determined
Waste Management Program	Construction	Operation	Not determined
Material Management Program	Construction	Operation	Not determined
Socioeconomic and Cultural Program	Design and Planning Phase	Operation	Not determined
Fauna Rescue and Relocation Plan	Prior to Cleaning and Clearing, by work area	New works commissioning	Construction Phase
Risk Prevention Plan	Design and Planning Phase	Operation	Not determined

Activity	Beginning	Ending	Duration
Contingencies Plan	Design and Planning Phase	Operation	Not determined
Citizen Participation Plan	Design and Planning Phase	Operation	Not determined
Environmental Education Plan	Construction Commissioning	Construction Closure	Construction Phase
Monitoring and Follow-Up Plan	Pre-Construction	Operation	Not determined
Reports	Design and Planning Phase	Operation	Not determined
EMP revision	Design and Planning Phase	Operation	Not determined

8.6 Citizen Participation Plan

8.6.1 Introduction

As it is commonly known, during every planning process, the diagnosis phase allows us to become aware of issues and identify their possible solutions and, thus, obtain information on the best way to intervene on the specific environment involved.

If there is an event that opens the possibility of citizens becoming involved to a certain extent during the diagnosis phase it is that of granting the people the right to express their opinion regarding the environmental resources management, through the provisions of the General Environmental Law and the standards regulating said law.

To that effect, a broad process of consultation and attention to the concerns and suggestions of the people interested in and possibly affected by the Project was set forth. Consequently, the result of performing the study described here is to make the Project as transparent as possible, so that the different risks to the people and the environment where they live and which sustains them may be acknowledged.

Upon considering the issues mentioned above, the citizen participation plan was developed, including the following:

- Record of the opinions expressed by some representatives of civil society;

- Interviews to exchange opinions with individuals representing the impact zone; and,
- Conducting a poll through the population of those communities which might be affected more directly by the implementation of the Project.

It is appropriate to point out that, to a good extent, the citizen participation process was initiated by the ACP during the year 2006, in light of the referendum conducted regarding this topic. In many cases, this encouraged those individuals who were consulted to say that they had information regarding the Project prior to the actual consultation phase. Some of these participation actions have been used as a reference for the presentation of this part of the report, and it is understood that one of the activities carried out was an extensive communication campaign prior to the referendum and, therefore, the Citizen Participation Plan focused on collecting opinions.

The survey took a look at the people's perception of the Project through a standard tool; simultaneously, they were able to obtain information on the Project from posters while the survey was conducted.

Therefore, not only a useful questionnaire was applied to collect answers to questions asked by the interviewers, but also an interactive session was conducted between the participants and the consulting team.

All this provided a broad view of the main concerns of the individuals interviewed regarding the Project and the need to introduce complementary mitigation measures to address these concerns.

Also, valuable information was collected regarding environmental degradation currently occurring

within the area of socioeconomic study or, in other words, the Project's reference zone. This served to alert Project promoters and key individuals of civil and political society with an interest on the subject about this environmental issue.

This should serve for these socioeconomic events, since they are the result of human actions, to be taken into account either to prevent their intensification or to put into practice mitigation measures independently from the implementation of the Project.

Another key aspect to be considered is that the Citizen Participation process is a dynamic process that should continue during Project construction activities, as well as during its operation, so that the people's main concerns regarding the project are addressed in a timely manner.

In that respect, this report summarizes the information gathered during this consultation process, as well as the guidelines to follow during the Project's construction and operation phases, so that a proper community relations program is established. Prior to presenting the results of the citizen participation activities developed for this EIS, we present a background summary of the disclosure and consultation process developed and promoted previously by ACP.

8.6.2 Previous Citizen Disclosure and Consultation Activities

As indicated above, as part of the activities related to the October 2006 referendum, the ACP carried out an extensive disclosure process. This process lasted 6 months and included different topics related to the Canal expansion proposal. The activities included the following:

Media participation. The ACP participated in 1,088 information and opinion radio and television programs.

Presentations: 2,088 informative presentations were made prior to the referendum, which explained in detail the expansion proposal; this effort made available the information directly to more than 235,692 Panamanians throughout the nine provinces and the Kuna Yala rural district.

Telephone line: ACP spokesmen took care of the free telephone line number 800-0714 "ACP RESPONDS" (from 9 a.m. to 9 p.m.) where they received 21,268 telephone calls from all over the country during the period May 29 through October 20, 2006.

Website: From April 25 to December 31, 2006, 5,160,991 visits to the ACP website (www.pancanal.com) and 1,056,317 downloads of the Canal expansion proposal through the construction of a Third Set of Locks, were registered.

E-mail: 4,600 questions were resolved through the e-mail address ampliación@pancanal.com (this address was active during the period of information of the expansion proposal).

Mobile units: The two mobile units of the ACP visited 63 townships within the provinces of Chiriqui, Herrera, Veraguas, Colon, Darien, Cocle, Los Santos and Panama and were visited by 10,120 persons.

Information centers: The Center, located in Building 714 at El Prado Avenue in Balboa, received approximately 1,800 visitors (it may still be visited to seek information). The ACP also made available to all citizens the expansion proposal at its information centers or ACP-Info plazas

throughout the country. The 17 Info plazas set up throughout the country took care of over 34,000 people.

Other: The day after the presentation of the expansion proposal for the construction of a third set of locks 250,000 inserts were included in all national newspapers. A total of about 820,000 inserts of the expansion proposal were distributed. The ACP also took care of the public in information stands and booths, and brochures placed at strategic locations where over 275,000 issues of the expansion proposal were distributed. Around 285,000 information materials (expansion proposal issues, graphic brochures and leaflets) were distributed in order to attend to different requests from schools, associations, government agencies, presentations and other activities.

Besides the above-mentioned disclosure efforts and as part of the Projects environmental impact evaluation process undertaken in light of the implementation of the Canal Expansion Project – Third Set of Locks, the ACP has developed diverse citizen participation processes. The activities conducted as part of these citizen participation processes may be summarized as follows:

- Category II EIS – Cerro Cartagena Earthmoving and Leveling: Interviews, leaflet hand-out, two informative meetings with the communities of Pedro Miguel and Paraiso, and publishing of press releases in the media.
- Category II EIS – Pacific Entrance Channel Widening and Deepening: Hand-out of 242 leaflets, 2 informative meetings with residents of La Boca and Diablo, and an informative meeting with business representatives from La Boca, Diablo, and Amador.
- Category I EIS – Site T6 Population Project: Interviewing key individuals from the community and applying 113 surveys to residents of Paraiso and Pedro Miguel.

8.6.3 Citizen Participation in the Panama Canal Expansion – Third Set of Locks Project

The Citizen Participation Plan Developer as part of this environmental impact study included surveying the people's opinion through polls, as well as interviewing key individuals individually and in groups.

8.6.3.1 Citizen Participation Polls

The survey took a look at the people's perception of the Project through a standard tool; simultaneously, they were offered information on the Project. Consequently, the process included not only applying a Standard tool to gather data through the questions made by the interviewers, but also an interactive session between the participants and the consultation team. This section presents the criteria used to define the population to be surveyed, the tools used, and the results obtained from this process.

Determining the sample of home surveys

Based on the inhabited localities of the Socioeconomical Study Area (SSA), an estimate of the population to be surveyed was made, which represents the reference sample from which the size of the relevant sample was determined (Table 8-9).

The main parameters used to estimate the sample were based on:

a) **Z**=Level of confidence: 95%=1.96

b) **e**=Sampling error = 4 %

c) **N**=total number of observations in the population = 351,800 homes.

d) Type of sample: probabilistic, stochastic and proportional. The events studied were considered as equally probable and improbable of occurring: **p=q**

e) Estimation formula (Garcia Ferrando, 2000) :

$$\frac{Z^2Npq}{Ne^2+Z^2Npq}$$

The resulting 599 homes amount was estimated based on these parameters. It was agreed to add 71 units to this number, considering an average annual increase of approximately 2% which allowed for updating the size of the sample, due to demographic growth. The ultimate estimated total of permanently occupied homes to be worked on was 670 (Table 8-9).

Table 8-9

Estimated and Updated Sample for the EIS

Number of observations in the population (N)	Estimated Sample	Updated Estimated Sample	%

351,800	599	670	0.19

Source: URS Holding's consultants team. Citizen participation poll, April 2007

Although the selected universe was subdivided according to the socioeconomic areas defined herein, (Table 8-10), we wish to point out that for the purposes of analyzing the results, the sample treated was the total resulting from the SSA; that is to say, the sample was not broken down by socioeconomic areas and certainly not by specific survey-included sites, because it was considered of little statistical significance when speaking of separate universes.

Based on said total sample, a distribution by inhabited locality was assigned to the relative weight that each of these localities had on the SSA. This resulted in various inhabited localities not being surveyed due to their little representation (less than 3 polls) in the final sample total.

On the other hand, Gatun Lake was specifically considered as a separate status, inasmuch as its original weight was multiplied by four (from 23 to 92 homes) so that every locality was represented in the opinions, given that this population is of particular importance to the ACP.

However, the rest of the areas were kept within the parameters established in the global sample estimation described above. In other words, even though when determining the sample these areas should be assigned 572 homes, actually the work was done with 578 homes.

In these cases, another inhabited locality close to the same socioeconomic area was added (when there was a home to survey) or no poll was taken simply because the estimation was not enough to do so. This happened with the socioeconomic area of Taboga Island.

Table 8-11 presents the final distribution of the houses-homes sample related to the above-mentioned socioeconomic areas; and Table 8-10 shows the composition per inhabited locality / township.

Table 8-10

Inhabited Localities, Per Socioeconomic Area, District, and Township of Location

Area	District	Township
Gatun and Costa Abajo de Colon	Capira	Ciri de los Sotos (Los Chorros de Ciri), La Trinidad (La Tagua)
	Colon	Ciricito, Cristobal, Escobal
	La Chorrera	Santa Clara, Amador, Arosemena, El Arado, Iturralde, La Represa, Mendoza,
Urban on the East Pacific Side	Panama	Ancon, 24 de Diciembre, Bella Vista, Betania, Curundu, El Chorrillo, Juan Diaz, Calidonia, Las Cumbres, Mañanitas, Parque Lefevre, Pedregal, Pueblo Nuevo, Rio Abajo, San Felipe, San Francisco, Santa Ana, Tocumen.
	San Miguelito	Amelia Denis de Icaza, Arnulfo Arias, Belisario Frias, Belisario Porras, Jose Domingo Espinar, Mateo Iturralde, Omar Torrijos, Omar Torrijos, Rufina Alfaro and Victoriano Lorenzo.
Urban on the West Pacific Side	Arraijan	Arraijan (Cab.), Cerro Silvestre, Juan D. Arosemena, Nuevo Emperador, Veracruz, Vista Alegre
	La Chorrera	Barrio Balboa, Barrio Colon, El Coco, Feuillet, Guadalupe, Playa Leona, Puerto Caimito
Urban on the Atlantic Side	Colon	Barrio Norte, Barrio Sur
Transisthmian Corridor	Colon	Buena Vista, Cativa, Limon, Nueva Providencia, Sabanitas, Salamanca, San Juan, Santa Rosa

Area	District	Township
	Panama	Chilibre
Taboga	Taboga	Taboga

Source: URS Holding's consultants team. Citizen participation poll, April 2007

Table 8-11

Distribution of Sample Population According to their Socioeconomic Area

Region	Houses	%
Gatun and Costa Abajo de Colon	92	13.7
Urban on the East Pacific Side	401	59.9
Urban on the West Pacific Side	115	17.2
Urban on the Atlantic Side	16	2.4
Transisthmian Corridor	46	6.9
Total	**670**	**100.0**

Source: URS Holding's consultants team. Citizen participation poll, April 2007

Table 8-12

Distribution of Sample Population According to Inhabited Locality / Township

Community	Frequency	%	Accumulated %
Lagartera Grande	4	.6	.6
La Arenosa	9	1.3	1.9
Lagarterita	7	1.0	3.0
Caño del Gigante	1	.1	3.1
Nuevo Porvenir	2	.3	3.4
Escobal	31	4.6	8.1
La Ullama	1	.1	8.2
Los Cedros	2	.3	8.5
Ciricito	2	.3	8.8
El Congal	2	.3	9.1
Cuipo	4	.6	9.7
Pablon	1	.1	9.9
Nuevo Ciricito	1	.1	10.0
Los Laguitos	2	.3	10.3
Los Chorros del Ciri	3	.4	10.7

Community	Frequency	%	Accumulated %
La Laguna	5	.7	11.5
Pueblo Nuevo	1	.1	11.6
Gamboa	10	1.5	13.1
Santa Rosa	1	.1	13.3
Guayabalito	3	.4	13.7
Las Cumbres	34	5.1	18.8
Bethania	22	3.3	22.1
Carrasquilla	18	2.7	24.8
Las 500	19	2.8	27.6
San Antonio-Tocumen	47	7.0	34.6
Monte Oscuro	7	1.0	35.7
Pedregal	18	2.7	38.4
Auto Motor	15	2.2	40.6
Villa Guadalupe	5	.7	41.3
Pueblo Nuevo	9	1.3	42.7
Rio Abajo	12	1.8	44.5
Juan Diaz	19	2.8	47.3
Don Bosco	17	2.5	49.9
Parque Lefevre	18	2.7	52.5
Chilibre	17	2.5	55.1

Community	Frequency	%	Accumulated %
San Juan	5	.7	55.8
Sabanita	6	.9	56.7
Buena Vista	3	.4	57.2
Providencia	2	.3	57.5
Limon	2	.3	57.8
Salamanca	1	.1	57.9
Cativa	10	1.5	59.4
Arraijan	68	10.1	69.6
La Chorrera	47	7.0	76.6
Colon City	16	2.4	79.0
Samaria	19	2.8	81.8
Gonzalillo	4	.6	82.4
Chorrillo	11	1.6	84.0
Arnulfo Arias	9	1.3	85.4
Amelia Denis de Icaza	13	1.9	87.3
Omar Torrijos	10	1.5	88.8
San Felipe Catedral	4	.6	89.4
San Isidro	5	.7	90.1
Santa Ana	11	1.6	91.8

Community	Frequency	%	Accumulated %
Bella Vista	15	2.2	94.0
Ancon	4	.6	94.6
Calidonia	10	1.5	96.1
Belisario Frias	18	2.7	98.8
Nuevo Veranillo	8	1.2	100.0
Total	670	100.0	

Source: URS Holding's consultants team. Citizen participation poll, April 2007

Tools Used

An Informative Poster (Annex 6) was prepared, summarizing the Project, which was used for each surveyor to have information on the Project at the moment of the interview. This poster was particularly useful when the persons interviewed did not have any information on the project. Each surveyor had one informative poster during this phase and could provide the explanations required in each case.

A poll consisting of two main sections was designed; the first section was destined to gather general data on the individual interviewed and his/her community, and the second section was to get their opinion on the Project. Annex 6 presents a model of the survey applied as well as the polls taken.

Results from the citizen participation polls

Below we present the main results obtained from the citizen participation polls. In general, we present the data pertaining to all the localities within the universe of interest as a whole.

General Characteristics of the populations consulted within the SSA

First we may say that distributing the family heads who offered their points of view by sex revealed a majority of men exercising this role. Six out of every ten homes had a male as head of the family; this is very similar to the official reports that refer to this aspect within the townships involved. (Table 8-13).

Table 8-13

Sex Distribution of the Family Heads

within the SSA

Sex	No.	%
Female	255	38.1
Male	415	61.9
Total	670	100.0

Source: URS Holding's consultants team. Citizen participation poll, April 2007

Distributing all consulted family heads by age shows that the population is mostly young and productive in this historical stage. Almost 70% of the family heads interviewed declared to be from 25 to 59 years old. (Table 8-14)

Table 8-14

Age of Family Heads within the SSA

Range	No.	%
< 25	38	5.7
25 to 44	271	40.4
45 to 59	196	29.3
60 and older	165	24.6
Total	670	100.0

Source: URS Holding's consultants team. Citizen participation poll, April 2007

Regarding the schooling level of the population within the SSA, it became evident that they have a medium to high education level. This is illustrated on Table 8-15, which shows that the education distribution of family heads tends to range between the high school and university levels. Only a 25% or the reference universe has but an elementary schooling level. This actually reflects the educational characteristics of the population of the metropolitan area, which is where the individuals who were consulted live.

Table 8-15

Schooling of Family Heads within the SSA

Level	No.	%
No schooling	16	2.4
Elementary	163	24.3
High school	335	50.0
University	156	23.3
Total	670	100.0

Source: URS Holding's consultants team. Citizen participation poll, April 2007

In general, most of the population who participated in the citizen consultation had very similar demographic characteristics to the rest of the population universe within the SSA; this may be seen on the baseline report on the socioeconomic aspects of this study.

Tables 8-16 to 8-18 refer to the percentage of times that the population mentioned the issues they perceived at their home, community and environmental levels. Those issues with a significant percentage were selected; the first order including those with a 30% or more and the second order included those with a lower percentage but not less than 10%. The rest was considered of too little significance to be mentioned.

In this sense, less than 30% of the individuals consulted within the socioeconomic areas of Gatun Lake – Costa Abajo de Colon and the East and West Pacific Sides, mentioned the issues perceived as most important. Only in the Atlantic Urban area and the area of the Transisthmian Corridor, over 31% and 34.8% of the participating population felt and expressed that unemployment was an issue in their respective areas (Table 8-13). However, unemployment did represent a secondary order for the group of individuals consulted in both Pacific Side areas. And so did lack of provision of public services to the population within the Transisthmian Corridor area, which was mentioned by 15.2% of said total (Table 8-16).

Table 8-16

Home Issues per Percentage of Times Mentioned by the Population within the SSA, by Socioeconomic Area

% of times mentioned	Socioeconomic Area				
	Gatun and Costa Abajo de Colon	**Urban East Pacific Side**	**Urban West Pacific Side**	**Urban Atlantic Side**	**Transisthmian Corridor**
30% and over	None	None	None	Unemployment (31.3%)	Unemployment (34.8%)
Over 9% but under 30%	None	Unemployment (14.7%)	Unemployment (16.5%)	None	Public services (15.2%)

Source: URS Holding's consultants team. Citizen participation poll, April 2007

It is worth mentioning that individuals interviewed in farms or agricultural facilities did not mention having any issues representing a minimum relevant percentage poll result.

At the community level, the polls identified mainly two first order issues: lack of infrastructures and roads. These two issues had a high mentioning percentage both in the Gatun Lake and Costa Abajo areas, and a little lower but also of first order of importance, in the urban on the Pacific Side and the Transisthmian Corridor areas (Table 8-17).

Crime and lack of security appeared as another issue perceived as highly important by the

individuals consulted both in the East Pacific Side and Urban Atlantic Side areas, with 38.7% and 37.5% of their respective populations (Table 8-17).

Unhealthy conditions and unemployment were perceived among community issues mentioned by at least 10% of the individuals consulted in each of the socioeconomic areas considered, except in Gatun Lake and Costa Abajo.

Table 8-17

Issues Perceived in Communities, Per Percentage of Times Mentioned by the Population within the SSA, by Socioeconomic Area

% of times mentioned	Socioeconomic Area				
	Gatun	**Urban East Pacific Side**	**Urban West Pacific Side**	**Urban Atlantic Side**	**Transisthmian Corridor**
30% and more	Infrastructures and roads (63%)	Crime and Insecurity (38.7%)	Infrastructures and roads (49.6%)	Crime (37.5%)	Infrastructures and roads (45.7%)
Over 9% but under 30%	None	Infrastructures and roads (16%)	Crime and Insecurity (14.8%)	Unhealthy Conditions (25%)	Crime and Insecurity (19.6%)
		Unhealthy Conditions (16%)		Unemployment (18.8%)	Unemployment (19.6%)

Source: URS Holding's consultants team. Citizen participation poll, April 2007

With regards to the environment, only in the Urban Atlantic Side area 30% or more of the

individuals consulted raised the issue of general pollution. That is to say, pollution of the different natural resources found in the area (Table 8-18).

Inefficient waste management was mentioned in a secondary order by the population of the following areas: Transisthmian Corridor, Urban on the East Pacific Side (mentioned a 15.2% of the times in both cases) and the Urban Area on the Atlantic Side, in which one-out-of-four individuals consulted in this area of Colon, indicated that this was a problem.

Table 8-18

Perception of Environmental Issues, Per Percentage of Times Mentioned by the Population within the SSA, by Socioeconomic Area

% of times mentioned	Socioeconomic Area				
	Gatun	**Urban East Pacific Side**	**Urban West Pacific Side**	**Urban Atlantic Side**	**Transisthmian Corridor**
30% and over	None	None	None	General pollution (31.3%)	None
Over 9% but under 30%	General pollution (17.4%)	Inefficient waste management (15.2%)	General pollution (15.7%)	Inefficient waste management (25%)	General pollution (19.6%)
		General pollution (13%)			Inefficient waste management (15.2%)

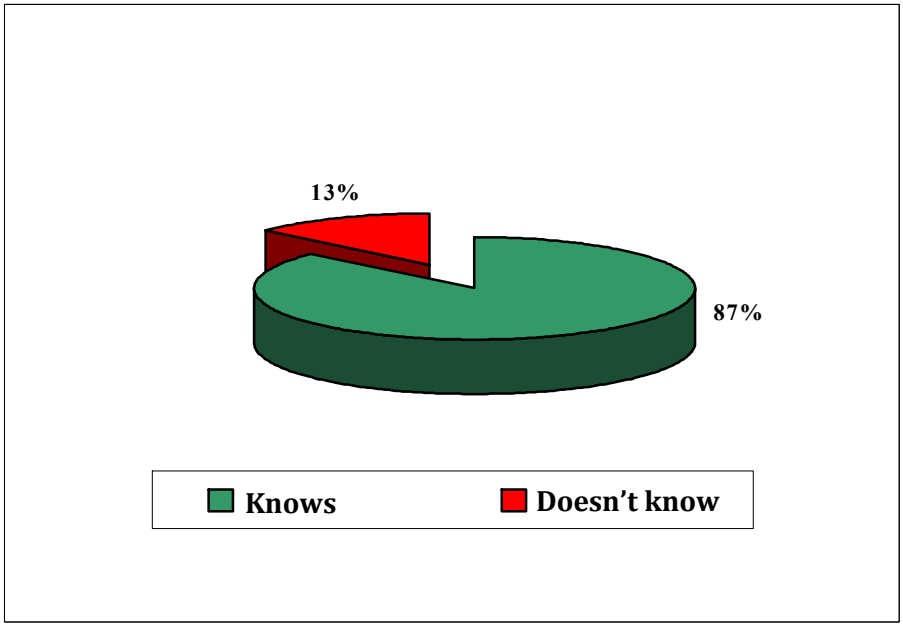
Source: URS Holding's consultants team. Citizen participation poll, April 2007

How the Community Perceives the Project

The first question to the population consulted was whether they knew about the Canal expansion project or not. The results of the poll were that almost nine out of every ten heads of family within the whole area said that they knew something about it (Chart 8-1).

Chart 8-1

Level of Knowledge on the Project of Population of SSA



Source: URS Holding's consultants team. Citizen participation poll, April 2007

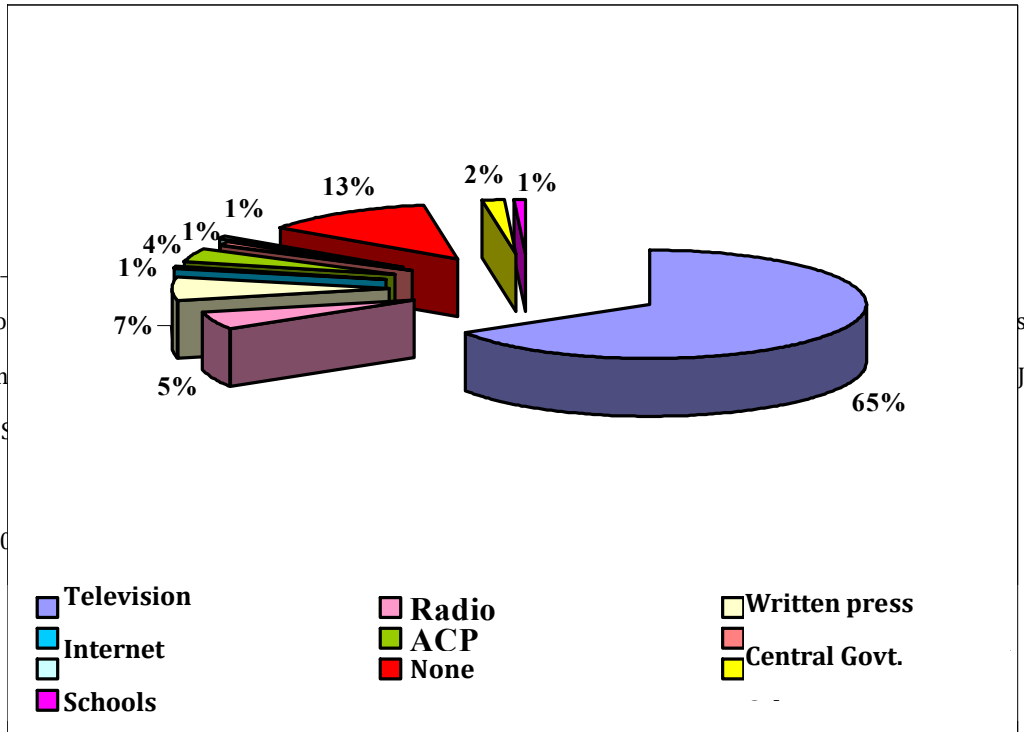
When individuals consulted through the citizen participation poll were asked about the source or means by which they had come to know about the Project, 65% said that it was through the television. The rest of the sources did not show a percentage of over 7%, such as overall written press (Chart 8-2).

This seems to be related to the television programs mentioned above, promoted by the ACP.

Up to this point, the team relied exclusively on the answers from the population interviewed, base on their own vision of the Project. From this point forward, the survey team proceeded to give out information on the Project. With this information at hand, the team started inquiring about the population's perception regarding the implementation of works of this sort and characteristics, as indicated on the poster used for these purposes. Below we describe the population's perception regarding the possible impacts, as well as some suggestions on decision-making to face them.

Chart 8-2

Source of the Information Obtained on the Project



Firstly, it became apparent that at the home level the majority (69.3%) thought that the Project will neither have a positive impact on their lives, nor a negative impact. In other words, individuals polled thought that the alleged benefits from the Canal expansion will not reach their homes, except for 24.8% of them. Very few of those who answered this question indicated that there would be negative impacts on their homes due to the Project (Table 8-19).

Table 8-19

Perception of the Population within the SSA on Impact

Of the Project, By Reference Environment

Environment	Level of Impact			
	No answer %	Positive Impact %	Negative Impact %	No Impact %
Their home	1.0	24.8	4.9	69.3
Their farm	71.0	1.5	0.9	26.6
Their job	19.1	15.2	2.1	63.6
The environment	13.9	6.9	32.5	46.7
Their community	2.5	49.1	9.6	38.8
The Country	0.9	86.8	7.5	4.8

Source: URS Holding's consultants team. Citizen participation poll, April 2007

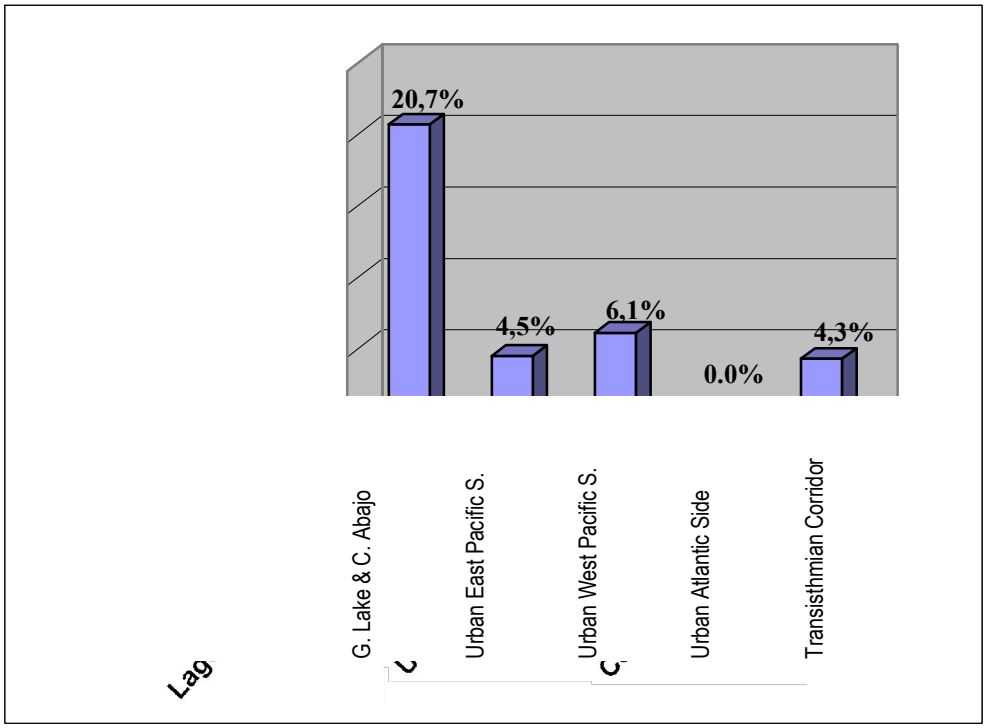
On the other hand, those who had agricultural farms did not see a significant reason in the implementation of the Project to expect impacts affecting their premises; Table 8-19 is eloquent in this respect. It is worth noting on said table that almost a 30% of the polled population had a farm. This population was almost exclusively located within the Gatun Lake socioeconomic area.

When asked about their jobs (or labor activity), the answer was similar to that regarding the expected impact on their homes. Over 60% thought that their jobs would not be affected (neither for better nor for worse); on the other hand, the percentage of those who bet on positive impacts was slightly higher (15.2%) than that of those who foresaw negative impacts on their jobs (2.1%).

The individuals consulted anticipated that the environment would be the space or ambit most affected by negative impacts.

Chart 8-3

Population Expecting Positive Impacts on the Environment, by Socioeconomic Area



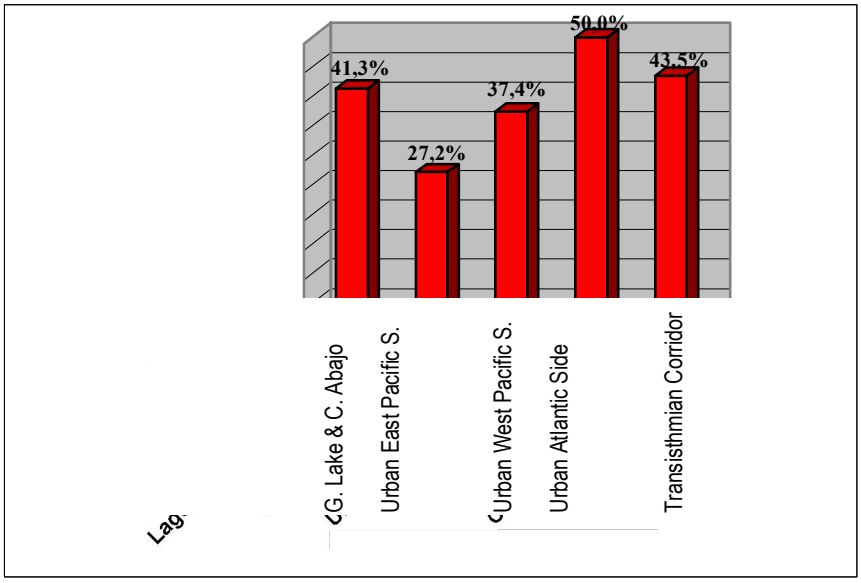
Source: URS Holding's consultants team. Citizen participation poll, April 2007

Therefore, about one third of the individuals polled pointed out this possibility (Table 8-19). At this level, opinions were not very inclined to expecting positive impacts; only 6.9% of individuals polled were. The majority – 46.7% – thought that there would be no impacts whatsoever on the environment (Table 8-19).

Throughout the different socioeconomic areas within the entire SSA there was not an homogeneous opinion; this low percentage contrasts with the moderate, but significant, relative importance of the population of Gatun Lake, which thought that there will be positive impacts on the environment of their respective socioeconomic area (Chart 8-3). On the other hand, the people of Colon seemed to be the least supportive of the idea of this Project generating beneficial impacts on the environment: there was no favorable opinion in this respect in the Urban Atlantic area and very few in the Transisthmian Corridor area, mostly consisting of the populations from the District of Colon (Chart 8-3 and Table 8-19).

Chart 8-4

Population Expecting Negative Impacts on the



Source: URS Holding's consultants team. Citizen participation poll, April 2007

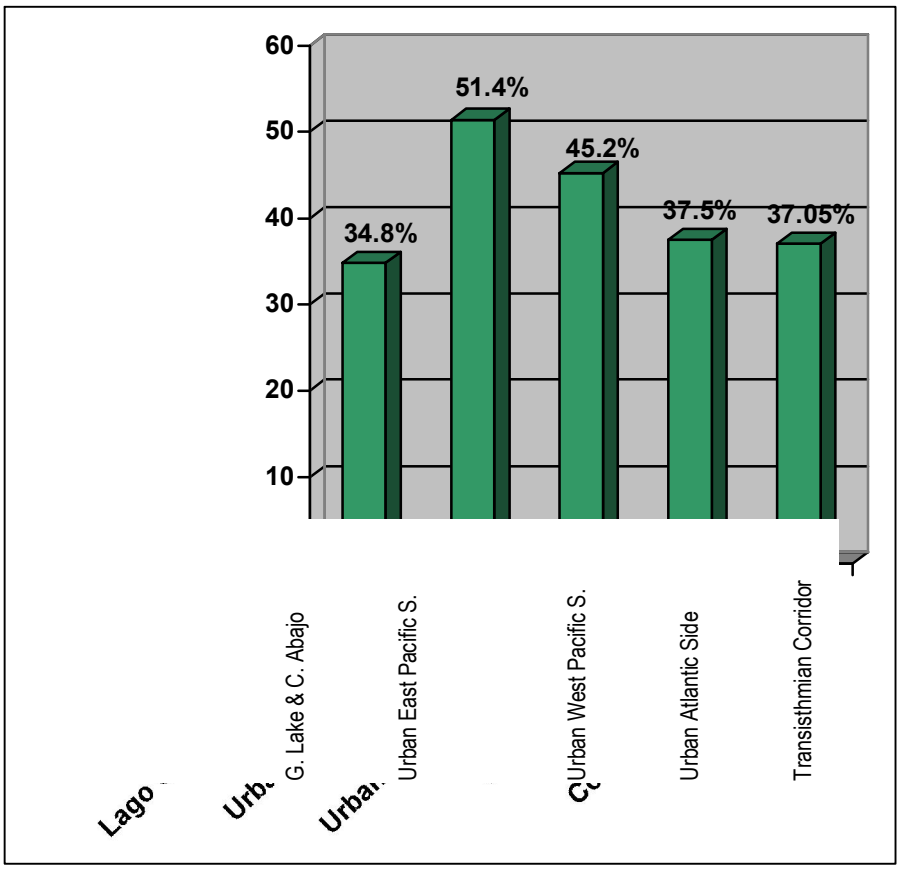
An analysis of the answers regarding negative impacts suggests that the villages located in the area

of the Province of Panama (Urban area on the East and West Pacific Sides) are less inclined to believe that the Project will generate negative impacts than those in the Province of Colon; hence, the higher percentages of the two areas pertaining to the Province of Colon (Chart 8-4).

As for the opinions that the environment will not be subject to any sort of impact, it is precisely in the areas within the Province of Panama (Urban on the East and West Pacific Sides) where opinions coincided with this perception (Chart 8-5).

Chart 8-5

Population Expecting that there Will Be No Impacts on the Environment, by Socioeconomic Area



Source: URS Holding's consultants team. Citizen participation poll, April 2007

There seemed to exist a significant relation between the socioeconomic area of the population and its perception on the Project's possible impacts; the areas that pertain to the Province of Colon were the most skeptical regarding the benefits of the Project.

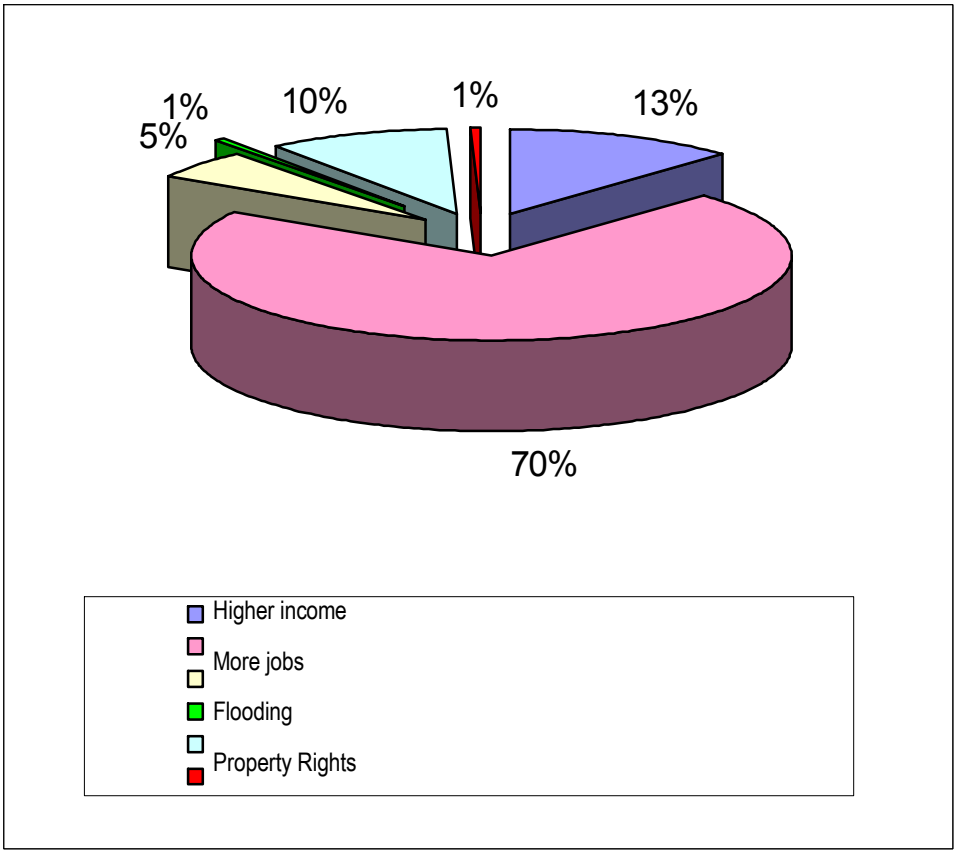
This relationship not only turned out to be valid for possible environmental impacts, but also for impacts on the community and homes. There was consensus throughout the country. That is to say, there was great coincidence among the individuals consulted in saying that, in the event the Project was executed, there would be positive impacts on the Country. Altogether, a little over 86% of the population had the same perception (Table 8-19).

In examining the description of the different types of impacts mentioned by the individuals consulted, a broader vision of their perceptions regarding the Panama Canal Expansion - Third Set of Locks Project and of how it would impact on either ambit becomes apparent. In fact, when we considered only those who opted for indicating that there would be some impact from the implementation of these works, we were able to observe that the highest expectation that the consulted population has, at the home level, is that the Project generates a higher level of employment (70%) and, also, of income-generating activities (13% of individuals consulted, Chart 8-6). This vision is very repetitive at the community and country levels.

Five percent of those sharing their opinions indicated that the Project works would bring about flooding (Chart 8-6). This opinion was expressed by the residents of the Gatun Lake area, due to the possibility of this lake's water level elevation directly having adverse effects on them.

Chart 8-6

Impacts Expected from the Project at the Home Level



Source: URS Holding's consultants team. Citizen participation poll, April 2007

Based on the expectation that some type of impact would occur, according to analysis units and socioeconomic areas, certain order of importance or significance in the views expressed by the

population consulted in each area became evident.

Except for the Urban Atlantic Side area, over 30% of the individuals interviewed in the rest of the areas said that they did not expect any favorable impact on their homes as a result of the Project's implementation (Table 8-20).

The expectation observed in the Urban Atlantic Side area regarding the Project impacting on job creation within their communities (opinion expressed by over 30% of individuals polled in this area) agrees with the diagnosis performed by their population with respect to their main problem: unemployment (Table 8-20).

Table 8-20

Expected Impacts on the Home, by Percentage of Times Mentioned by the Population within the SSA by Socioeconomic Area

% of times mentioned	Socioeconomic Area				
	Gatun Lake and Costa Abajo	**Urban Pacific Side**	**Urban Pacific Side**	**Urban Atlantic Side**	**Transisthmian Corridor**
30% and over	None	None	None	Jobs (31.3%)	None
Over 9% but under 30%	Jobs (19%)	Jobs (19%)	Jobs (21.7%)	None	Jobs (15.2%)

Source: URS Holding's consultants team. Citizen participation poll, April 2007

When the analysis was performed at the community and country levels, it became evident that the population of all these areas growingly expects that the Project will have a favorable impact on employment.

At the community level, except for the Gatun Lake and Costa Abajo area, a significant number of the population mentioned new job opportunities as the main impact of the Project.

It is appropriate to point out that a small group (14.1%) of people from Gatun Lake and Costa Abajo mentioned the risk of "flooding" (Table 8-21).

Additionally, about 17% of the participants of the consultation process carried out in the Transisthmian Corridor area expressed their concern that their community might not be taken into account (Table 8-18).

Table 8-21

Expected Impacts on the Community, by Percentage of Times Mentioned by the Population within the SSA, by Socioeconomic Area

% of times mentioned	Socioeconomic Area				
	Gatun Lake and Costa Abajo	**Urban Pacific Side**	**Urban Pacific Side**	**Urban Atlantic Side**	**Transisthmian Corridor**
30% and over	None	Jobs (40.4%)	Jobs (36.5%)	Jobs (56.3%)	Jobs (37%)
Over 9% but under 30%	Jobs (23.9%) Financial and social benefits (17.4%) Flooding (14.1%)	None	Financial and social benefits (11.3%)	None	The community might not be taken into account (17.4%)

Source: URS Holding's consultants team. Citizen participation poll, April 2007

At the country level, a greater number of residents mentioned new job opportunities as the expected relevant impact on every area considered (Table 8-22). However, the fact that in all areas, without exceptions, there were individuals who thought that there would be more investment but few would benefit from them must not be overlooked. This reflects that the Project is viewed as a distant event, to a certain extent.

In addition, it is worth mentioning that when asked about the possible expected impact on agricultural businesses the number of impacts mentioned was not significant. Likewise, job opportunities were not significantly mentioned.

Table 8-22

Expected Impacts on the Country, by Percentage of Times Mentioned by the Population within the SSA, per Socioeconomic Area

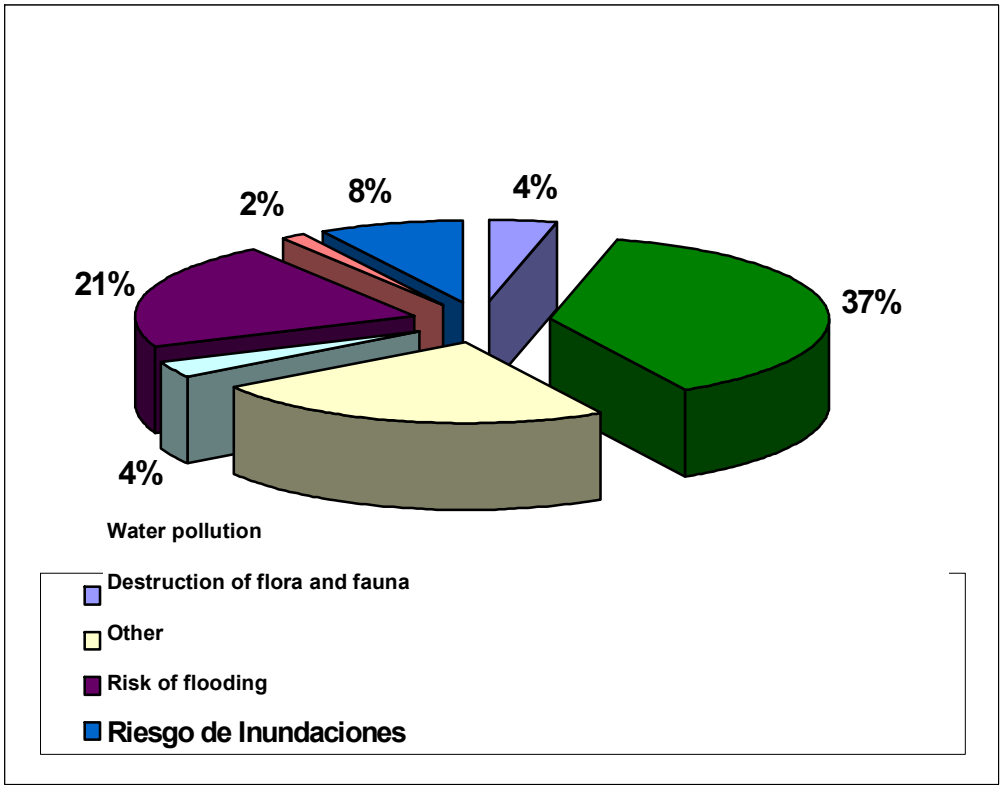
% of times mentioned	Socioeconomic Area				
	Gatun Lake and Costa Abajo	**Urban Pacific Side**	**Urban Pacific Side**	**Urban Atlantic Side**	**Transisthmian Corridor**
30% and over	Jobs	Jobs	Jobs	Jobs	Jobs
Over 9% but under 30%	More income (29.3%)	More income (23.4%)	More income (26.1%)	More income (25%)	More investments but little benefits (13%)
		Increased economy (10.7%)			
	More investments but little benefits (10.9%)	More investments but little benefits (10.5%)	More investments but little benefits (10.4%)	Education (12.5%)	
				More investments but little benefits (12.5%)	

Source: URS Holding's consultants team. Citizen participation poll, April 2007

Regarding what they thought would occur with the environment as a result of executing the Project; they mostly expressed a concern for the deforestation and affectation of the flora and fauna of the area that will need to be cleared from trees for the construction of the Project (Chart 8-7).

Chart 8 -7

Expected Impacts Caused by the Project on the Environment



Source: URS Holding's consultants team. Citizen participation poll, April 2007

Finally, when asked what impact they thought the Project's would have on the environment, only the population of the Urban Atlantic area -in the city of Colon- mentioned a significant impact. That

is, they thought the works might result in the destruction of the flora and fauna of nearby areas. Almost one third of the individuals polled thought so.

Besides the above-mentioned impact, no other significant percentual impacts on the remaining areas were anticipated; however, other impacts such as the risk of flooding were mentioned by the residents of the Gatun Lake and Costa Abajo areas in addition to deforestation (Table 8-23). Actually, most of the population in these areas felt that the Project would have little or no impact on their environment.

Table 8-23

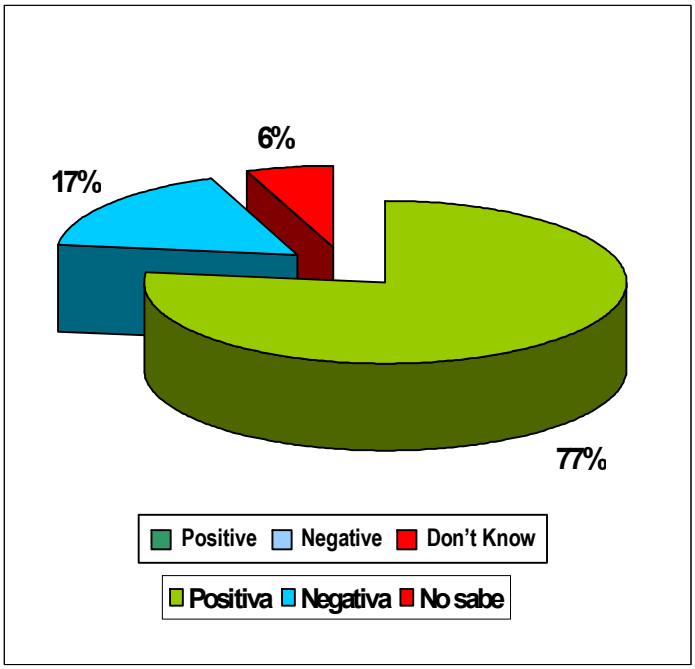
Expected Impacts on the Environment, by Percentage of Times Mentioned by the Population within the SSA, and Socioeconomic Area

% of times mentioned	Socioeconomic Area				
	Gatun Lake and Costa Abajo	**Urban Pacific Side**	**Urban Pacific Side**	**Urban Atlantic Side**	**Transisthmian Corridor**
30% and over	None	None	None	Destruction of flora and fauna (31.3%)	None
Over 9% but under 30%	Flooding (14.1%)	Deforestation (14.7%)	Deforestation (16.5%) Destruction of flora and fauna (11.3%)	Deforestation (12.5%)	Deforestation (19.6%) Destruction of flora and fauna (17.4%)

Source: URS Holding's consultants team. Citizen participation poll, April 2007

Chart 8-8

Residents Opinion on the Project



Source: URS Holding's consultants team. Citizen participation poll, April 2007

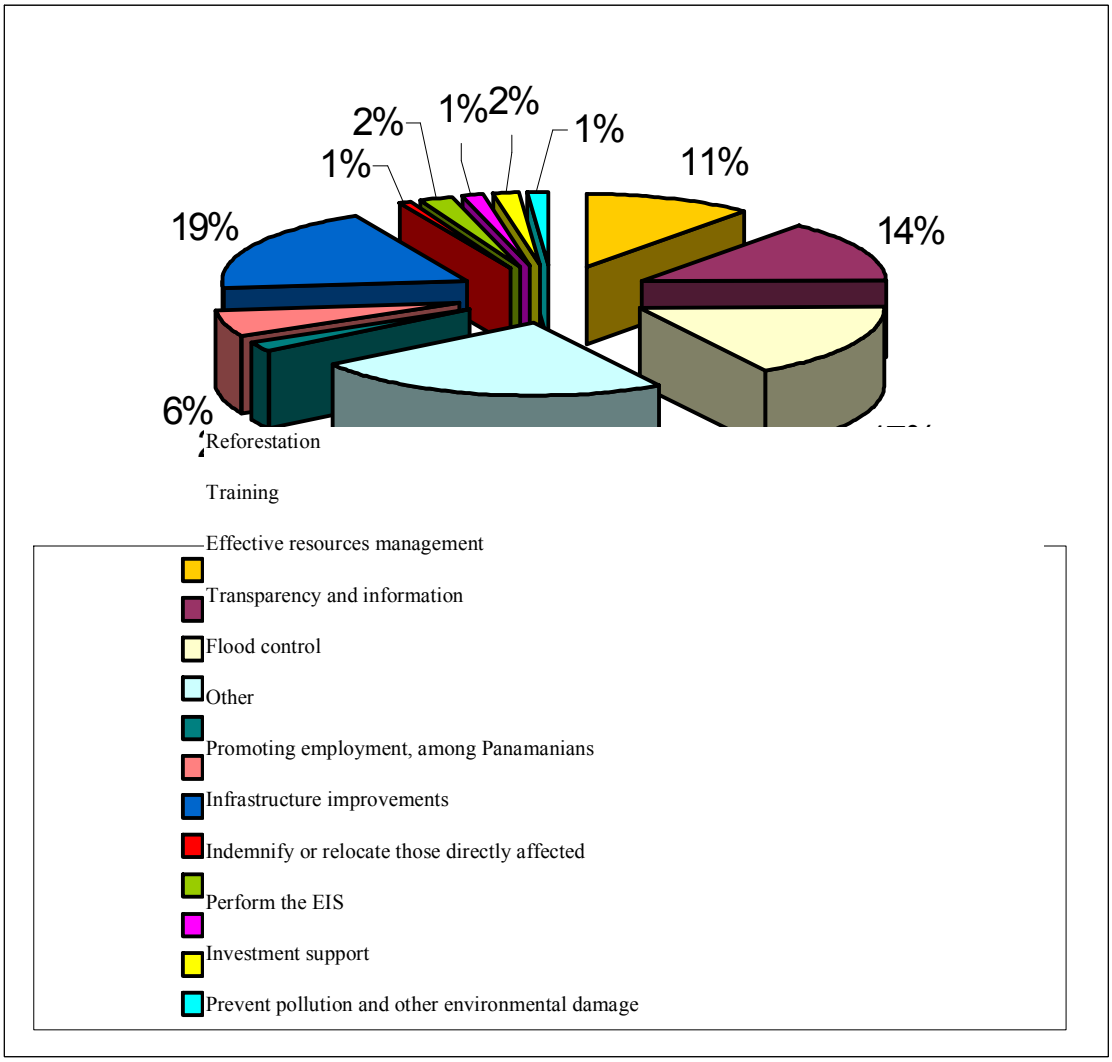
Finally, a control question to identify the favorable or unfavorable disposition that the population within the SSA might have towards the project was considered. And the information gathered reflects a generally high level of Project acceptance. According to Chart 8-8, over three fourths of the population polled had a positive perception of the Project. This clears any doubt regarding the previous findings of similar perceptions.

In view of the different types of impacts that the population forecasted, they proposed a series of measures to mitigate negative impacts or, as the case may be, strengthen the positive impacts.

From these, the following measures stand out: a transparent Project management, effective resource management, and trying to generate employment for the locally available manpower, which represent 60% of all suggestions registered (Chart 8-9).

Chart 8-9

Measures Proposed by the Population Surveyed for the Project's Implementation



Source: URS Holding's consultants team. Citizen participation poll, April 2007

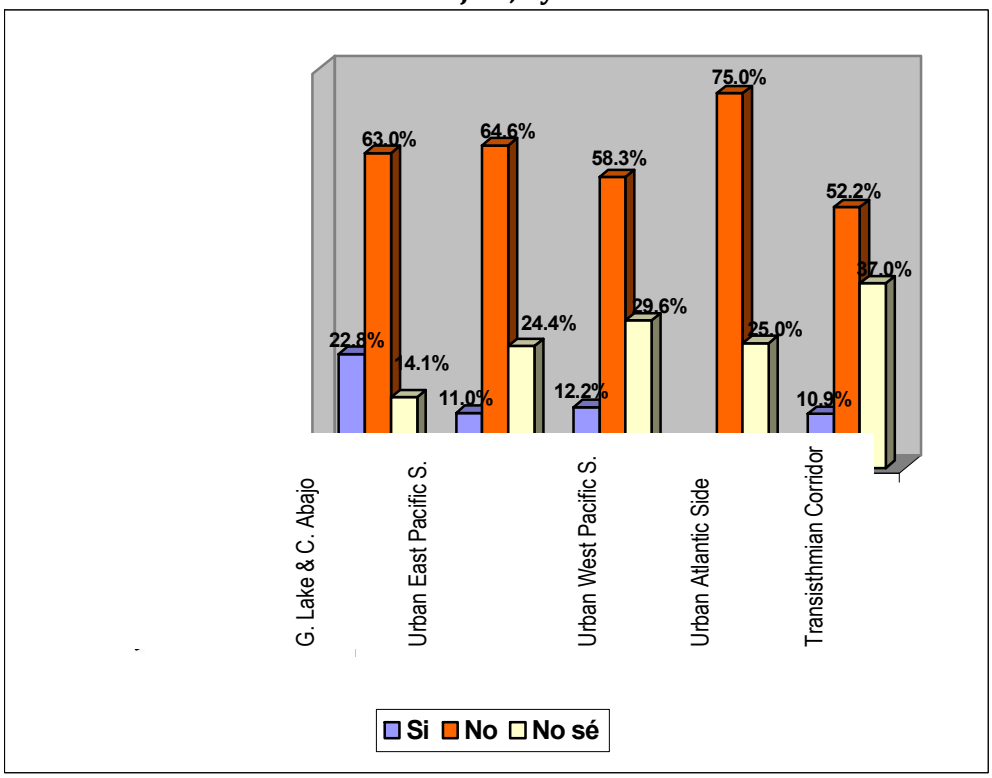
In general, residen

ts have a positive image of the Project. The different communities categorically expressed that they approved of the Project's implementation.

Seventy-five percent of citizens consulted in the Urban Atlantic Side and 63% of the residents of the area of Gatun Lake and Costa Abajo are of the same opinion. The area where less people were that categorical about their approval was that in the Transisthmian Corridor, and this has to do with the high percentage of people from this area that did not have an opinion about the Project (Chart 8-10).

Chart 8-10

Percentage of People that Perceive that the Community will Oppose the Project, by Zone



Source: URS Holding's consultants team. Citizen participation poll, April 2007

8.6.3.2 Interviews with Key Persons of the SSA of the Project

In addition to the home polls conducted, a series of consultations were carried out with representatives from different organizations and institutions, such as key individuals who represent their community's opinions or promote opinions therein because they maintain a daily relationship with their activities and somehow have an impact both at the community and national level. These interviews were conducted with a standard questionnaire, which was applied to groups and individuals. Annex 6 presents the standard formats used for these interviews.

Opinions from organizations and institutions

Two events were organized to conduct group interviews; the first one on April 16, 2007 at the Hotel Intercontinental Playa Bonita in the province of Panama, and the other on April 18, at the Hotel Melía Panama in the province of Colon. Both events' main attendees were township representatives and majors from the different townships and municipalities included in the Socioeconomic Study Area of the Project. Annex 6 presents the list of invitees and attendees to both events.

A total of 39 representatives from organizations and institutions were interviewed. Fourteen of them belonged to government organizations or institutions, and 25 were non-governmental representatives. Among the government institutions were included institutions at the national, district, and local levels. Interviews with non-governmental organizations included representatives

from environmental, religious, community, labor, business, professional, public services, and other organizations. Table 8-24 presents a detailed list of the organizations and institutions interviewed.

It is relevant to note that over 80 representatives from diverse organizations and institutions were contacted; however, a number of them, for different reasons, were not able to contribute to or participate in the events they were invited to; therefore, their opinions -of those who are willing to exercise their right to participate in the citizen consultation- are very valuable and may enrich this study and should be considered whenever the Project's public forum is carried out.

Table 8-24

Interviews with Representatives from Organizations and Institutions

Category	Sub-Category	Organization	Interviewee
Governmental	National	Labor Office	National Director of Labor Inspection
		Metropolitan Natural Park	Environmental Research and Management Assistant
	District	Arraijan City Council	Major
		Panama City Council	Director of the Summit Park
		Sabanitas Municipal Police Agency	Municipal Police Officer
	Local	Santa Clara Community Board	Township Representative
		Veracruz Community Board	Township Representative
		Nuevo Emperador Community Board	Township Representative
		Ancon Community Board	Township Representative
		Sabanitas Community Board	Township Representative
		Curundu Community Board	Legal Counsel
			Public Relations Director
			Administrator
		Cristobal Community Board	Secretary

Category	Sub-Category	Organization	Interviewee
		Ciricito Community Board	Secretary
		Cativá Community Board	Secretary
Non-Governmental	Environmental	National Association for Nature Conservation (ANCON, by its acronym in Spanish)	Science Bureau Representative
		Smithsonian Tropical Research Institute	Public Programs Director
		National Society for the Development of Rural Enterprises and Areas (SONDEAR, by its acronym in Spanish)	Chief, Environmental Projects
		Natura Foundation	Communications Officer
	Religious	Hossana Christian Community	Apostle
		Panama Caritas	National Catholic Episcopal Conference Director
		God's Assembly	Assistant Pastor
		Salem Apostolic Community	Pastor
	Community	Ibergun Health Committee	Community Leader
	Labor	Canal Workers Union	President
		National Organized Workers Council (CONATO, by its acronym in Spanish)	Director

Category	Sub-Category	Organization	Interviewee
		Teachers in Action Movement (FAM, by its acronym in Spanish)	Guilds Secretary
		United Workers Central (CUT, by its acronym in Spanish)	Secretary for Economic and Social Affairs
		Unified Construction Workers Union (SUNTRACS, by its acronym in Spanish)	National Board of Directors Member
		National Taxi Services Union (SNTT, by its acronym in Spanish)	Secretary for Tourism and International Relations
	Business	Panamanian Association of Business Executives (APEDE, by its acronym in Spanish)	President
		Colon Duty-Free Zone	Security Director
	Professional	International Agronomists Association	President
		Panamanian Association of Engineers and Architects (SPIA, by its acronym in Spanish)	Administrative Manager
	Public services	Edemet - Edechi	Head of Information
		ETESA	Environmental Analyst
	Other	Center for Popular Legal Assistance (CEALP, by its	Voluntary Worker

Category	Sub-Category	Organization	Interviewee
		acronym in Spanish)	
		Panamanian Centre for Social Studies and Actions (CEASPA, by its acronym in Spanish)	Director
		Justice and Peace Commission	Executive Director
		Panama Ports Company	Contracting Engineer

Source: URS Holding's consultants team. Citizen participation poll, April 2007. Note: this list includes all participating institutions.

Among the different points of view that came up during this consultation with the interviewed organizations and institutions is that the Canal expansion will mostly have a positive impact on their ambits, since it will generate jobs and increased income for the population.

Amid those who commented that the Project would generate negative impacts, some base this opinion on political interests, others mentioned their fear to be removed from their residential areas, while others pointed out the possibility that jobs were given to foreign personnel and suggested that measures needed to be taken in this respect.

A few other organizations thought that the Project would not have any impact on them whatsoever.

Contrary to what they thought about the type of impact the expansion would have on them, organizations expressed that the Project will have a negative impact on the socionatural

environment given the ecological damage that it will cause, as well as effects such as the lake's salinity, species migration and affectation, and deforestation. In the presence of these impacts, they suggested that reforestation measures should be taken, ecosystems and similar systems should be recreated, while maintaining a transparent information management and performing all required technical studies.

As for the type of impacts that organizations and institutions thought that the Canal Expansion will have on the country, they said to expect both positive and negative impacts. Among the positive impacts is that they expect the construction works to generate an increase in fiscal revenues, Panamanian manpower and therefore wealth that they hope will be well distributed. According to the interviewees, this itself will have negative impacts because there will be more people migrating towards the capital city, while public services conditions will not change and job generation will not occur in the initially estimated amounts.

Likewise among the negative impacts, they say that this Project's cost will exceed the estimated cost and this debt will have to be paid by the people. They say that it is not necessary to execute this Project because the modernization works that are underway today are sufficient for large vessels to navigate the Canal and will prevent its privatization as well as having to pay to have room for U.S. warships and aircraft carriers.

Amid religious groups, as well as labor organizations, some thought that this Project will benefit the country and others that it will be harmful. One of the benefits most accepted in this group is job generation; while one of their concerns is that it may indebt the country.

Environmental groups, public services companies and professionals, all agree that the Project will have a positive impact on the country, particularly on the economy and job generation.

Specifically in the case of the group workshop conducted in the province of Colon, participants included not only representatives from the provincial and community government, but also civil and religious community group leaders. Participants expressed their favorable opinion on the Project impacts on their communities and organizations, since they considered that as the Project develops so will employment and commerce, and economy will improve. However, not all of them foresee a social improvement as a given product of the economic improvement.

A representative from the Gatun Lake area was concerned that the Project would have a negative impact if it were necessary that some people leave their communities in order to expand lake capacity. There is also concern over whether raising Gatun Lake's level will affect houses in the communities of Champion, San Andres, Limon, Villa Luzmila, La Represa, Laguito and Ibergun.

Regarding possible impacts on the environment, participants of the citizen consultation process thought that the Canal expansion will have both negative and positive impacts, since it will create tourism opportunities; improve maritime transits administration, set new competitive horizons, and productivity and efficiency will increase. Although some did indicate that this project will have negative impacts, it was only a minority who also recognized its positive aspects even though they think that nature will disappear in some areas. Consequently, they suggested that there be increased dialogue, discussions and commitment with affected populations.

Regarding expected impacts at the country level, they also thought that there will be positive impacts, since Panama will be placed in a state-of-the-art position and the Project will allow the construction of the Costa Abajo bridge. Additionally, it will cause land valorization, increased employment opportunities, improve everyone's quality of life, especially Colon residents', and the Canal will become the cornerstone of the Country's development.

Although this group of key individuals consider that the Project will have positive impacts, they requested that their suggestions about hiring local workers, relocations to better places, promotion of commercial growth, and participation of provincial government and technical boards in solving unemployment and other issues in the communities involved be taken into account.

Finally they indicated some concern regarding national and international immigration to populated locations within the metropolitan region, such as in the cases of Colon and Arraijan, particularly because public services capacity is already insufficient to serve actual demands.

Another concern had to do with local governments not having the required mechanisms to receive income taxes from the works or some other way to obtain resources, or respond to growing social problems demands, which would be produced by said immigration.

Key Individuals at the Community Level

In order to complement the information offered by the population within the SSA, consideration was given particularly to conduct interviews with a series of individuals considered as "key individuals" due to their social, political or economic role within such area or interest. Additionally, on account of their role, these individuals maintain contact with the residents of the areas involved.

On-site interviews with representatives from community commercial and service establishments, church representatives (temples, groups or parishes), health staff at health centers or subcenters, community boards, townships, and school principals were conducted.

When we compare the perception expressed by the residents of interviewed communities altogether with that of key individuals at the community level, their similarity becomes evident.

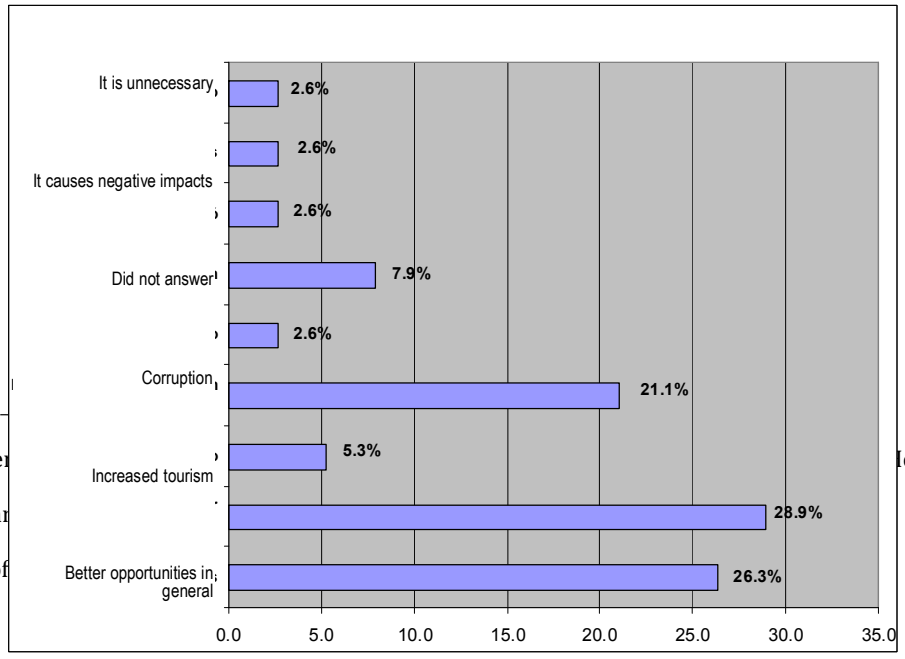
Indeed, employment generation and an increased economic activity, producing higher income is the type of impacts identified as relevant by both types of population.

Key individuals added the possibility of obtaining higher education (Chart 8-11), which neither many of the residents nor other key individuals in general who were also interviewed mentioned.

But similarities were not only found when identifying the estimated impacts, but also in their suggested measures to mitigate adverse impacts or to reinforce virtual benefits.

Chart 8-11

Impacts Expected by Key Individuals in

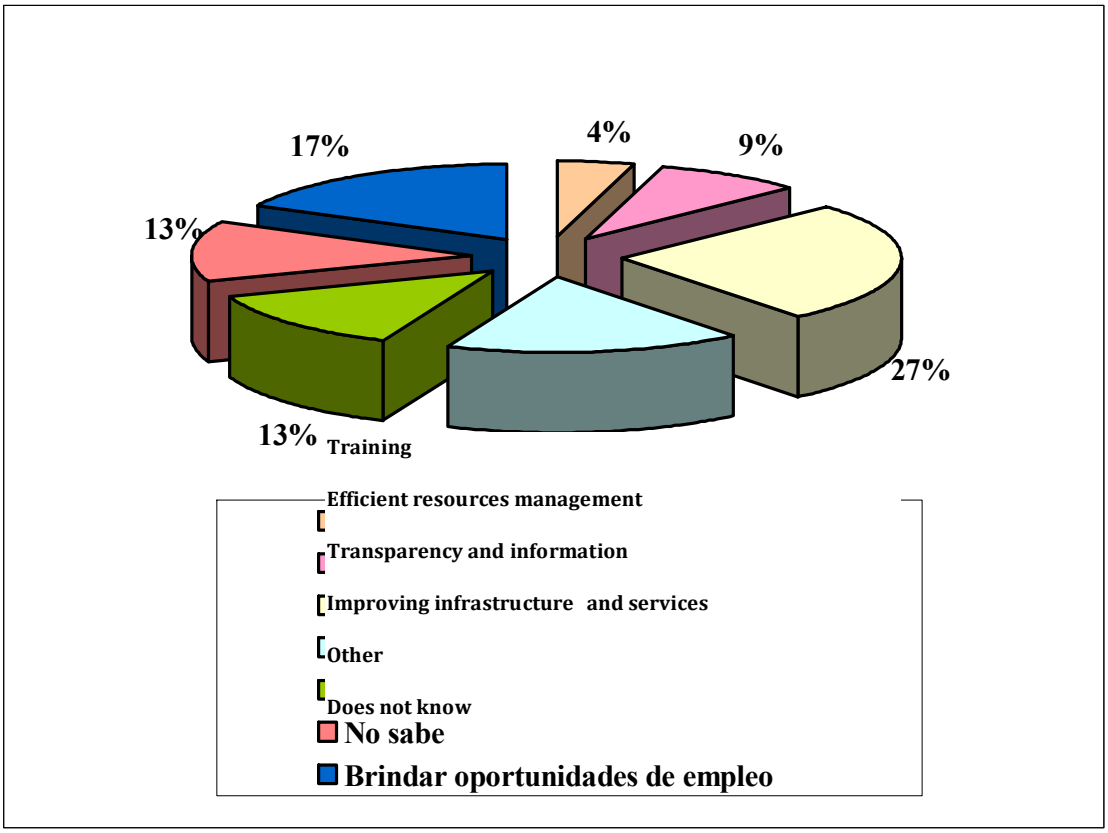


Source: URS Holding's consultants team. Citizen participation poll, April 2007

Indeed, these key individuals indicated that the main measures had to do with transparency and information (to the public) and, in a second level of importance, with providing local workers with job opportunities and efficiently managing resources, which would be closely related to that Chart 8-12).

Chart 8-12

Measures that Key Community Leaders Proposed be Taken when Executing the Project



Source: URS Holding's consultants team. Citizen participation poll, April 2007

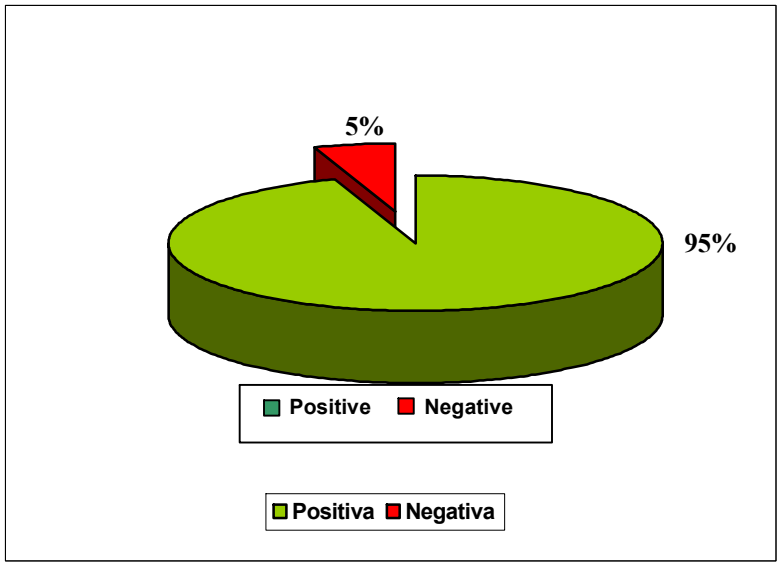
To close this section it is appropriate to add that the perception and therefore the opinion of these key individuals who are closely related to community life are very similar to that expressed by the residents of the localities interviewed.

This was so, repeatedly, even when directly asked for their perception of the Project. In fact, over 80% (Chart 8-13) of participants spoke favorably about it; this percentage is not far from the percentage of residents who felt the same way about it.

Once again, the criterion, with certain reservations indicated by the interviewees, favors the implementation of the Project thanks to the expectations created by it.

Chart 8-13

Key Community Member's



Source: URS Holding's consultants team. Citizen participation poll, April 2007

8.6.3.3 Conclusions of the Citizen Participation Process

A high ratio (more than eight out of every ten cases) of the population that participated in this phase of the citizen participation process knew the Canal expansion project to some extent. This was the case with community residents as well as key individuals and, even more so, with local government representatives and representatives from different kinds of organizations who offered their points of view on this subject.

On the other hand, residents made clear what their vision of the different types of impacts that might result from the Project's implementation was. These impacts were differentiated according to the socioenvironmental ambit or scenario. Consequently we learned that the population consulted, including the key individuals, see the Project as an opportunity for the Country and, to some extent the communities, to benefit by its expected positive impacts.

At the residents home and workplace levels, these percentages were somewhat lower than at the Country and community levels, since in most cases the opinion was that impacts would be hardly noticeable or non-existent.

The interviewees themselves explained that even though the Project will energize economy as a whole, move many millions of dollars along the economic circuit, and generate many jobs positions, they do not have a clear picture of how these benefits will reach them directly, either through a member of their homes or their communities. Similar arguments were held by other types of key individuals of Panamanian society and the communities involved.

Some authorities, especially from the city of Colon and the West Panama Area on the Pacific Side, voiced their concern regarding the management of the migratory flow that will move towards the areas under their responsibility, considering that the existing resources are insufficient to attend to the new demand for a larger volume of basic and social services.

In the environmental ambit, when asked for their opinion on the damages that the Project would generate, interviewees indicated that they were concerned that it would impact the environment causing a reduction of the forest cover which, in turn, would result in reducing or affecting the

fauna and flora found within the SSA.

Given the types of impacts expected by the population, they emphasized the need for mitigation measures such as: transparency and public information, offering job opportunities to local workers and, just as important, managing resources efficiently.

In summary, it is most likely that the population will favor rather than oppose the Project's implementation even if they perceive that there might be some type of adverse impact on the environment, while expecting that political and institutional measures be taken to promote equality of terms on the benefits to communities and homes, which the relevant residents and key individuals will support.

8.6.4 Community Relations

The objective of this section on Community Relations is to define procedures and mechanisms, both to keep communities informed about major Project elements, as well as to handle any concerns, issues, and grievances they may have. It also has the purpose of complying with the requirement established in the Ecuador Principles that all Category A Projects and, as required, Category B Projects, must establish a mechanism to handle grievances as part of their implementation system, that may allow the filing of grievances and facilitate the resolution of any concerns and grievances from the individuals or groups that may be affected.

8.6.4.1 Locations and Means to File Inquiries and/or Grievances

In order to continue the process of community participation launched as part of this Environmental Impact Study, once Project construction starts and in order to maintain a constant coordination and flow of information between the concerned communities and the Panama Canal Authority as the promoter, a Community Relations office shall be established on the Pacific Side and another one on the Atlantic Side. These offices shall be located at any of the communities in the vicinity of Project development sites.

The Panama Canal Expansion – Third Set of Locks Project Community Relations offices shall serve as the main point of contact between the Project and the affected communities. Their telephone numbers and the names of contact persons shall be distributed among the

communities adjacent to the work sites, to enable any person wishing to do so to obtain information regarding the Project by calling these offices on the telephone or visiting them. These offices shall constitute the main channel for the public in general to contact Contractors and submit any questions, concerns, and/or grievances.

Community Relations offices shall have a person in charge of receiving and handling any communication with the communities, as well as to ensure that their concerns are passed on to the appropriate responsible parties and resolved.

At the start of the Project construction, the weekly schedule of these offices shall be disseminated among the local authorities, unions, community leaders, and the media.

Any complaint, concern, request, or comment from the communities must be handled promptly.

Once the construction work ends, the community relations functions shall be taken up by the Corporate Communications Division of the Panama Canal Authority for the purpose of keeping a continuous communication with the communities that consider themselves affected by the operation of the Project.

8.6.4.2 Communications Log

Any calls or visits shall be recorded in a communications log. The staff handling communications with the community shall take the following steps to properly record the information, which shall include:

1. Name;
2. Telephone (public) number of the community or section, if any;
3. Name of the community to whom the person calling or visiting the office belongs;
4. Date and time of the communication;
5. Description of the complaint, request, or information requested;
6. The reply provided by the staff that handled the case;
7. The action required to handle the case, and a clear description that may allow a follow up of the case; and
8. Every call or visit log shall be kept in a file.

A weekly report regarding the follow up of requests or grievances shall be prepared and submitted by the person in charge of the Community Relations offices to the person in charge of Environmental Affairs. This follow-up report shall clearly state whether the concern was handled and resolved, what actions are ongoing to do so, and if not, the reason why the problem could not be resolved and the conditions that would facilitate a solution.

8.6.4.3 Disclosure

Flyers shall be used to disseminate information locally. Flyers are a very effective means to provide written information about the progress of the work or of a particular structure that might be of interest to the community in general or to groups residing in specific areas near work areas. Flyers may be distributed door to door in major town sites, or by leaving copies at grocery stores or other public places near work sites. Communities can be informed with flyers about the progress of the work, the schedule for the coming period, and any other information that may be of interest to them. The names of contact persons for specific purposes and an updated list of telephone numbers may be provided in the flyers.

Another means that may be used to provide Project information, including the progress of the works is *El Faro*, published by the Panama Canal Authority every fifteen days. It circulates throughout the country, and would serve to obtain a wide dissemination about the Project in its various stages. Also, the television program *El Canal al Día*, which may be seen weekly, as well as the Panama Canal Authority website, may be used to provide information to the general public.

8.6.4.4 Conflict Resolution

In the event a conflict arises between the involved and/or potentially affected parties and it has not been possible to resolve it expeditiously through the means described above, and for the sole purpose of providing a solution in the quickest and most efficient manner, seeking always to preserve the well-being of the population involved, the application of the following alternative methods of Conflict Resolution established in the laws and regulations currently in force in the Republic of Panama is proposed:

- Mediation
- Conciliation
- Arbitration

Notwithstanding the merits of the judicial system and its contribution to the institutionalization of the basic principles of social harmony, its high costs and slowness undermines its effectiveness. Therefore, as alternative to traditional conflict resolution methods, there are other ways to resolve conflicts effectively, promptly, economically, and permanently that at the same time preserve the relations between the parties through mediation, conciliation, and arbitration, which are among the best known.

These three conflict resolution methods are legally supported by Law Decree 5 of July 8, 1999, "whereby the General Arbitration, Conciliation, and Mediation Regime is established" (Official Gazette No. 23, 837 of July 10, 1999) and Resolution No. 106-R of April 30, 2001 of the Ministry of Government and Justice "whereby provisions are issued to enforce Law Decree No. 5 of July 8, 1999 are issued" (Official Gazette No. 24, 296 of May 8, 2001) which governs the registration of the professional status of mediators and establishes a Mediator Registry under the Ministry of Government and Justice. The basic procedures and steps for the application of these methods are described in detail in the above mentioned laws.

Among the benefits that make these new methods recommendable are the savings in time and financial resources. It is a basic fact that these new conflict resolution alternatives are more coherent with the new human relations paradigm, as they allow moving toward proposition instead of confrontation. Moreover, it has been proven that agreements reached in this manner preserve the relations between the parties better after involving themselves directly in the resolution of their differences. Also, those who reach an agreement by themselves are more committed to its

compliance.

Mediation. The word "mediation" comes for the Latin root "mediare," which means being in the middle or dividing in two. Mediation is more than a negotiation; it is a method of handling conflicts in a non adversarial manner whereby a neutral third party known as mediator offers both parties some space to study the best alternatives to resolve controversies and assist them with special techniques to identify their interests and reach an agreement that may satisfy everyone. For these reasons, the parties involved feel that both have won in this process and are also preserving their relationship.

Mediation allows a process of communication, and this process is resolved "in" communication. The objective of neutrality is to open a dialogue in such a way that may allow an alternative construction of a statement of facts. The input each party brings to the process, whether it is a prepared statement of facts, or the position assumed, must be questioned and the entire dispute may be brought down and sometimes, the conflict as well.

The mediation process normally has six stages, i.e.:

1. The initiation of preliminary contacts between the mediator and the parties.
2. The intervention of a mediator in the conflict and the establishment of the general rules that will guide the process.
3. The gathering of information on the conflict, and the identification of the items to be resolved.
4. The development of options to resolve each item.

5. An evaluation of the options of the agreement, by comparing them to the alternatives of the other parties.

6. A definitive total or partial agreement on the substantive nucleus of the conflict, and the preparation of the necessary plan for its ratification, execution, and control.

Conciliation. Conciliation is a means to resolve conflicts, in which one or more third impartial parties assist the parties in conflict in attempting to reach a reciprocally acceptable agreement. Since the conciliator has no authority to decide the controversy, he must apply a series of techniques designed to overcome communication barriers.

As such, conciliation is also an informal and voluntary process bound by confidentiality, and if these principles are not sufficiently ensured, there will be no possibility of an effective conciliation. It constitutes a minimal guarantee and advantage which the parties need to be accorded, as there is the added key element of the conciliator himself on whom the responsibility lies to channel the conflict toward a mutually satisfactory resolution.

Now then, once the basic concepts have been explained, it is indispensable to establish the differences between these two alternatives. Although there is no consensus on doctrine, conciliation differs from mediation in the option the conciliator has to suggest, present, or outline to the parties a solution to their controversy. This means that the solution is now not solely the parties', but is a solution of a third party known as the conciliator. On the other hand, in mediation, a neutral third party known as mediator is not allowed to propose an alternative solution, but must use the mediation techniques to get the parties to reach an agreement.

Arbitration. The difference here is that, contrary to what happens in the conciliation and the mediation, in arbitration there is an impartial third party who issues a decision that is mandatory and binding for the parties in controversy.

Thus, arbitration is an adversarial mechanism whose typical structure is that of a legal action. However, the decision that brings the litigation to an end is not issued by state judges, but by private parties selected freely by the parties by using a procedure that has also been selected in order to resolve the conflict with the least amount of formal interference.

There are other ways of conflict resolution, such as the Facilitation and Negotiations Table. Facilitation is a voluntary process used to resolve conflicts before their reach a critical point. It has a less formal character and emphasizes that the way to reach an agreement is through the collaboration method. Facilitators act as moderators in large meetings, and ensure that everyone participates and is heard.

The negotiations table applies when a conflict is already in evidence and the various positions have already been assumed by leaders whose representation is accepted by all. In this case, it is possible to convene all parties and interact jointly in search for a solution.

Any of the above described conflict resolution methods may be applied depending on the type of conflict and the disposition that exists among the parties. The main objective is to detect the conflict at an early stage, or to detect the problem among the parties before a conflict arises. Once the type of conflict or problem is analyzed, it is indispensable to talk to the parties to understand their position and the strategy they prefer to follow. Depending on the type of conflict, there are alternative and more appropriate methods of resolution; nonetheless, the parties involved are the ones who will have the last word with regard to the strategy to be followed.

Therefore, the strategy must be defined and the mediator or conciliator who is most suitable must be found to satisfy the two parties involved. Once defined, the established guidelines for each alternative method of conflict resolution must be followed as they are described in the above section. An expert mediator or conciliator would then be in charge of implementing the Resolution Plan.

8.6.4.5 Reporting

Reporting is covered by Section 8.1 of this Environmental Management Plan, under Reports.

8.7 Risk Prevention Plan

The Risk Prevention Plan has been structured in such a way that it presents its objectives as the first item, followed by the identification of risks and the measures to manage them during the construction and operations stages of the Panama Canal Expansion Project – Third Set of Locks. In addition, it presents the assignment of responsibilities and regulations that must be complied with during the development of the Project. It must be pointed out that the measures established herein are complemented by the aforementioned programs, such as waste and materials management, as well as Panama Canal Authority safety regulations.

The objective of the Risk Prevention Plan is to define the preventive actions and measures to be applied to avoid occupational accidents, incidents, and illnesses. It is important to keep in mind that in addition to the regulations set forth in this plan, Contractors shall comply with the standards of the Panama Canal Authority who, being the promoter of the Project must ensure that all activities are conducted according to the environmental regulations in force.

8.7.1 Identified Risks

There will be activities during the Project construction stage that may create hazardous situations to persons, the environment, equipment, and infrastructures.

The works to be performed, as well as the related physical, chemical, and biological aspects of the various Project development stages have been taken into account to evaluate

dangers and risks inherent to those various stages. The analysis focused on the types of risks that would require the activation of the Contingency Plan in the event of a risk related incident. It is important to point out that the Contractor is responsible for safety and health in all Project activities, both for prevention as well as for incident response (**Panama Canal Authority Contract Standard 2600 ESS-129)**. In addition to the above, safety and hygiene measures are included that must be kept up at all times to avoid affecting the health of Project workers.

At the time the analysis to identify risks was done, they were classified under the following categories: biological, chemical, and physical hazards. Biological hazards include animal or insect bites, animal attacks, and contact with poisonous, urticarial, and/or allergenic vegetation. Chemical hazards have been found to be those that arise in dangerous atmospheres and spills. Physical hazards include those created by fire, flood, falls, and exposure to natural elements, the use of mechanical equipment, explosions, and electricity.

The risks that can arise during the various stages of the Project are very similar. Their probability rate varies depending on the activities that will take place and their scope. In this regard, it is important to keep in mind that the analysis submitted below is a general one and is based on the various Project tasks, independently of the stage in which they are performed.

It must be considered that prior to construction and operation activities, Contractors must submit for approval a specific risk prevention plan for the activities to be performed, such as for the substances and materials that are required.

8.7.1.1 Physical Hazards

- Fire hazards: Welding work, the use of hydrocarbons (oil, lubricants, and fuel for portable power generators) at the work site, and the use of heat generating equipment are some of the early factors in fire hazards.

- Flooding hazards: These risks arise when water accumulates in work areas as a result of the effect of rainfall and the swelling of the bodies of water near Project work sites, endangering workers.

- Seismic hazards: These risks occur when infrastructures that are temporary or under construction are affected by tremors or earthquakes, and endanger workers at the affected sites.

- Work-related accident risks: Some of the construction work will involve working at heights of more than 1.8 meters, which creates the possibility of falling; likewise, depending on the location of the work site, there is the possibility of falling in the water. These risks also create the possibility of worker injury due to falling materials, machinery, and other situations that may result in contusions, lacerations, bleeding, pain, and loss of consciousness.

- Risks due to Exposure to Natural Elements: These risks may be found at locations on rugged terrain where workers or stacked materials may slide down. Likewise, when work is performed in certain work areas located on or near bodies of water, there will be drowning risks.

- Risks due to Mechanical Equipment: These types of risks will be created by the equipment used during the various Project stages, and includes the possibility of running over workers and causing cuts and bruises. They also occur during the operation of equipment with moving parts, the misuse of machinery and/or tools, and support operations such as that of vehicles transporting materials and supplies.

- Electrical Risks: These risks occur when temporary electrical installations are required for construction, electrical maintenance, and the operation of portable power generators. The main consequence of this hazard is the electrocution of workers performing such tasks.

- Explosion Risks: These risks can happen at drilling and blasting operations performed without taking the necessary precautions when the handling of blasting materials (explosives).

8.7.1.2 Chemical Hazards

- Risks from the Handling of Chemicals: The mishandling of chemicals can harm the health of workers when they come in contact with the skin or eyes, or by breathing in hazardous substances.

- Spills: This type of risk includes the possibility of accidentally spilling liquid and hydrocarbon supplies or raw materials on the ground or into bodies of water.

- Hazardous Atmospheres: Work (such as welding) performed in confined spaces, enclosed spaces, and confined spaces aboard floating equipment such as caissons can

create hazardous atmospheres.

8.7.1.3 Biological Hazards

- Risks due to contact with Poisonous, Urticarial, and/or Allergenic Vegetation: These risks can affect workers clearing overgrown areas, including pasture land, who can come in contact with urticarial and/or toxic species of vegetation (such that of the Euphorbia genus).

- Risks from Animal and Insect Bites: These risks include snake and other animal bites, as well as insect bites, including those by mosquitoes, chiggers, and ticks. Their occurrence is more common in Panama Canal Authority conservation areas and other forested sections, or where the vegetation is mostly brush and stubble.

- Animal Attack Risks: Risks may be found mainly in water and swampy environments, due to the presence of animals such as the various types of crocodiles and caimans that could attack Project workers.

Table 8-25 shows the measures, actions, and controls that may be implemented to prevent the occurrence of such risks.

Table 8-25

Risk Prevention Actions

Risk Type	Risk Identification	Preventive Measures
Physical	Fire	1. Store separately any oxygen and acetylene tanks used for welding work. 2. Before performing any welding work, remove all combustible materials from the areas adjacent to the workplace. 3. Keep a portable fire extinguisher on hand at all work sites. 4. Avoid the accumulation of unnecessary combustible materials at the work sites. 5. Verify that any heat or sparks generating activities are performed at a reasonable distance away from combustible materials. 6. No smoking at work sites.
	Flood / Earthquake	1. Provide adequate maintenance to water containment infrastructures. 2. Have discharge infrastructures in case of emergency. 3. Keep an Evacuation Plan on hand. 4. Identify flood susceptible or unstable areas, and establish safety zones. 5. Restrict construction and maintenance work in areas that could be affected by preventive or emergency spills.
	Work Related Accidents	1. Use harnesses for overhead work, anchoring them to safe locations. 2. Use protective netting. 3. Install protective guardrails. 4. Make a proper identification of the capacity of load lifting equipment. 5. Conduct periodic inspections of the condition of harnesses, scaffolding, ladders, slings, strapping, and railings; use protective netting; label and tag equipment, and discard equipment. 6. Use antiskid surfaces. 7. Prohibit any overhead work while carrying equipment and tools in hands. 8. Secure safety zones.

Risk Type	Risk Identification	Preventive Measures
	Exposure to Natural Elements	1. Require workers to walk with caution and avoid slippery slopes (on loose earth, gravel, etc.). 2. Require the use of safety shoes. 3. Use netting or meshwork to prevent materials from sliding. 4. Identify landslide prone areas and establish safety zones. 5. Require swimming ability for work in aquatic environments, and the use of life vests as required by the type of activity.
	Use of Mechanical Equipment	1. Use equipment, machinery, and tools in good working condition, with adequate protectors (as applicable). 2. Demarcate safety zones for machinery and vehicle traffic. 3. Keep vehicles carrying materials within the 15-km/hr speed limit inside construction sites. 4. Use reflectorized safety cones and signs in hazardous areas.
	Electrical	1. Hire qualified personnel for electrical work. 2. Define and disseminate clear procedures for electrical work. 3. Use tools in good working condition. 4. Comply with electrical installation regulations. 5. Use electrical extensions powered from circuits protected by automatic ground fault circuit interrupters (GFCI breakers) o plugs with GFCIs.
	Explosions	1. Train workers on the handling of explosives and how to conduct themselves in areas with explosion risks 2. Maintain only the required volumes of explosive substances or materials at work areas. 3. Activate the alarm system prior to the use of explosives. 4. Post signals in areas with explosion risks.

Risk Type	Risk Identification	Preventive Measures
Chemicals	Handling of Chemicals	1. Have available for workers Material Safety Data Sheets (MSDS) in Spanish at work sites, explaining the precautions required while handling chemicals. 2. Train workers on the proper handling of the chemicals they must use, as well as the appropriate personal protection equipment they must use and wear. 3. Provide workers with the personal protection equipment required for the handling of chemicals, as specified in Material Safety Data Sheets (MSDS). 4. Provide work sites with a minimum of equipment, materials, and supplies to handle chemical emergencies, as required by the respective MSDS. 5. Provide work sites with eyewash bottles and water for situations that may require safety drenching or flushing.
	Spills	1. Design hydrocarbon containment basins with a capacity of 110% of the contents of the largest tank. 2. Keep secondary containment valves in their off position and drain any accumulated rainfall as necessary. 3. Keep maintenance work in work areas strictly at the necessary minimum, and prioritize the use of field facilities for this work. In the event of any maintenance work at work sites, perform such work on surfaces with some type of temporary waterproofing. When performing maintenance work on equipment that may leak or drain fuel or lubricants, use drums to collect these fluids, and spill containment materials must be kept near work sites.

Risk Type	Risk Identification	Preventive Measures
	Hazardous Atmospheres	1. Verify that welding work is done in well ventilated areas. 2. Provide the proper breathing protection when doing welding work in poorly ventilated areas. 3. When working in confined spaces, post a standby person outside to act as an observer. 4. Prior to performing any work in confined spaces, discuss the procedures to ensure worker safety with the Supervisor; prior to performing any work, the quality of the atmosphere shall be checked, as required by the national standard (Technical Regulation DGNTI-COPANIT 43-2001) and Panama Canal Authority Standard 2600 ESS-290.
Biological	Animal and insect bites	1. Ensure that workers use adequate clothing to minimize skin exposure to animals and insects. 2. Prohibit workers from unnecessarily disturbing wildlife in the area. 3. Instruct workers on the risks of working in areas that pose this type of risk, and on the proper precautionary measures. 4. Provide workers with insect repellent as required.
	Animal attacks	1. Instruct workers on the risks of working in areas posing this type of risk, and on the proper precautionary measures. 2. Prohibit workers from unnecessarily disturbing wildlife in the area. 3. Workers shall not wander away by themselves, but always work in groups.
	Contact with poisonous, urticarial, or allergenic vegetation	1. Require that workers use adequate clothing to minimize skin exposure to this type of vegetation. 2. Prohibit workers from touching or collecting vegetation in work areas. 3. Provide gloves for activities where contact with vegetation is unavoidable. 4. Instruct personnel on the risks of working in areas posing this type of risk, and on the proper precautionary measures.

Source: URS Holding, Inc.

8.7.2 Responsibilities

Within its legal framework, the Panama Canal Authority has established a standard (2600 ESS-129) whereby the Contractor is responsible for its own risk management and for the prevention and response to its emergencies. In this context, the internal standards established by the Panama Canal Authority for its contracts (2600ESS-129) state that the Contractor shall be the main and solely responsible party for the safety and health of its employees, as well as for the activities they perform. Therefore, the Panama Canal Authority shall establish in all its contracts that Contractors shall comply both with their own internal standards as well as with the environmental and safety standards that apply to the activities they perform.

For the purpose of reducing personal harm, encouraging maximum efficiency, and avoiding unplanned interruptions due to work accidents during construction, the Contractor shall assign concrete responsibilities to its trusted employees that will include a Project Administrator and Supervisors in charge of the implementation and regular revision of the measures established in the Plan.

8.7.2.1 Contractor's Project Administrators

For the purpose of enforcing the measures described above, the following shall be the responsibilities of a Contractor's Project Administrator and of the person in charge of safety with regard to the activities during the construction stage, as required:

1. Conduct a periodic inspection of the Project to identify potential risks, as well as to enforce the implementation of the preventive measures, as required.

2. Hold weekly meetings with supervisors during the various stages of the construction, to discuss the related risks and the preventive measures that need to be applied.

3. Verify that supervisors and employees comply with risk prevention measures, and stop any activity deemed unsafe.

4. Evaluate the need to modify the prevention plan throughout the entire Project performance period.

5. In the event a preventive measure established herein is not effective, conduct the necessary coordination to modify it.

6. Prepare a report on the investigation of any incident related to any of the risks defined in this prevention plan, and take any necessary measure to prevent a reoccurrence of similar situations.

7. Immediately report any incident, accident, or plan modification to the Panama Canal Authority Safety Division.

8. Provide proper maintenance to personal protection equipment for specific applications.

9. Keep the stock of personal protection equipment at a level adequate for the number of employees that will need such equipment.

8.7.2.2 Contractor's Supervisors

1. Personal protection equipment shall be supplied as required by Project activities, and it shall be

inspected to ensure that it is in good working condition.

2. Verify the proper use of personal protection equipment, such as:

   a) Safety shoes – As required for work risks.

   b) Hard hats – Required for all the tasks shown.

   c) Eye protection – As required for work risks.

   d) Hearing protection – As required for work risks.

   e) Personal safety harness – As required for work risks.

   f) Respirators – As required for exposure to chemicals.

3. Hold work safety orientation meetings with all employees prior to the start of work, and periodically during the performance of the Project.

4. Verify that all employees have been properly trained on health and safety requirements, and on their specific jobs.

5. Comply with all the regulations established by the Panama Canal Authority.

6. Immediately report any personal injuries, spills, and accidents to the Project management.

7. Ensure that all work sites have adequate signaling.

8. Conduct a monthly inspection of the mechanical equipment used in the Project.

9. Conduct accident investigations on the following:

   a) Injuries requiring first aid: description, cause, and prevention.

   b) Personal injuries treated by a physician: description, cause, and prevention.

   c) Equipment damage: description, cause, and prevention.

10. Conduct and record monthly work inspections.
11. Provide trained firefighting personnel and equipment.
12. Provide field personnel with the proper communications equipment for the performance of their duties.
13. Store flammable liquids properly.
14. Post and keep the following important emergency telephone numbers at work areas:
    a) Panama Canal Authority Emergency and Protection Control Center
    b) Contractor Physician
    c) Panama and Colon Fire Departments
    d) National Police
    e) Health Centers

Emergencies must be evaluated and reported to the Panama Canal Authority to make sure its normal operations and the services it must provide are not affected by them.

8.7.2.3 Contractor's Employees

1. Employees shall comply with all rules, regulations, and performance standards of their assigned tasks.
2. Employees shall be responsible for the care and security of the personal protection equipment provided to them.
3. Employees shall be instructed on the importance of participating in the safety and

environmental meetings.

4. All accidents, personal injuries, and leaks that occur shall be reported to Supervisors.

8.7.3 Regulations

8.7.3.1 Safety Instruction and Training

The Environmental Education Plan included in this Environmental Management Plan contains more detailed information on the training to be provided by the Contractor to its employees during Project construction and operation. Nonetheless, as the success of the Risk Prevention Plan depends on the training provided to its employees, the Contractor shall be required by the Panama Canal Authority to apply the following basic guidelines to complement the safety instructions and measures established in the abovementioned Environmental Education Plan:

1. For the purpose of controlling or eliminating any risk or exposure that may cause illness or injury, every employee shall be instructed about the regulations that apply to his working environment, and trained to recognize and avoid unsafe conditions around him.

2. Employees who are required to handle or use hazardous materials shall be trained with emphasis on the safe use and handling of such materials and their potential risks, as well as the required personal hygiene and protection.

3. Every employee who must use personal protection equipment due to the activities he performs shall be responsible for the use and care of the equipment he is provided.

4. Employees shall comply with the regulations on the entering of confined or enclosed spaces, and shall be trained on the nature of the risks involved, the necessary precautions

to be taken, and the use of the required protection and emergency equipment. The Contractor shall comply with any specific regulations the Panama Canal Authority applies to the work to be performed.

5. The following records shall be kept at employee reporting stations or offices:

   a) A record of work related injuries and illnesses.

   b) Supplemental records on every work related accident or illness.

6. All work accident and illness records shall be updated and available to the pertinent competent authorities and/or institutions that may require their review.

8.7.3.2 Personal Protection Equipment

As a minimum, and for every operation where exposure to hazardous conditions exists, employees shall use the proper personal protection equipment and follow the personal protection program standards (2600 ESS-114 of the Panama Canal Authority), which updates and complements the provisions of the Panama Canal Authority Risk Control and Occupational Health Regulations. This equipment shall be stored according to its manufacturer's instructions, and the necessary security precautions shall be taken at its storage location to insure its protection.

The Project administration shall be in charge of determining the protection equipment required for the activities performed, and for providing Supervisors with the necessary equipment for their employees. In turn, Supervisors shall enforce the use of this equipment.

Personal protection equipment shall include:

1. Eye and Face Protection.

a) Employees shall be provided with eye and face protection equipment when machine or operations present the potential of eye or face injury from physical or chemical agents.

b) Employees whose vision requires the use of corrective lenses in spectacles, shall be protected by goggles or spectacles of one of the following types:

- Spectacles whose protective lenses provide optical correction;
- Goggles that can be worn over corrective spectacles without disturbing the adjustment of the spectacles;
- Goggles that incorporate corrective lenses mounted behind the protective lenses.

2. Foot Protection. Sandals and canvas footwear are absolutely prohibited. Employees exposed to potential risks shall wear safety footwear at all times.

3. Head Protection. Employees working in areas where there is the possibility of injury from impact by flying objects or electrical shock or burns shall wear hard hats.

4. Hearing Protection (Panama Canal Authority Standard 2600 ESS-215)

a) Hearing protection devices shall be provided to employees wherever it is not feasible to reduce noise levels or shorten the exposure to such levels.

b) Hearing protection devices inserted in the ear shall be fitted or determined individually by competent persons to ensure their adequate use and size, and to determine the necessary protection level and the adequate protection equipment. Plain cotton is not an acceptable protection device.

8.7.3.3 Hygiene and Vector Control Measures

Certain procedures must be implemented to avoid vector proliferation in work areas during Project construction and operation activities. In addition to the provisions of Panama Canal Authority Standards 2600 ESS-285 (Work Site Housekeeping) and 2600 ESS-225 (Pesticide Application, measures shall be applied which shall include the following:

1. Keep all dining areas, stoves, refrigerators, and microwave ovens clean to prevent them from turning into breeding sites for microorganisms that can affect worker's health. Inspections shall be conducted to verify if such equipment is kept clean.

2. Refrigerators for food must be kept at a temperature of 5°C or less. Food must be stored in containers, and the storage of food in plastic or paper bags or lunchboxes shall not be allowed.

3. To prevent spills inside microwave ovens, keep food containers covered while warming food.

4. No food, trash, dishes, boxes, work tools, or any type of container shall be permitted in the lockers.

5. Once a container used to store solid or liquid waste that does not meet the required sanitary requirements is detected, it shall be disposed of immediately.

6. Any garbage that can decompose must be removed daily in order to prevent bad odors and the proliferation of insects and rodents.

7. Ensure that all liquid waste receptacles meet the proper requirements to prevent spills.

8. Any organic garbage receptacles placed outdoors shall have covers with a good fit, designed to prevent the accumulation of water and avoid insect breeding.

9. All organic garbage receptacles shall be lined with plastic bags.

8.7.3.4 Housekeeping Rules

One of the main concerns of all construction personnel shall be good work site housekeeping to prevent accidents. Nonetheless, these housekeeping tasks must be planned at the beginning of the work, and shall be verified periodically until the Project is fully completed.

1. Work areas shall be free of waste and debris of any type during the entire Project performance.
2. At storage areas and shops where activities and operations will be conducted over a short period, any debris, waste, and materials not in use shall be removed from the work area because they constitute a fire risk. In the case of backhoes, care shall be taken to remove all oil on traffic areas to prevent skidding or slipping.
3. Compliance is required with the provisions of the Waste Management Program which include guidelines for the management of solid and sanitary refuse, as well as their risks.

8.7.3.5 Fire Protection and Prevention

The Contractor shall be responsible for developing and maintaining an effective workplace fire protection and prevention program during the entirety of the Project construction and operations. Therefore, the Contractor is responsible for verifying that its employees and Subcontractors comply with all the measures established in the Plan.

Fire Protection

In order to ensure an effective protection against fire risks, the Contractor shall comply with fire protection regulations, which shall include the following:

1. Have the required fire prevention and extinguishing equipment available at all times.
2. Ensure access to fire extinguishing equipment by placing it at accessible and conspicuously marked locations.
3. Conduct periodic maintenance and inspection of all firefighting equipment. Any defective equipment must be replaced.
4. Firefighting crews (fire brigades) shall be equipped and trained to assure adequate protection of human lives.
5. Provide a twenty pound type ABC fire extinguisher within a radius of 15 m at the site, wherever more than 25 liters of flammable fluids or 3 kg. or more of flammable gases are being used. This requirement shall not apply to motor vehicle fuel tanks.
6. The use of carbon tetrachloride and other toxic vaporizing liquid fire extinguishers is prohibited.
7. Use Table 8-26 as a guide to select the appropriate portable fire extinguishers.

Table 8-26

Fire Extinguisher Data

Class	Water	Foam	Carbon Dioxide	Sodium or Potassium	Multi-Purpose ABC

				Bicarbonate	
A: Wood, paper, trash having glowing embers	YES	YES	NO	NO	YES
B: Flammable liquids, gasoline, oil, paint, grease, etc.	NO	YES	YES	YES	YES
C: Electrical equipment	NO	NO	YES	YES	YES

Source: 29 CFR Part 1926

For effective fire prevention, the Contractor shall comply with the following:

1. Cables and lighting or power equipment shall be installed according to the requirements of NEC 1999 and RIE applicable in the country.
2. There shall be absolutely no smoking in any areas where operations may generate a fire risk. Conspicuous "No Smoking" or "No Lighting of Unauthorized Fires" signs shall be posted to keep workers informed about the areas so designated.

8.7.3.6 Exposure to Noise and Vibrations during Work

Permanent hearing loss may result from noise exposure, while vibrations can cause severe harm to the nervous system of workers exposed to them. Therefore, the Contractor shall apply the necessary controls during activities that generate noise and vibrations. To this end, the Contractor shall comply with Panama Canal Authority standards 2600 ESS-215 (Hearing Protection) and 2600 ESS-250 (Hygiene at Vibration Generating Sites). Additionally, the following requirements must be met:

Noise Levels

1. Noise levels shall not exceed 140 dB peak sound pressure levels during impulse or impact exposure periods.
2. The Contractor shall provide noise exposure protection equipment to all employees. Noise mitigation levels shall be taken into account at the time of selecting hearing protection equipment.
3. A hearing protection program shall be established for those employees exposed to noise levels over 85 dB during their 8-hour work periods. This program shall include an initial audiometry upon hiring, and every six months thereafter until the end of their employment.
4. Any noise variation that reaches the maximum level at intervals of one second or less shall be deemed as continuous.
5. Warning signs shall be posted at work sites where noise levels exceed the 85dBA limit.

Vibration

1. The time a worker is exposed to vibration from equipment, machinery, and work tools shall be controlled. In order to ensure that such worker exposure does not exceed the standard in force, workers shall be provided with the necessary protection equipment, and working equipment and instruments shall be periodically maintained.
2. Any vibration producing equipment must be equipped with vibration absorbent material.
3. The use of antivibration equipment shall be mandatory for equipment that can produce vibration levels harmful to a person's health.
4. Conduct medical surveillance to detect musculoskeletal problems in employees exposed to vibrations.

8.7.3.7 Operation of Heavy Equipment

For the purpose of achieving an effective operation of heavy equipment, the contractor shall comply with certain duties and responsibilities to ensure that the equipment used is in acceptable mechanical working condition, such as:

1. Any employee using heavy equipment must be knowledgeable about its operation and limitations. Likewise, he must know the regulations to be followed regarding the equipment at the work site.
2. The equipment shall be inspected at the beginning and at the end of each shift. These inspections shall be recorded.
3. The proper fire extinguishers shall be provided for the equipment to be used.
4. A system shall be devised and implemented to warn others that equipment is being moved. It may consist of honking a horn or ringing a bell for 15 minutes prior to moving the equipment, and operating the alarm when backing up.
5. The equipment must be stopped when lubricant, fuel, or antifreeze fluid leaks are detected.

8.7.3.8 Management of Combustible and Flammable Liquids and Toxic Substances

For a safe management of hazardous liquids, the Contractor shall:

1. Keep storage areas clear of weeds, rubble, or any other combustible material which does not need to be stored.
2. Control the access to storage areas and place conspicuous and legible No Smoking signs.

3. Electrical equipment used in flammable liquid and solvent storage areas must be of a design for use in hazardous atmosphere conditions.

4. Approved portable containers and drums shall be used at all times for storage and handling of combustible and flammable liquids. Metal safety containers shall be used to handle and use flammable liquids in quantities of more than one gallon, except for flammable liquid materials that are highly viscous, which must be handled in their original shipping containers. For quantities of one gallon or less, only the original container shall be used or metal safety cans for storage and handling of flammable liquids shall be used.
5. Flammable liquids and fuels shall be stored away from structures, and separated by walls that can withstand at least two hours of fire. Likewise, an ABC portable fire extinguisher with a capacity of not less than 20 lbs. shall be kept available at a distance of not more than 5 and 20 meters.
6. Every vehicle used for transportation or distribution of liquid fuels or other flammable substances shall have at least one Type ABC fire extinguisher with a minimum capacity of 20 lbs.
7. Smoking, lighting fires, or engaging in activities that can generate any type of spark is prohibited in areas used to receive, supply, or distribute flammable combustible liquids. In cases where welding work is required at a distance of less than 50 feet, the use of fireproof screens is mandatory to confine heat, sparks, or shavings.

8. Ensure that operators turn off motors on all fuel loading equipment and that no cellular telephones are used when performing this activity.

8.7.3.9 Blasting and Explosives Use

When there is the need to use explosives, the Contractor shall coordinate with the Panama Canal Authority Safety Division, who shall conduct all the necessary coordination for the use of these products at work sites. However, the Contractor shall comply with the safety requirements for the

control, transportation, storage, use, preservation, and disposal of explosives as established by the manufacturer, the Ministry of Government and Justice, the Panama Canal Authority, and the Panama Fire Department. Requirements to be met by the Contractors shall include the following:

1. Personnel using explosives or ammunition shall be trained in their handling, and shall also know the regulations established by the manufacturer of the product used. Explosive specialists and blasters shall hold a valid license issued by the Ministry of Government and Justice through the Panama Fire Department.

2. Exposure to explosives shall be limited to the minimum time possible. Only the personnel strictly needed shall be allowed, and the storage of explosives, as well as their handling shall be done by means of proven methods.

3. Explosives shall be stored in magazines according to their type and IME (Institute of Manufacturers of Explosives) requirements. Only short-term storage shall be allowed.

4. All personnel involved in the use of explosives shall be familiar with emergency procedures.

5. All explosive material shall have a Material Safety Data Sheet (MSDS), which shall be reviewed and approved by the Panama Canal Authority's Occupational Safety Division.

6. In cases in which a vehicle used for the transportation of explosives must be sent for repairs, it should be checked to ensure that it is not carrying any explosive materials.

7. Blasting shall be done during daylight, and alarm systems shall be set up in access areas to signal the time when they will be conducted. The alarm shall be checked to ensure that it will be audible over surrounding noise levels.

8. A National Police officer shall be present during the entire blasting process and the return of the material, as necessary.

9. When the use of explosives is required in populated areas, a plan to inform the community

shall be established in order to avoid alarming the residents.

8.7.3.10 Using Gas Cylinders

The popularity of the use of gas cylinders is due to the fact that product compression allows the storage of a larger amount of product in a reduced space, which facilitates work. When cylinders are in good working condition, it is possible to control the release of their contents. However, should they fail, the contents can be released violently, and they can become a serious physical threat. Therefore, it is important to take the following into account when using them:

1. Prior to the use of a cylinder, its valve must be cleaned to remove any dust or dirt it may contain.
2. Gas cylinder valves must be opened slowly, ensuring that they are either totally open or totally closed, and never partially closed.
3. Cylinders with leaks shall be removed immediately.
4. Do not exchange regulators, as some are specific to each gas. Also, valve safety devices must not be altered in any way.
5. Ensure that cylinders receive adequate maintenance by personnel qualified for these tasks.

8.7.3.11 Stabilization of Slopes and Unstable Areas

In areas where earth movement, slope adjustment, and blasting are necessary, the Contractor shall be responsible for ensuring the safe passage of persons and equipment. For this reason, the Contractor shall take all the required actions to stabilize any areas that may pose a safety hazard to workers, local traffic, and the population.

8.7.3.12 Control of Access Zones

The access of employees to work sites during the construction and operation phases shall be coordinated with the Panama Canal Authority, and shall be the Contractor's responsibility. The admission of personnel shall be authorized only when they must perform specific functions, with the exception of the areas designated for public use.

To comply with the above, the Contractor shall:

1. Submit to the Panama Canal Authority for its approval, the methodology to be implemented to provide access to work areas. This methodology shall include the means of identifying employees who must have access and stay in work areas (identification cards), as well as the use of safety equipment (such as hard hats).
2. Assign personnel to be in charge of searching packages, belongings, and vehicles at entry and exit points.
3. Warning signs shall be located in places where access is not permitted, either because they are Canal operating areas or because the activities performed pose some type of hazard to other employees. The Contractor shall ensure that these warning signs are placed in locations where they are visible to all employees and other persons transiting the area.

8.7.3.13 Use of Signals, Signs, and Barricades

For the purpose of establishing a uniform system of signals, signs, and barricades, the following

shall apply:

1. Accident prevention tags shall be used as a temporary means to warn employees about an existing hazard, such as defective tools and devices, etc.

2. All construction areas shall be marked with visible and legible traffic signals in areas where there is any type of hazard.

3. When operations are such that signs, signals, and barricades do not provide the necessary protection at work areas or roads, flagmen or other appropriate traffic controls shall be provided.

4. Flagmen shall use sign paddles or red flags of at least half a square meter in size, and red lights in periods of darkness.
5. Workers assigned to flag signaling shall position themselves along the edge of the road next to the traffic direction they are controlling, and never on the road.
6. Flagmen shall be provided with a red or orange warning garment which they shall wear for signaling with flags. Warning garments worn at night shall be made of reflectorized material.

7. Flagmen shall be posted at a distance sufficiently away from the place the work is being performed, to allow drivers to slow down and stop safely.

8. Flagmen shall ensure that they have visibility in the direction of the traffic they are controlling as well as of the activities other workers are performing. If this is not possible, flagmen shall be in direct and continuous communication with the location of their fellow workers, such as by two-way radio or telephone.

9. Solid barricades shall have a minimum height of 40 inches and be painted with stripes four to six inches wide, in yellow and black, or white and red. In the case of flexible barriers, these shall be three inches wide and depict the reason why they have been placed.

8.7.3.14 First Aid

First aid consists of the immediate and temporary care provided to the victim of an accident or sudden illness, until the services of a physician are secured. Prior to the start of the Project, it shall be clearly established who the persons qualified to treat this type of situations shall be, as very often accident victims are affected instead of assisted by persons wishing to help without any type of instruction in this field. There shall always be a First Aid kit available to the person in charge of administering First Aid.

1. Prior to sending First Aid kits to work areas, the quality of their contents must be checked to ensure that they are in good condition. The First Aid kit shall contain the materials described in Table 8-27, or those approved by a consulting physician, in a weatherproof container with individually sealed packages for each type of item.

2. Keep physician, health center, and ambulance telephone numbers in a visible location.

3. The person in charge of each kit is responsible for having a qualified person in his crew to administer first aid.

4. All injuries occurring during any activity shall be reported to the person in charge, however small they may seem.

5. All accidents shall be reported to the field office on an incident report form prepared by the person in charge of each group.

6. Develop and implement an emergency plan to handle serious medical emergencies (such as a heart attack, amputation, serious lacerations, head injuries, etc.), describing in detail the procedures to be followed as an initial treatment and the stabilization of the affected personnel, until emergency medical treatment and transportation is provided to the nearest hospital with the capacity to treat such types of emergencies.

Table 8-27

Field First Aid Kits

	FIELD FIRST AID KIT
#	DESCRIPTION
4	4 medium pairs of Latex gloves
1	1 sterile dressing for burns, 1"
1	1 sterile dressing for burns, 3"
1	1 sterile dressing for burns, 8"
1	1 gauze dressing, 2"
1	1 gauze dressing, 3"
1	1 gauze dressing, 4"
2	2 warm compresses
1	1 antiseptic / analgesic cream
1	1 8 oz. bottle of peroxide
10	10 non adhesive gauze
1	1 4 fluid ounce isotonic solution
1	1 microshield
1	1 triangular bandage

	FIELD FIRST AID KIT
#	DESCRIPTION
8	8 disposable thermometers
1	1 diagnostic penlight with pupil gauge
9	9 iodine cotton tips
100	100 cotton tips
1	1 antibiotic ointment
1	1 pair scissors (paramedic, also to be changed)
2	2 tweezers
50	50 Band Aids
1	1 elastic bandage, 3"
1	1 adhesive tape, 1"
1	1 adhesive tape, ½"
4	4 eye patches
1	1 elastic bandage, 4"
6	6 auto-adhesive bandages, 2"x2"
1	1 dressing with bandage
1	1 trauma bandage, 12"x30"
1	1 First Aid Manual

	FIELD FIRST AID KIT
#	DESCRIPTION
10	10 2-tablet envelopes with oral serum
1	1 bottle eyewash, or similar
1	1 emergency thermal or shock blanket
1	1 package cotton
1	1 glucose gel, 15 gr.
1	1 stethoscope
1	1 sphygmomanometer
1	1 bottle activated coal
1	1 small bottle Ipecac
20	20 envelopes alcohol towelettes

Source: URS Holding, Inc.

8.8 Wildlife Rescue and Relocation Plan

8.8.1 Introduction

Since there are vertebrate species in the Project area, some of which are considered in danger of extinction, it is possible that during the Project construction phase, mainly during clearing of

vegetation and earth movement, the life of some animals may be threatened. In order to avoid or mitigate any direct damage to animals, an operation for the rescue and relocation of fauna species must be conducted, especially of land species with little mobility, arboreal, and nocturnal. Nests, burrows or hollows that may be located in the Project footprint area will probably be destroyed, but the rescue operation shall be directly precisely to the rescue of animals in those places.

To avoid or minimize the number of deaths of wild animals during construction, a fauna rescue operation must be conducted. Among the objectives of this measure is the capture of most of the animals of the vertebrate fauna that could be eliminated, disturbed, or who will lose their habitat during the construction stage, as well as the transfer of these animals to adequate locations where their survival may be ensured. The groups of vertebrates to be rescue are mainly: (a) land and arboreal mammals, (b) certain birds and nests with eggs, (c) reptiles, and (d) amphibians.

8.8.2 Schedule

The rescue program must be implemented prior to the clearing and brush hogging of the vegetation cover, and its duration may vary depending on the work areas. The duration of the rescue program shall ensure, at all times, the capture of the largest number of animals.

8.8.3 Capturing Mammals

In order to capture land mammals (such as possums, spiny rats, agouti, paca, other rodents, Dicey's rabbits, etc.), 20 Tomahawk live trap transects (40 x 12 x12 cm), set at 20 meter intervals shall be

installed by sector (mature secondary forest, young secondary forest, and stubble). In these transects 30 live Sherman type traps and 40 Tomahawk traps (25 x 7 x 7 cm) shall be set for small animals, each one at a distance of 20 m. Each type of trap shall be set in pairs, one at ground level, and the other on branches or on trunks of trees or bushes 5 to 10 m from the ground, in order to capture the arboreal species.

Some nocturnal species may be captured manually or with nets by blinding them with the light from lamps or capturing them directly in their tree trunk hollows during daylight.

8.8.4 Capturing Birds

Birds that for some reason are unable to fly away or move toward a safer place shall be rescued manually or with nets. Likewise, nets with eggs or hatchlings abandoned by their parents shall be rescued and taken to a shelter for their care.

8.8.5 Capturing Reptiles and Small Amphibians

The search for reptile species shall be done both during daytime as well as nighttime. Reptile and amphibian individuals shall be located visually during the general search or by inspecting the microhabitats of these species. When an individual is found, it shall be captured manually or with nets; in the case of poisonous snakes, they shall be caught with the aid of tongs and leather gloves, and placed in sacks.

8.8.6 Capturing Caimans and Crocodiles

In the case of crocodiles and caimans, there is already some previous history of such activity in the Project area.[11] Equipment such as boats, high power flashlights, pullers, antenna or snap loop snares, trammel nets, and snake tongs will be necessary. Newborn and small juveniles shall be captured with tongs or directly by hand. Trammel nets and antenna or snap loop snares may be used for catching juveniles; subadults and adults may be caught with pullers, and trammel nets and snap loop snares may be used for larger adults (more than 1.20 meters). As in the case of small reptiles, their capture will be done on daytime and nighttime schedules.

Runs must be made along the banks or coastlines, mangroves, and lagoons or marshy areas in order to locate the nests or haunts of these species. During daytime searches for individuals, watery areas shall be checked also for the proper conditions to operate boats at nighttime. In the event conditions are not good to operate boats, the areas shall be cleared and easements established. Once captured, the individuals shall be transferred and relocated to sites selected in coordination with ANAM.

8.8.7 Transferring and Releasing Rescued Individuals

After their capture, animals will be transferred to areas with proper and safe habitats that may be located in natural areas with environmental features similar to those of their existing habitats in the study site (such as forests, rivers, etc.). This area must meet the necessary conditions to provide

11 University of Panama, Department of Natural and Exact Sciences and Technology. Center for Biotic Resource Studies (*CEREB*), February 2006. Final Report on the "Rescue of Crocodiles in the Cocoli and Gatun Lagoons in Panama Canal Operating Areas."

the habitat requirements of each one of the rescued species. In view of the fact that the Soberanía National Park, the Cruces National Park, the San Lorenzo Protected Area, and the forests on the west side of the Canal are next to the area of direct Project impact, these could be sites adequate to transfer and release rescued individuals, as they have well preserved forested zones where these animals can find shelter.

8.8.8 Interagency Coordination and Cooperation

The animal rescue and relocation program shall be conducted in full coordination with ANAM, who shall determine the release sites. ANAM shall be kept informed about the capture, the captured species, and the number of rescued individuals.

Likewise, the Panama Canal Authority shall invite other organizations with experience in this field (Summit Park / the Municipality of Panama, ANCON, the Audubon Society) to participate in a Wildlife Rescue and Relocation Training Program, whose participants could collaborate in the rescue and relocation program.

8.9 Environmental Education Plan

The implementation of an Environmental Education Plan is required for Project workers as required by regulations in order to minimize the probable impacts (poaching, illegal logging, pollution, etc.) that could result from the presence of personnel at Project sites.

The objective of this Plan will be to instruct, educate, generate awareness, and provide tools to Project employees to comply with our country's existing environmental protection regulations and the obligations derived from this Environmental Impact Study.

Project Contractors shall submit to the Panama Canal Authority for its consideration a detailed Training Plan, by type of work to be performed by crews that must include, as a minimum, the guidelines defined in this Plan.

8.9.1 Contents of the Plan

In the first place, there must be a discussion of environmental matters in general, followed by the obligations generated by the Environmental Impact Study under the Environmental Management Plan, that must be met by workers while working on this Project.

The development and training of personnel shall cover, as a minimum, the following subjects:

1. Erosion control and sedimentation
2. Illegal extraction of natural resources
3. Poaching
4. Illegal logging
5. Hazardous and non-hazardous waste management
6. Hydrocarbon and chemical spill control
7. Air, water, and soil pollution
8. Identification of cultural resources
9. Vector and pest control
10. National and international environmental laws
11. Relations with neighboring communities
12. Project Environmental Management Plan
13. Penalties in Panama for environmental law violations

8.9.2 Organization of Training

Environmental training shall be provided to each worker prior to the start of his work on the

Expansion Project. Such training shall be provided in groups of 15 to 20 workers, over 2 to 3 days, and shall be conducted by an environmental specialist. Training will consist of interactive lectures given by the specialist with supporting literature (pamphlets, booklets, leaflets, posters, etc.).

In addition to the initial training, monthly talks shall be given to field personnel to refresh or update their environmental knowledge.

8.9.3 Training Records

Contractors shall keep an updated record of the training provided to Project workers. This record shall contain the date of the training, general information on the person to whom it was provided (name, cedula number, and Project job), his signature, and the information and signature of the person who provided the training.

A similar record shall be kept of the short monthly talks held.

Every worker shall be required to attend the entire training program to obtain a clear understanding and knowledge about the various special environmental management requirements for the entire Project.

8.9.4 Training Follow-Up

After the start of the construction work, the Environmental Specialist shall supervise the work of all employees and report any non compliance incident or negligent actions by any employee. The proper management of human resources shall be one of the key components of the training program. In the event an employee incurs in negligence, he shall be required to undergo retraining on the Environmental Management Plan.

The Environmental Specialist shall report about any worker who does not show diligence in complying with the environmental guidelines applicable to the Project and shall issue him a warning; if he persists in his attitude, he shall be reported and removed from the work site.

8.10 Contractor's Contingency Plan

Once the construction stage begins, and throughout the entire stage of the construction of a Third Set of Locks, there will be the possibility of accidents due to risks at all work fronts. These accidents may consist of overturns, cuts, fires, spills, and accidents due to mechanical problems or lack of experience of construction personnel, because the work involves the use of heavy equipment, explosives and work in areas with unexploded ordnance, floods, earthquakes, etc. Contractors and workers must be prepared to provide an immediate and adequate response to such types of situations.

In view of the above, the following are the minimum contingency measures the Contractor must

adopt to handle the unexpected risks, as described in greater detail in subsequent sections:

1. During the transportation of explosives and hazardous substances, an escort is required with a First Aid kit, fire extinguisher, radio communications, and the ability to take quick action to assist persons and prevent an accident from evolving into a tragedy and/or an environmental disaster.

2. Safe tank trucks shall be used for the transportation of fuel to work areas, equipped with a first aid kit, radio system, and a fire extinguisher;

3. Work areas shall have an appropriate vehicle in good working condition, and the proper equipment and materials to control fires, explosions, and fuel spills. Likewise, they shall have a radio or telephone system, a first aid kit, and trained personnel to handle emergency cases;

4. An efficient and safe system to communicate with the person in charge of the work, the ACP Emergency and Protection Control Center, and the nearest Fire Department shall be maintained to handle any accident in order to prevent any actions from adversely affecting Canal operations and ship traffic. The Panama Canal Authority shall be notified to ensure that its normal operations and services are not disrupted.

5. A good alarm system shall be established to warn workers timely and provide first aid to accident victims;

6. Work fronts shall have the proper equipment to remove landslide material or provide assistance in the event of floods or accidents in rivers or lakes, as well as accidents due to earthquakes;

7. The proper equipment, materials, and qualified personnel shall be kept available so they may take quick and effective action in the event of spills or accidents that could affect rivers, streams, and lakes;

8. All fuel storage areas shall have centrifugal suction pumps for the timely control of spills; and

9. In more distant areas where it may be difficult to obtain emergency treatment, adequate infirmaries shall be established to treat accident victims.

In addition to the above, all personnel working in the development of this Project must know and comply with the Contractor's emergency and contingency program during the construction stage and with the Panama Canal Authority emergency and contingency program during the operations phase.

8.10.1 Objective

The objective of this plan is to reduce the possibility of harm to persons, property, the environment, and the operation of the Canal as a result of the activities of the Panama Canal Expansion – Third Set of Locks, by:

1. Preserving environmental quality and preventing or minimizing pollution in general, as well as that of water and soils due to fuel or hazardous substances at work fronts;
2. Preventing any possibility of fire or explosion due to a fuel spill, unexploded ordnance in work areas, or lack of caution when handling explosives;
3. Reducing damage caused by floods, earthquakes, landslides, or mismanagement of equipment in work areas;
4. Protecting infrastructures and Project equipment.

8.10.2 Action Priorities

In the event multiple emergencies arise, the following order of priorities shall be established:

1. The protection of human lives;
2. The protection of human settlements (districts, sections, or housing developments), as warranted;
3. The protection of water bodies from pollution (potable water systems, rivers, streams, lakes, etc.);
4. The protection of wildlife areas from pollution; and
5. The protection of Canal infrastructures.

8.10.3 Organization

This plan contains the basic aspects to be considered by Project personnel and has been structured in such a way that it may integrate the activities construction personnel must perform with the actions to be taken in case of a contingency. Being the promoter, the Panama Canal Authority has the responsibility of informing the ANAM Regional Office and the Ministry of Health about any change or event that may alter the established procedures.

The major Plan components are:

1. Objective
2. Priority of actions
3. The establishment of responsibilities
4. Arrangements with local authorities
5. Contact list
6. Emergency action plans
7. Emergency response measures
8. Emergency control equipment and materials
9. Contingency Plan revisions and updates.

8.10.4 Responsibilities

Within its legal framework, The Panama Canal Authority has established its standard (2600 ESS-129) whereby the Contractor is responsible for its own risk management, as well as for its emergency response. In this context, these internal standards established by the Panama Canal Authority for its contracts (2600 ESS-129) specify that the Contractor shall always be the main and sole party responsible for the safety and health of its employees, as well as for their activities. For this reason, the Panama Canal Authority shall stipulate in all its contracts that Contractors shall comply both with the Panama Canal Authority internal regulations as well as with all environmental and safety regulations in force that are applicable to the activities they will perform.

In this context, during the construction stage the Contractor shall be responsible to the Panama Canal Authority for the implementation of all the measures in the Contractor's contingency plan. After the delivery of the construction and during the operations stage, the Panama Canal Authority will assume the implementation of contingency plans for the operation of the Project, and shall include incident response actions in its own Contingency Plan.

During the construction stage, the main responsibilities shall be assigned to the Contractor's Project Administrator, the Contractor's Safety Manager, and the Contractor's Supervisors. These persons will be responsible for coordinating all emergency response actions and must be knowledgeable about all the details of the Contingency Plan, including all operations and activities at the work sites, the location, and characteristics of the managed waste, and the location of the records and work area layouts. The following is a summary of their responsibilities:

8.10.4.1 Contractor's Project Administrator

He is one of the trusted employees of the Contractor, and shall have the following functions and responsibilities:

1. Ensure that there are the human, technical, and financial resources to implement the Contingency Plan.

2. Whenever it is necessary to prepare contingency reports, and approve and submit them to the appropriate authorities.

3. Enforce compliance with the Contingency Plan, in coordination with the Project Supervisor, and conduct regular meetings and inspections to ensure its implementation.

4. Investigate any accidents or incidents that occur upon activation of the Contingency Plan, prepare the appropriate report, and coordinate any actions to correct any such situations involving the procedures followed at the site, the Contingency Plan, and the environmental remedial / mitigation actions.

5. Notify the Panama Canal Authority Safety Control and Emergency Dispatch Center and the authorities about any incident that occurs which may require the implementation of any of the action plans.

6. Coordinate, as required, the participation of the authorities and other external resources, to handle contingencies.

7. Ensure that there is enough and accessible equipment, as well as the proper materials for the control of contingencies.

8. Coordinate any training required for the proper implementation of the Contingency Plan.

8.10.4.2 Person in Charge of Safety

The Safety Manager shall assist the Contractor Administrator. This function may be performed by the person in charge of the Project environment, or any other employee who knows the responsibilities under the Plan.

8.10.4.3 Supervisors

These are the persons in charge of the work fronts during the construction stage, or in charge of partial components of the construction phase (such as earth movement, electrical work, public utility work, etc.). Their duties include:

1. Prior to the performance of their tasks, evaluate the risks and actions to be applied.
2. Implement the action plan that is appropriate to the situation, as required.
3. Keep in close communication with the Project Administrator and the person in charge of safety regarding safety measures, their compliance, and the activation of action plans.
4. Coordinate any action to handle emergencies with workers in the specific area, the person in charge of safety, and the Project Administrator.
5. Ensure that their workers know and are able to apply the procedures in the action plans of this Contingency Plan.
6. Prepare contingency reports as required.

8.10.5 Coordination with Local Authorities

Prior to starting work, with the knowledge of and in coordination with the ACP Emergency and Protection Control Center, the Contractor shall enter into the necessary agreements with the Fire Departments in Panama and Colon, the National Police, and any Emergency Teams that may be required in case of any contingency, for the purpose of establishing the means to notify and gain access to the corresponding locations within the work areas in the event their support is required to handle emergencies. Also, local hospitals and clinics must be informed about the properties of the hazardous materials waste handled at the Project and the types of injuries or illnesses that can be caused by fires or explosions. Likewise, local authorities shall be invited to inspect work sites. If they refuse to do so, this fact shall be recorded in the Hazardous Waste Management records.

Table 8-28 below provides a list of the authorities that may not be omitted from the Contingency Plan, along with their telephone numbers in the event of an emergency.

Table 8-28

Contacts for Preparation of a Contingency Plan

Agency	Telephone number
National Environmental Authority – ANAM – Panama Metro	500-0910
a. Colon Regional Office	442-8348
b. Panama West Regional Office	254-3048
SINAPROC – Main telephone exchange	316-0053/56/78
Emergency	335
Colon Provincial Office	447-1448
Panama Fire Department	103
Buena Vista Fire Department	442-6311
National Police main telephone exchange	511-7000
Emergency	104
Panama Social Security	269-0222/263-5444
Ambulance	229-1133
Red Cross – Ambulance	228-2187
Santo Tomas Hospital	207-5600
Manuel A. Guerrero Hospital	441-5077/5151
Ambulance	441-5077

Agency	Telephone number
Mobile Medical Emergency System (*SEMM*)	264-4122
Ministry of Health (*MINSA*)	512-9400

Source: Panama Government agency website; Panama and Colon Business, Corporate and Residential Telephone Directory 2007-2008.

8.10.6 List of Contacts

During the construction stage, it is important that the Contractor designate in the Contingency Plan the personnel responsible for its various actions. This information must be kept at an accessible location, and all personnel must be informed about it. Table 8-29 provides the recommended format for the internal contact list.

Table 8-29

Information on Internal Contacts

for the Activation of a Contingency Plan

Position	Name	Office telephone	Cellular telephone
Project Administrator			
Person in charge of Safety			
Supervisors, by type of work being performed			

Source: URS Holding, Inc.

8.10.7 Emergency Action Plans

An Emergency Action Plan must describe in detail the general measures and the order in which the actions must be taken to handle emergencies resulting from the risks identified in the appropriate section of the Risk Prevention Plan.

Table 8-30 shows the general steps to be taken once any of the identified emergencies occurs.

Table 8-30

General Procedure Scheme

Risk	Type of Emergency	Procedure
Physical Risks 1. Fire 2. Flood 3. Earthquake 4. Falls 5. Exposure to Natural Elements 6. Use of Mechanical Equipment 7. Electrical 8. Explosions	*Manageable	1. Once an emergency is detected, the Supervisor must be informed. 2. The Supervisor goes to the area and evaluates the situation. 3. Instructions are issued to apply the specific contingency measures appropriate to the case. 4. Once the situation has been controlled, the Project Administrator is informed about it. 5. The corresponding report is prepared.
Chemical Risks 1. Handling of Chemicals 2. Spills 3. Hazardous	*Unmanageable	1. Once an emergency is detected, the Supervisor must be informed. 2. The Supervisor goes to the area and evaluates the situation. 3. Immediately after it is determined that the situation is not controllable, the Administrator or the person in charge of safety is notified so that the Panama Canal Authority Safety Division, as well as any outside support resources (Fire Department,

Atmospheres		National Police, ambulances) are notified. 4. The Supervisor proceeds with instructions to apply any possible measures provided conditions so allow it.
Biological Risks 1. Bites 2. Animal Attacks 3. Contact with Poisonous or Urticant Vegetation		1. The Administrator or person in charge of safety go to the area and stay at a safe location until help arrives. The area may be evacuated, if necessary. 2. Once outside resources are obtained, the Administrator directs them to the site of the emergency. 3. Instructions are given to prepare a report.

Source: URS Holding, Inc. *Manageable and unmanageable situations apply for any of the identified hazards.

8.10.8 Emergency Response Measures

8.10.8.1 Fires

Due to the complexity of Project activities, there will be a diversity of reasons why a fire may be generated, including: the use of explosives, blasting, welding, the use of fuel and hazardous substances, etc. Therefore, the following response measures are established in the event of fire:

1. Immediately upon the identification of an emergency situation, the area Supervisor shall be notified and he will go to the site of the incident.
2. Workers must then practice what they learned at their Contingency Plan training by taking a fire extinguisher, foam tank, or hose closest to the site of the incident, and extinguishing the fire, if possible.
3. Once the situation has been controlled, the Supervisor notifies the Administrator or person in charge of safety about the incident, and prepares a report.
4. The Administrator or person in charge of safety approves the reports and forwards it to the authorities. He also ensures that the equipment used to extinguish the fire is placed back in its storage location.
5. In situations where the Supervisor determines the need for outside resources, and if conditions so allow it, the personnel shall be organized to start firefighting operations while waiting for firemen to arrive.
6. The Supervisor informs the Administrator or person in charge of safety about the incident, with the following procedure:

a) Coordinates with the closest fire station its assistance to handle the incident, and goes to the site.

b) Notifies the ACP Emergency and Protection Control Center about the situation.

c) Depending on the extent of the incident, evaluates the need to evacuate the site and waits for outside assistance.

d) Once the emergency has been resolved, prepares the corresponding report and submits it to the ACP Emergency and Protection Control Center within a period of not more than 24 hours.

e) Ensures that the firefighting equipment that has been used is placed back in its proper storage location.

8.10.8.2 Floods / Earthquakes

1. Immediately upon identifying an emergency situation, the Area Supervisor shall be informed, and he shall go to the site of the incident.

2. Personnel shall put into practice the instructions they received during their Contingency Plan training. The area is evacuated.

3. In the event of a flood, once the Supervisor evaluates the situation, workers shall be organized for the construction of dykes and levees. At the same time, water shall be pumped out of work sites.

4. In cases where the Supervisor determines that they are facing a non-manageable situation, the Administrator or person in charge of safety is called, and he shall apply the following procedures:

    a) Coordinates with the National Civil Protection System to obtain its assistance for

handling the incident, and goes to the site.

b) Informs the ACP Emergency and Protection Control Center about the situation.

c) Waits for outside assistance and directs it to the affected site.

d) Once the emergency is resolved, he prepares the corresponding report and submits it to the ACP Emergency and Protection Control Center, as well as the competent authorities within a period of not more than 24 hours.

8.10.8.3 Work-Related Accidents

The procedures described below apply to all hazards that may affect workers, including those derived from the handling of mechanical equipment, power systems, the handling of chemicals, the effects of hazardous atmospheres, explosions, and all emergency situations resulting from contact with animals or vegetation:

1. Workers who detect an emergency shall report it immediately to the Supervisor and the person in charge of First Aid.
2. A First Aid kit is located and treatment is administered to accident victims.
3. The person in charge of First Aid goes to the place where the victims are, evaluates the assistance they have received and determines whether:
    a. Victims need to be transferred to a specialized medical center;
    b. Victims must be kept immobilized and an ambulance shall be called to the site of the incident to carry victims.
4. In the event specialized treatment is needed, the person in charge of First Aid shall coordinate

the transfer of victims with the Administrator or person in charge of occupational health. In cases where the cause of the accident involves chemicals, the Materials Safety Data Sheet on the chemical that caused the emergency shall be provided to the medical center.

5. Once the emergency is resolved, the Administrator or person in charge of safety shall prepare the corresponding report and submit it to the ACP Emergency and Protection Control Center, and to the competent authorities.

6. The Administrator or person in charge of safety shall ensure that the First Aid kit supplies that have been used are replaced.

8.10.8.4 Natural Elements

1. Immediately upon identifying an emergency situation, the Area Supervisor and the person in charge of Safety shall be informed, and they shall go to the site of the incident.

2. Workers shall put into practice the instruction received during the Contingency Plan training, and all will be moved to safety zones.

3. The person in charge of First Aid shall apply the established contingency measures for work-related accidents mentioned above.

4. Once the Supervisor evaluates the situation, workers are organized for the removal of the accumulated material or for aquatic rescue.

5. In cases where the Supervisor determines that they are facing a unmanageable situation, the Administrator or the person in charge of safety is called, and he shall proceed as follows:

    a) Coordinates with the National Civil Protection System their assistance in handling the incident, and goes to the site.

    b) Informs the ACP Emergency and Protection Control Center about the situation.

c) Depending on the extent of the incident, evaluates the need to conduct the rescue of trapped workers.

d) Waits for outside assistance and directs it to the site of the incident.

6. Once the emergency is resolved, the Supervisor prepares the corresponding report and submits it to the ACP Emergency and Protection Control Center and to the competent authorities within a period of not more than 24 hours.

7. The Administrator or person in charge of safety shall ensure that the First Aid supplies that have been used are replaced.

8.10.8.5 Fuel or Lubricant Spills

1. Immediately upon detecting an emergency, workers shall inform the Section Supervisor.

2. The Supervisor goes to the emergency site to evaluate the situation and coordinates the pertinent actions. He instructs all personnel to move to a safe location.

3. Once the Supervisor is in the area, he must evaluate the situation to determine whether it is possible to handle the spill with the resources in the area, and shall:

    1. Immediately control the source of the spill.

    2. Request fire extinguishers to be sent to the spill site.

    3. If necessary, coordinates the containment of the spill with containment barriers for ditches and drainages, and the use of absorbent material.

4. The Supervisor shall notify the person in charge of safety about the incident and shall provide preliminary information about its extent.

5. The person in charge of safety shall:

a. Evaluate the need to go to the site to support Plan actions, depending on the extent of the incident.

b. Prepare the corresponding report and submit it to the ACP Emergency and Protection Control Center and the competent authorities.

c. Ensure that equipment and materials used to contain the spill are placed back in their storage.

6. In cases where the Supervisor considers that they are facing an unmanageable situation, he shall notify the Administrator or person in charge of safety about the situation, who shall:

    a. Coordinate and proceed with actions with outside resources.

    b. Notify the ACP Emergency and Protection Control Center and the competent authorities.

    c. Go to the site to provide support to Plan actions.

    d. Coordinate spill cleanup tasks.

7. When bodies of water are affected by spills, the Administrator or person in charge of safety shall ensure that additional measures are taken, including:

    a. Sampling of water quality 24 hours after the spill, at a minimum of three locations (0, 500 and 1,000 meters) downstream from the source of the spill.

    b. Repeat sampling every three days at the same locations until the water returns to its normal condition.

    c. Notify water users in a proper and timely manner about the existence of a contaminant, and notify them when the water becomes normal again.

8. Once the emergency situation is resolved, the Supervisor prepares the corresponding report and submits it to the ACP Emergency and Protection Control Center and the competent

authorities.

9. The Supervisor ensures that the equipment and materials that have been used to contain the spill are replaced.

In the case of fuel spills, it is important to proceed to excavate and cleanup the material once the spill has been contained. The final disposal of the absorbent material and contaminated soil must be done at sites authorized as Contractor disposal sites. In the event the product spilled is a petroleum byproduct, it shall be treated prior to its disposal with products that accelerate its biodegradation process.

8.10.9 Emergency Control Equipment and Materials

Every Contingency Plan shall include a list of the equipment available to handle emergency situations. Likewise, once the work areas are established, site layout drawings shall be prepared showing the type and location of such equipment and material, as well as the minimum quantities to be kept in stock. Nonetheless, their characteristics and quantities shall be determined by the area where the emergency can happen. The following are proposed as a minimum:

1. First Aid kit
2. Communications equipment
3. Personal protection equipment for cleanup work, such as leather gloves, goggles, and protective clothing
4. Portable fire extinguishers

5. Fire extinguishing foam cylinders
6. Fire hoses
7. Floating containment barriers for major spills
8. Booms and absorbent pads
9. Cleanup products for small fuel spills
10. Shovels, machetes, and pickaxes
11. Large plastic bags
12. Flashlights
13. Backhoes to excavate contaminated materials
14. Containers, drums, and temporary storage bags to clean up and transport contaminated materials
15. Absorbents such as pillows, rags, and rolls to contain and collect spilled liquids
16. Commercial spill equipment (or their functional equivalent) that comes with a large variety of prepackaged absorbents for large or small spills.

8.10.10 Contingency Plan Revisions and Updates

The Contingency Plan shall be revised yearly, whether or not emergencies have occurred, since the purpose is to update the information it contains and improve the established procedures. This revision shall be in charge of those responsible for the implementation of the Plan, such as the Project Administrator, the person in charge of safety, and the Supervisors.

All changes made to the Contingency Plan shall be recorded. It is also mandatory to inform the ACP Emergency and Protection Control Center and the authorities about what was observed, any recommendations, and the changes made. These changes shall be relayed to all employees.

Whenever there is an emergency situation, it is vitally important to review and analyze the incident starting with its causes and ending with the results of the application of the Plan. This analysis will be made for the purpose of verifying whether the established process is effective, and if it is not, the pertinent changes that must be made.

8.10.11 Emergency Situations Post Construction Delivery by Contractor and During Operations

Once the project is turned over to the Panama Canal Authority, the operations phase begins and the Contingency Plan that will be in force thereinafter shall be according to the Panama Canal Authority Contingency Plan, taking into account the transition period. The following guidelines shall apply at such point in time and will be the ones that are currently applied by the Panama Canal Authority under its Contingency Plan. For the operation of the new works, the Panama Canal Authority Contingency Plan shall be revised to include the new structures, an analysis of the new risks, and the identification of responses to these new hazards.

At the present time, the Panama Canal Authority has an Emergency and Contingency Management Division that establishes regulations applicable to emergency situations. These regulations follow legal requirements such as those of Agreement 12 of June 3, 1999, whereby the Panama Canal Authority Risk Control and Occupational Health Regulations are approved;

Agreement 13 of June 3, 1999, whereby the Panama Canal Regulations on Navigation in Panama Canal Waters are established; Agreements 65 of April 22, 2003 and 71 of December 16, 2003, which modify the Regulations on Navigation in Panama Canal Waters; and Agreement 10 of May 6, 1999, whereby the Regulations for the Handling of Emergency Situations are established, etc.

The following is the general structure of the Contingency Plan to be implemented by the Panama Canal Authority during the operations phase of the Project.

1. The criteria to handle the situation as it occurred.
2. The emergency flow chart to determine the parties involved.
3. The identification of the type of incident that occurred, which may involve:
    a. Marine or at coastal facilities.
    b. Radioactive materials.
    c. On land:
        i. Fire
        ii. Hazardous materials
        iii. Hydrocarbons
        iv. Mass medical
    d. Aircraft incidents or accidents
    e. Derailment
    f. An announced natural disaster that may occur (such as tsunamis, floods)

g. Floods

h. Natural disasters that have occurred (such as earthquakes)

i. Terrorism, bomb threat, and sabotage.

4. An automatic search for contacts (on an internal level).

5. The search for resources to be used, which could be government, private, or local.

6. Action Plans, which shall be specific, depending on the type of incident, such as:

   a. Ships in general

   b. Ship fires

   c. Structural fires

   d. Hazardous materials

   e. Hydrocarbon spills

   f. Mass medical

   g. Bomb threats

   h. Floods

   i. Earthquakes

7. The activation of an Incident Command System (ICS) that designates persons who will be in charge of activities and their functions.

8. A consultation of geographic information showing the location of hydrants, oil storage sites, safe grounding sites, and other infrastructures that may be required or affected.

It is important to point out that for the development of each action plan on item 6 of this section there must be a clear idea of the situation in question, the plans already in place, and the availability of resources. The following is a structure of the specific action plans to be developed prior to starting the operations phase.

1. Objectives: the purpose of the actions to be implemented and the expected results.
2. Organization of the Incident Command System: it defines specifically each type of incident, and indicates the established lines of authority so that all units will know to whom they must report.
3. Assignment of Resources: it allows all involved units to know the resources available.
4. Support Plans: these include a safety plan that covers field communications and media relations.

8.11 Post-Operations Environmental Recovery Plan

Environmental recovery will take place after the completion of all activities and closure of the sites that will not be used again, as required. The objective of the environmental recovery is to restore conditions that may promote the reestablishment of natural biological communities in former work areas.

Environmental recovery includes the following tasks:

1. Reshaping of the terrain to its former profile prior to the construction Project

2. Erosion control
3. Revegetation
4. Landscaping of grounds

The Contractor shall submit a specific Environmental Recovery Plan for each temporary work site that will be set up for the construction. The species to be used shall be native species, and must be approved by the Panama Canal Authority.

The environmental recovery plan shall be applied to Contractor field site closure activities, and shall include shops; materials exchange depots, as well as rock grinder, concrete, and asphalt plants. The plan shall also include the closure of certain disposal sites of dredged or excavated material when they have reached their capacity.

The closure of field installations will require the removal of entire infrastructures, both above ground and under the ground. In the latter case, drainage pipes, underground fuel tanks, etc. must be removed. Any waterproof surface may be demolished if the Panama Canal Authority considers that there will be no further use for the site. Rubble and debris shall be disposed of at an authorized disposal site. Once all infrastructures are removed, the area shall be restored with vegetation or landscaping.

Some materials disposal sites may reach the end of their useful life during or at the end of the construction stage. In such a case, they shall be reshaped, maintenance provided to their drainages, and regenerated. Maintenance shall also be provided to the structures of disposal sites that remain active (in use) after completion of the construction stage.

Rock grinder, concrete, and asphalt plants shall be disassembled and transported by the Contractor outside the construction sites at the end of the construction stage. The former locations of these plants shall be cleared and cleaned up. Any debris shall be adequately disposed of at authorized disposal sites.

Most of the actions mentioned in the above paragraphs shall be performed upon completion of the construction stage. However, any prevention and control measures implemented during that phase shall make the restoration of the sites easier and less expensive.

At the beginning of the construction stage, the Contractor of any portion of the works shall submit a Site Demobilization, Cleanup, and Restoration Plan consistent with the Project work schedule.

Closure and recovery activities shall be monitored to verify that the objective of ensuring that no environmental liability has been left behind is met. The Contractor shall be the party responsible for the environmental recovery plan and the closure. For this purpose, the Contractor shall submit, at least six months prior to the start of the demobilization of any sector of the works, an updated Site Demobilization, Cleanup, and Restoration Plan for the approval of the Panama Canal Authority.

8.12 Abandonment Plan

Due to the growing strategic importance at a national and international level over the short, medium, and long range, and the fact that the Canal is already part of the world's heritage, it is not foreseen or anticipated that the works and infrastructures of the Panama Canal Expansion Project –

Third Set of Locks will ever be abandoned. On the contrary, in the same manner as has occurred with the existing Canal infrastructure, it is expected that the infrastructure to be constructed will be fully integrated to its milieu and will become a permanent part of the landscape and its environment.

In this context, there is no reason to prepare an Abandonment Plan. If the preparation of a Post-Operations Environmental Recovery Plan is found to be applicable, its contents shall be as included in the following section.

8.13 Environmental Management Costs

The costs associated with the implementation of an Environmental Management Plan are described in detail in Table 8.31 (Environmental Management Plan Costs – Physical, Biological and Socioeconomic Costs) and in Table 8.32, which shows a summary of the Environmental Management Plan costs and includes the cost of the Monitoring Plan and of other plans, such as the Wildlife Rescue and Relocation and Environmental Education Plans.

Table 8-32

Summary of Environmental Protection Costs[12]

CONSTRUCTION PHASE		
Description	**Cost (in US$)**	
	Total	**Annual**
Monitoring and Control of the Implementation of Mitigation Measures		
• Physical Aspects	8,991,500.00	
• Biological Aspects	5,558,433.07	
• Socioeconomic Aspects	4,840,000.00	
Environmental Monitoring Plan		
• Air Quality, Noise Levels and Vibration	1,172,000.00	
• Soils Protection	910,000.00	
• Water Quality and Sediment	3,271,000.00	
Wildlife Rescue and Relocation	1,024,000.00	
Environmental Education Plan	270,000.00	
Post Operations Environmental Recovery	1,000,000.00	

12 This table shows the ***approximate costs*** based on various reference sources and/or the consultant's experience. They are not final and must be confirmed by the Panama Canal Authority at the appropriate time, according to market conditions.

TOTAL CONSTRUCTION PHASE COSTS	**27,036,933.07**	
OPERATIONS PHASE		
Surveillance and Control of the Implementation of Mitigation Measures		
Physical Aspects		100,000.00
Biological Aspects		
Socioeconomic Aspects	70,000.00	
Environmental Monitoring Plan		
Air Quality, Noise Levels and Vibration		30,500.00
Soils Protection		180,000.00
Water Quality and Sediment		225,000.00
TOTAL COST OF THE OPERATIONS PHASE	**70,000.00**	**535,500**