

ERM Response to Summary Statement of Nicaragua Canal Environmental Impact Assessment Review Panel

An independent Nicaragua Canal Environmental Impact Assessment Review Panel (Panel), which was assembled by Florida International University and chaired by Dr. Alan Covich from the University of Georgia, met in March 2015 to review preliminary findings of the Canal de Nicaragua Environmental and Social Impact Assessment (ESIA), primarily relating to its potential ecological and hydrological effects. This Panel issued a Summary Statement, which is attached hereto in full. This memo responds to this Summary Statement.

ERM wants to acknowledge and thank the Panel for their significant contribution. Although the panel had limited time, it did quickly focus on key issues and provided thoughtful and valuable comments that have strengthened the Canal de Nicaragua ESIA. ERM has carefully considered the Panel's Summary Statement. As indicated in our attached responses, and in the ESIA itself, we have already acted on many of the Panel's list of 15 main concerns – by gathering additional data, updating our analysis, modifying our conclusions, and/or adopting their recommendations.

In addition to these 15 main concerns, the Panel also provided some more general comments, which we respond to below. Please note that several of our responses reference the Project's Environmental and Social Action Plan, or ESAP, which ERM has prepared and included in the Executive Summary of this ESIA. An ESAP is used to describe and prioritize actions needed to address gaps in the Project design, ESIA, management plans, management systems, or stakeholder engagement process to bring the Project in line with international standards.

The very short (i.e., 1.5 years) period that was approved by HKND for this environmental study was insufficient given the magnitude of the proposed projects associated with the canal construction.

- ERM Response – ERM has been previously quoted in the media as saying the ESIA schedule was aggressive. The lack of a final detailed Feasibility Study hampered our analysis. ERM recommends in the ESAP that several additional studies be completed to confirm key design assumptions “*before a final decision is made by the Government of Nicaragua*”.

A much more complete analysis of alternatives is essential before a scientifically robust evaluation can be completed.

- ERM Response – ERM agrees with this statement to some extent. We believe the consideration of alternatives was sufficiently robust to identify Route 4 as the only route with the *potential* to adequately mitigate/offset its impacts and meet international standards. ERM agrees that further

consideration of alternatives is warranted in several areas as identified in the ESAP, including the West Canal alignment (i.e., modified Brito Alternative), the design of the Camilo Lock (i.e., integrated or split lock), and the Caribbean port location (i.e., Punta Águila or Lago Atlanta). ERM also recommends optimizing the design of the excavated material placement areas to further minimize environmental and social impacts.

It appears that for a number of ESIA topics, inadequate resources were allocated to support a proper sampling effort and analysis.

- ERM Response – ERM understands the panels concerns, and while not disagreeing with these concerns, we note the following:
 - The sampling program for this ESIA was “fit for purpose.” It was designed to gather sufficient data on which to base conclusions about likely Project effects and to develop appropriate mitigation measures. In this case, ERM used methods based on Conservation International’s Rapid Assessment Program (CIRAP). As Conservation International notes, “standard field research takes years, but political leaders will not usually wait that long to make decisions affecting the most biologically important areas of Earth. CIRAP gathers relevant scientific information quickly enough to aid in protecting such places from irreversible damage that can occur on a very short time scale.”
 - ERM applied the Precautionary Principle where risks were high. In several cases, because of unacceptably high uncertainty or the lack of necessary data, ERM strongly recommends in the ESAP the collection of additional data *“before a final decision is made by the Government of Nicaragua.”*
 - ERM only reached conclusions where we believed we had sufficient data to support those conclusions. In most of these cases where ERM reached conclusions, additional data would have been useful to add confidence/reduce uncertainty, but we did not believe additional data would have fundamentally changed our conclusions. In some of these cases, our conclusion was that the Project would have a significant adverse impact, and we did not believe we needed more data to confirm that conclusion.
 - ERM also recommends a detailed Monitoring Plan be implemented to gather additional data to increase our understanding of the Project area and to apply adaptive management principles to help manage any emerging impacts.

Climate change must be considered and incorporated into every aspect of the design.

- ERM Response – ERM agrees completely. The extent that climate change (e.g., changes in temperature, evapotranspiration, and rainfall) may

influence the overall Project water balance is critical to confirm that water required for canal operations does not come at the expense of Lago de Nicaragua, wetlands, and other aquatic habitats. ERM recommends in the ESAP that a comprehensive water balance be conducted that takes into consideration climate change, among other factors.

Plans for restoration of impacted watersheds and for mitigation of numerous effects of construction and maintenance of the canal need to be much more clearly defined.

- ERM Response – ERM agrees completely. The level of detail in this ESIA reflects the level of detail available for the Project, which is at an early Feasibility Study level of design. ERM recommends additional studies to confirm preliminary assumptions on design elements, which could have a significant effect on project impacts (e.g., water balance, Lago de Nicaragua sediment stratigraphy). As the details of the Project design are finalized, the details of the mitigation and restoration plans need to be further defined and finalized as well.

A management framework that includes sufficient funding for the national administration of the project is essential.

- ERM Response – ERM agrees completely. A Project of this magnitude would be a challenge for the government of any country to manage. Although a bit beyond the scope of a normal ESIA, ERM identifies in the Conclusions and Recommendations (Chapter 14) the importance of Governance, which includes the important roles of the Government of Nicaragua, civil society, and various international development institutions in both assuring the Project is implemented in accordance with good international practice, and that Nicaragua maximizes the benefits of the Project for the good of the people of Nicaragua. Many of the mitigation measures identified in this ESIA are beyond the legal ability of HKND to implement (e.g., regional watershed management, wastewater treatment, enforcement of protected area regulations) and require the active involvement of the Government of Nicaragua. This would likely require international funding, capacity building, and technical support for the Government of Nicaragua.

Responses to the 15 concerns raised by the Panel relative to the ecological and hydrological assessments conducted by ERM are presented herein. Each concern is listed, paraphrased for conciseness, with ERM's response to the concern and a cross-reference to where the topic is discussed in the ESIA.

Table 1. Responses to Concerns Raised by the Nicaragua Canal Environmental Impact Assessment Review Panel

Concerns	Response	Location in ESIA
<p>1. Additional characterization of sediment physical and chemical composition, transport, and fate is needed to adequately assess impacts to water quality and aquatic life due to re-suspension of sediments in the lake.</p>	<p>ERM has addressed this concern in the ESIA by collecting additional data, updating the analyses, and conducting a literature review.</p> <p>The sediment cores collected by HKND for this assessment are presented in ESIA Section 5.7.13 (summary) and Appendix RH-1 (full data set). ERM also conducted a literature review of sediment data in Lake Nicaragua, which is included in the ESIA. ERM concludes that there is not enough information to characterize the sediment's physical or chemical composition or to confirm its stratigraphy across the lake. ERM recommends that further analysis and assessment consisting of a detailed program of core-drilling and geophysical exploration in the Lake be completed prior to construction (see ESAP #12).</p> <p>The effects of sediment re-suspension on water quality and lake aquatic life are included in ESIA Section 6.4.4 (summary) and Appendix RH-8 (detailed analyses). The residual assessment of re-suspension impacts induced by dredging is based on HKND's assertion that the confined disposal facilities are adequately designed and sized to contain all of the silts and clays dredged within Lake Nicaragua. Vessel-induced effects, considered to be confined to the canal itself are also included in the assessment. The majority of sediment transport effects are expected to occur near the canal and the artificial islands. They comprise a relatively small footprint compared to the rest of the lake.</p> <p>Long term sediment impacts on water quality and aquatic life are also covered in ESIA Section 6.4.4 (water quality) and ESIA Section 7.3 (aquatic life). The water quality evaluation considers metals, pesticides, and nutrients in re-suspended sediments induced by the Project. The assessment criteria utilize trophic status, light penetration, constituent concentrations, and habitat suitability.</p>	<p>ESIA Section 5.7.13, 6.4.4 and 7.3, Appendix RH-1, and Appendix RH-8</p>

Concerns	Response	Location in ESIA
<p>2. Additional field data would improve the validity of the hydrodynamic model used to predict circulation of currents in the lake. Redistribution of sediments via lake circulation create impacts that are additive to the already decreasing water quality due to increasing human impacts.</p>	<p>ERM acknowledges the concern that the hydrodynamic modeling used in the assessment is limited by the availability of data for calibration. ERM has addressed this concern by identifying additional lake circulation data from the literature, updating the analyses, and placing the model results into context with comparative studies of similar lakes.</p> <p>Lake circulation is presented in ESIA Section 5.7.9 (baseline summary) and Appendix RH-3 (details). The three-dimensional, time-varying hydrodynamic model of the lake was validated with the available, limited ADCP measurements collected by ERM along the canal route. The model is also limited by the age and detail of the bathymetric survey used to develop the gridding. Given the available information, however, the model was able to simulate satisfactorily the expected current velocities and patterns described in the literature, especially the flow reversal at the lake bed typical of shallow lakes (Wetzel, 2001, and Rueda et al, 2003) . Further analysis and assessment using the model requires an updated bathymetric survey and detailed program of velocity measurements in the lake. ERM recommends that HKND undertake these additional works, and subsequently validate and apply the hydrodynamic model as part of their management efforts, as specified in the Lago de Nicaragua Management Plan.</p> <p>The effects of the Project on lake circulation and sediment transport are discussed in ESIA Section 6.4.4 (impacts summary) and Appendix RH-8 (sediment transport details). The analysis is based on the available data, the hydrodynamic model, and the literature (comparative studies). Modeling is just one component used primarily to make relative comparisons. Given the available information and assessment tools, ERM found that the majority of sediment impacts would be localized along the canal route and the confined disposal facilities. In addition, the long-term mass balance for sediment in the lake is not expected to be altered by the Project. Therefore, it is unlikely that the Project related changes in sediment would further decrease the existing water quality conditions of the entire lake on its own.</p>	<p>ESIA Sections 5.7.9 and 6.4.4, Lago de Nicaragua Management Plan, Appendix RH-3 and Appendix RH-8</p>

Concerns	Response	Location in ESIA
<p>3. Insufficient data on water quality across Lake Nicaragua and inflowing rivers represents a gap that greatly limits understanding of how nutrient cycling and contaminants may be affected by dredging.</p>	<p>ERM acknowledges the concern that the water quality assessment is limited by the availability of water quality data throughout the lake and in its larger influent rivers. ERM has addressed this by presenting the raw data collected for the ESIA and incorporated supplemental data from MARENA and other researchers into the baseline and assessment.</p> <p>The water quality analyses for this assessment are presented in ESIA Section 5.7.12 (summary) and Appendix RH-1 (full data set). The baseline and assessment include a literature review of water quality data in Lake Nicaragua and comparative studies in similar lakes as contextual support of the primary data collected by ERM for this assessment. ERM recommends that HKND undertake additional water quality sampling as part of their management efforts, as specified in the Lago de Nicaragua Management Plan and the Management Plan for Water Resources by Watershed and Sub-Watershed.</p> <p>The effects of the Project on nutrient cycling in the lake, and specifically the effects from dredging, are discussed in ESIA Section 6.4.4 (impacts summary). ERM based the analysis on ERM field data, literature data and information, and hydrodynamic modeling. This combination of methods is designed to fill the gap of existing information. The data, literature and modeling results, although individually insufficient to produce a comprehensive scientific analysis, are sufficient when combined to provide a basic understanding of nutrient cycling and contaminants and the relative impact caused by Project activities.</p>	<p>ESIA Sections 5.7.12 and 6.4.4, Appendix RH-1, Appendix RH-8, Lago de Nicaragua Management Plan, and Management Plan for Water Resources by Watershed and Sub-Watershed</p>

Concerns	Response	Location in ESIA
<p>4. Effects of canal operation on post-construction water quality, and the trophic status of the affected rivers and Lake Nicaragua are highly uncertain but likely large in magnitude. Available data are of insufficient to assess current nutrient levels and trophic status of the affected surface waters.</p>	<p>ERM acknowledges the concern that the water quality assessment is limited by the availability of water quality data throughout the lake and in its larger influent rivers. In response, ERM integrated existing available information with sampling campaigns during dry and wet seasons, and the results of several numerical models. In addition, ERM has used a conservative approach in order to assess the post-construction effects on water quality of the lake and affected watersheds. Given the available information, ERM was able to identify major trends and patterns in nutrient levels and trophic status and provide an assessment of the relative impacts of the Project.</p> <p>Several literature work and independent sources, have considered the lake to be between mesotrophic and eutrophic or in some cases hypereutrophic status. The project has the potential to introduce different nutrient loads to Lake Nicaragua. Eutrophication has been identified as a long-term water quality concern for Lake Nicaragua.</p> <p>The project would also construct two additional reservoirs in the Punta Gorda watershed on the east segment of the canal: Lago Atlanta and Agua Zarca Reservoir. Their construction would affect the Punta Gorda watershed. The trophic status that was estimated for the reservoirs is between mesotrophic and eutrophic. This trophic status is consistent with the future trophic status in Lake Nicaragua.</p> <p>ERM recommends that the Government of Nicaragua and HKND implement land use management programs in the surrounding watersheds, in addition to the embedded controls and mitigation measures.</p>	<p>ESIA Sections 5.7.12 and 6.4.4, Appendices RH-1 and RH-8, Lake Nicaragua Management Plan, and Management Plan for Water Resources by Watershed and Sub-Watershed</p>

Concerns	Response	Location in ESIA
<p>5. The Lake Nicaragua biogeochemical modeling was based on only two calibration (or validation) points and, the correspondence between the few observed values and the modeled values were often poor.</p>	<p>ERM acknowledges the concern that the water quality modeling is limited by the availability of water quality data throughout the lake. In response to the Panel's comments, we have recast the 3-dimensional unsteady water quality model as a support tool to be considered in combination with a simpler model, raw data, literature data, literature studies of Lake Nicaragua, and comparative studies of similar lakes. ERM's 3D water quality model helps to provide spatial and temporal context of the processes in Lake Nicaragua and the relative quantifiable effects of the Project. The water quality modeling analysis conducted by ERM includes Lake Nicaragua, Lago Atlanta, and Agua Zarca Reservoir. Baseline, project, and project with climate change conditions were considered.</p> <p>In the Environmental and Social Management Plans, ERM recommends that HKND design and implement a frequent, spatial and temporal water quality and sediment monitoring program to definitively evaluate potential impacts during both construction and operations activities.</p>	<p>ESIA Sections 5.7.12, and 6.4.4 Appendix RH-1 Appendix RH-7 Appendix RH-8 Lago de Nicaragua Management Plan Management Plan for Water Resources by Watershed and Sub-Watershed</p>

Concerns	Response	Location in ESIA
<p>6. More attention to long-term climate forecasts is needed to provide management alternatives under climate-change scenarios. The capacity for storing freshwater supplies to operate the canal is also unclear.</p>	<p>ERM agrees that long-term climate change impacts on the Project be included in the assessment. ERM has applied the climate change projections accepted by the Government of Nicaragua via MARENA in its water resources evaluations. ERM evaluated both high and low projections among the ensemble of projections recognized by MARENA.</p> <p>Hydrologic models have been run considering the project under climate change projections. Climate change effects have been included by changing the rainfall and atmospheric inputs in the numerical models. The major impact on the hydrological response of the watersheds would be a reduction of runoff. A reduced runoff would imply a reduction of water availability, increased competition for water, and a higher potential for salinity intrusion.</p> <p>The hydrodynamic model reveals slight variations in lake surface elevation and currents due to climate change.</p> <p>ERM recommends that HKND prepare an updated and comprehensive lake water budget that considers climate changes for use in managing lake levels (see ESAP #14).</p>	Project Description ESIA Sections 5.7, 6.4.3, 6.4.4, 6.4.5, 10.4 Appendix RH-2 Appendix RH-3
<p>7. The water balance of the canal may be wrong. Estimates of the average annual runoff for the Punta Gorda watershed suggest the Nicaragua Canal will not have sufficient flows to operate the locks during dry years (e.g., a one-in-four year-drought) and this shortfall would be especially critical during multi-year droughts.</p>	<p>ERM acknowledges the concern that the water balance study for the Project provided by HKND is limited in its scope and scale. There are a few assumptions made by the Panel during their review process which we believe are incorrect and want to clarify. These assumptions are noted in the table provided at the end of our responses.</p> <p>The water balance provided by HKND (included as Appendix RH-12) does not include the new lakes and ponds in the Punta Gorda Watershed or ecological flow releases. It is computed at monthly average rates and increments, and it uses old bathymetry and topography information for the storage volumes of Lake Nicaragua and the new lakes in the east. ERM developed watershed hydrologic models of individual components of the Project, which generate results consistent with the water balance produced</p>	Project Description ESIA Sections 5.7 and 6.4.5, Appendix RH-2, Appendix RH-12, Management Plan for Water Resources by Watershed and Sub-Watershed, and Lago de Nicaragua Management Plan

Concerns	Response	Location in ESIA
	<p>by HKND. ERM's models apply the same coarse level of detail used by HKND.</p> <p>ERM recommends that HKND complete a more accurate Project water balance taking into consideration updated lakeshore topography, bathymetry, evapotranspiration, future non-Project water demands, reservoir water storage, proposed salinity management measures, current lock design, watershed hydrology, ecological flow releases, and climate change to confirm adequacy of water supply for canal operations without impacting water levels in Lago de Nicaragua (ESAP #14).</p> <p>Water resource management of the Punta Gorda watershed and Lake Nicaragua are discussed in the Water Resources by Watershed and Sub-Watershed and Lago de Nicaragua Management Plans. These plans require that HKND prepare daily modeling of the Project's water budget and establish operating rules for water allocation during low flow conditions.</p>	
8. The potential for disruption of native species distributions and the likely introductions of non-native species along with a wide range of potential public health concerns will likely be especially important not only for managing the water budget but also for sustaining freshwater biodiversity in the species-rich Meso-American Corridor.	<p>ERM agrees that conversion of habitat would alter the distribution of some aquatic species, particularly those that cannot adjust to lowered water levels in some tributaries. Furthermore, not all freshwater species would be able to pass the drop structures that would be used to control erosion of the side slopes where streams would drain into the canal. Based on the Panel's comments we have incorporated additional discussion of these impacts for the West Canal and East Canal-Lake Slope segments, respectively. . In response to the panel's comments regarding disruptions in native aquatic species' distributions along the Project corridor, ERM added discussions of effects on aquatic habitat continuity. ERM added discussions of effects on the distribution of migratory species within each of the riverine Project segments. ERM also added a discussion of impacts on habitat use and movements by native demersal species in Lake Nicaragua. In response to the panel's comments on the Freshwater Biodiversity Impact Assessment about public health concerns, ERM added a discussion of the implications of creating new lacustrine environments on the Caribbean Slope for the</p>	ESIA Sections 7.3.3, 7.3.5, 8.3.2.2, 8.3.3.2, 8.3.4.2, and 8.3.5.2

Concerns	Response	Location in ESIA
	<p>spread of disease-carrying mosquitos (specifically <i>Anopheles spp.</i> and <i>Aedes aegypti</i>). Impacts on human health from unsanitary conditions and vector-borne diseases, both of which can be exacerbated by changes in the water budget, are further discussed in the Health Chapter.</p>	
<p>9. Loss of coastal mangroves and riparian forest buffers are also previously well-documented impacts throughout the tropics that need to be much more fully evaluated in this project. Protecting these habitats is critical to retain a diverse biotic community that sustains ecosystem services.</p>	<p>ERM recognizes and agrees with the importance of these habitats and has provided guidance to HKND on avoidance and minimization of impacts and developed targeted mitigation and offsetting measures to address the unavoidable impacts of the Project on these habitats. These discussions have been incorporated into the ESIA. In response to the panel's comments, ERM has revised the rationale for the sensitivity/importance rating for the aquatic habitat receptor to highlight the habitat value of the Brito mangrove. ERM has also added a short discussion of selected scientific literature highlighting the importance of forested riparian buffers in maintaining aquatic habitat and biodiversity, and the implications of the Project for aquatic habitat in the largely still-forested Indio Maíz Biological Reserve.</p>	<p>ESIA Sections 7.3.3.1, 7.3.4.1, 7.3.5.1, 7.3.6.1, 7.4.3.3, 7.4.4.3, 7.4.5.3, and 7.4.6.3.</p>
<p>10. It is essential to better understand the life history of migratory and endemic fishes and their use of near-shore habitats to evaluate future impacts to the population dynamics and to protect existing fisheries resources within the lake.</p>	<p>In response to the Panel's comments, ERM has provided additional discussion to support the biodiversity baseline analyses. The freshwater biodiversity baseline discusses migratory life histories, and identifies the migratory fish species within each of the Project segments. This information is included in Sections 5.10.5.1, 5.10.5.3, and 5.10.5.4. We have also included specific discussion of amphidromous shrimp and their habitat requirements with respect to riverine continuity in Section 5.10.5. Discussions of impacts on migratory freshwater species are included in Sections 7.3.3, 7.3.5, and 7.3.6. ERM has included riparian herpetiles in these discussions as well in light of their dependence on riparian continuity and the littoral fringe of permanent waterbodies.</p>	<p>ESIA Sections 5.10.5.1, 5.10.5.3, 5.10.5.4, 7.3.3, 7.3.5, and 7.3.6</p>

Concerns	Response	Location in ESIA
<p>11. Definitions and criteria of species conservation status should rely on IUCN criteria and definitions.</p> <p>Application of population viability analysis should be used to assess potential futures for threatened marine, freshwater and terrestrial taxa in Nicaragua. Knowledge of the biodiversity and productivity of lower trophic levels is incomplete.</p>	<p>In response to the Panel's comments, ERM has verified that IUCN Red List and National Red List definitions were used, along with information from published studies and Nicaraguan experts, in determining the conservation status, distribution, and extinction risk of rare terrestrial and freshwater aquatic species. Quantitative assessment of extinction risk using population viability analysis or other similar methods is not an option in the context of this ESIA due to lack of information that is needed to conduct such analysis. Information regarding the various stochastic components affecting population dynamics, population numbers, and trends for the rare freshwater, terrestrial, and marine species known to occur in the Project area are not available as none of the species have been the subject of intensive studies or field surveys in southern Nicaragua (and in the case of some of the species they have not been studied anywhere).</p> <p>The biological surveys conducted for the Project combined with other information from Nicaraguan experts provided important information on species range and distribution within and outside the Project area. This information, supplemented by relevant, available information on the species' habitat requirements and vulnerability to the types of impacts that would be caused by the Project, was used to determine the potential impact of the Project on rare species as presented in the ESIA.</p> <p>The Project's biological monitoring program includes monitoring of target rare terrestrial and aquatic species, review and analysis of the monitoring data by experts, and application of adaptive management measures if warranted. The information collected through the monitoring program would be a major contribution to the knowledge about the distribution and population status of the species in the region, their habitat preferences, and how they are responding to implementation of the Project and related mitigations and offsets.</p>	<p>ESIA Sections 7.3.3, 7.3.4, 7.3.7, 7.4.3.1, 7.4.4.1, 7.4.5.1, and 7.4.6.1</p>

Concerns	Response	Location in ESIA
<p>12. Given the many unknowns in tropical forest restoration, significantly higher targets than reforestation at a 1:1 ratio should be set for the protection of original habitats and for planned habitat restoration and protection with the expectation that reforested areas will not provide the same level of habitat quality and ecosystem services overall.</p>	<p>ERM acknowledges the Panel's comments but notes that the 1:1 reforestation ratio is based on Nicaragua's requirement as per Nicaragua Decree 79-2006. ERM agrees that this ratio is insufficient to fully mitigate for forest loss caused by the Project. ERM has recommended additional reforestation in the West Canal and East Canal Segments in order to achieve no net loss of forest and move towards net gain. Please refer to ESIA Section 7.4.3.1, 7.4.5.1, and 7.4.6.1 and the Biodiversity Management Plan for discussion of this issue.</p> <p>In addition to reforestation, ERM has recommended and HKND has committed to provide support for the protection of significantly larger areas of habitat within existing protected areas including the Indio Maíz Biological Reserve and the Punta Gorda and Cerro Silva Nature Reserves. The strategy in these areas is to halt encroachment and maintain the forest that still exists there and allow the natural succession to gradually restore the habitat that has been lost.</p> <p>As part of the comprehensive Lake Nicaragua management plan that ERM is recommending be developed by the Government of Nicaragua and other stakeholders, ERM is recommending a basin-wide effort to increase the extent of forested areas with the purpose of reducing nutrient loading and erosion and sediment transport, which would also improve habitat quality of uplands, wetlands, and aquatic ecosystems throughout Project affected watersheds and maintain or improve delivery of critical ecosystem services.</p>	Section 7.4.3.1, 7.4.5.1, and 7.4.6.1 and the Biodiversity Management Plan, Protected Area Management Plan

Concerns	Response	Location in ESIA
13. Further investigations outside the 10-km buffer zone are necessary to conclude that canal construction will not result in extinctions of threatened species by limiting connectivity of essential habitats.	Baseline freshwater aquatic and terrestrial surveys were conducted outside the 10-km buffer zone. In response to the Panel's comments, additional information from other published studies and Nicaraguan experts have been incorporated into the ESIA analysis of rare species and their extinction risk. Further, the information collected would be used as reference data for the Project's biological monitoring program, which includes monitoring of target rare terrestrial and aquatic species and application of adaptive management measures if warranted. Please refer to the Biodiversity Management Plan for further details.	Biodiversity Management Plan
14. Issues of large-scale ecosystem management are critical to the Pacific coast, in addition to the smaller, site-specific impacts as presented in the baseline information on marine biodiversity. More thorough review of existing data combined with more extensive sampling is needed to provide a sufficient analysis of population viability and community resilience.	<p>In response to the Panel's comments, ERM thoroughly obtained, reviewed, and incorporated additional Pacific Marine turtle secondary information into the Marine biodiversity Baseline. The obtained information helped to better understand the importance of the Pacific coast of Nicaragua for marine turtles.</p> <p>The additional information included data generated by organizations like Flora and Fauna International (FFI) and Paso Pacifico, plus scientific papers published by different authors over the last 10 years regarding the ecology of sea turtles in the Nicaraguan Pacific Coast. Further, information about specific management measures that are taking place throughout the Pacific region was obtained.</p> <p>Available information was filtered to focus on relevant data for the section of the Pacific coast between the Refugio de Vida Silvestre (RVS) Rio Escalante Chacocente, located about 30 km north of Brito, and RVS Flora, which is about 30km south of the area of Brito. The presence and abundance of turtle nests and the most important beaches for reproduction and conservation in this area has been specifically included in the baseline report. However, most of this information is only for turtle nesting in both RVS and there is insufficient published information about turtles in the Project's direct area of influence. It is important to note that, although there is little information about the presence and abundance in the Project's</p>	Marine Biodiversity Base Line, Biodiversity Impact Assessment & Marine Biodiversity Marine and Coastal Management Plan

Concerns	Response	Location in ESIA
	<p>direct area of influence, the additional information allowed for the identification of specific mitigation measures and monitoring plans for species of sea turtles expected to nest and/or make use of that area.</p> <p>The ESIA evaluates the impacts that could be generated by the construction and operation of the project in a comprehensive manner, looking at the ocean as a complex ecosystem with several components and processes. From that perspective, recommended mitigation measures often apply to more than one component. In the specific case of La Anciana, identified management measures take into account the presence and unique characteristics of this area, including in the management plan, mitigation and monitoring plans specifically tailored for it.</p> <p>The ESIA evaluated the habitats present, the dynamics of currents, and other processes that take place in the area of influence of the Project. That information allowed for mitigation measures that are intended to minimize impacts generated on the entire ecosystem. However, we are aware that the processes taking place in the marine ecosystem are complex and require further study, and therefore have proposed plans for intensive monitoring to characterize the dynamics, flow paths and other processes influencing the marine ecosystems within the area of influence. The results would be taken into account to assess the need to modify or improve the management plans as part of an adaptive management process.</p>	
15. A thorough review of peer-reviewed literature as well as published reports of previous environmental studies should be completed and incorporated into the environmental analysis to frame the historical, current, and potential future changes to the region.	In response to the Panel's comment, ERM has collected, reviewed, incorporated, and referenced many additional peer-reviewed studies and reports, including the ones provided by the Panel. These studies supplement the available baseline data and provide historical context relative to environmental trends in the Project area.	

Table 2. Clarifications to Assumptions made by the Nicaragua Canal Environmental Impact Assessment Review Panel

Panel Assumption	Response	Location in ESIA
1. Surface area of the Punta Gorda Watershed as 8400 km ² (pg 5).	The estimated area of the Rio Punta Gorda watershed is 2867 km ²	ESIA Section 5.7.4; Table 5.7-3: Nicaragua Watersheds
2. Rainfall of 3200 mm/yr and a proportional evapotranspiration of 0.68, which equals 2176 mm/yr, for the Rio Punta Gorda watershed (pg 5)	ERM used values estimated by MARENA for rainfall (2860 mm/yr), potential evapotranspiration (1518 mm/yr), and actual evapotranspiration (1200 mm/yr).	ESIA Section 5.7.9.3; Table 5.7-35: Punta Gorda River Hydrologic Characteristics